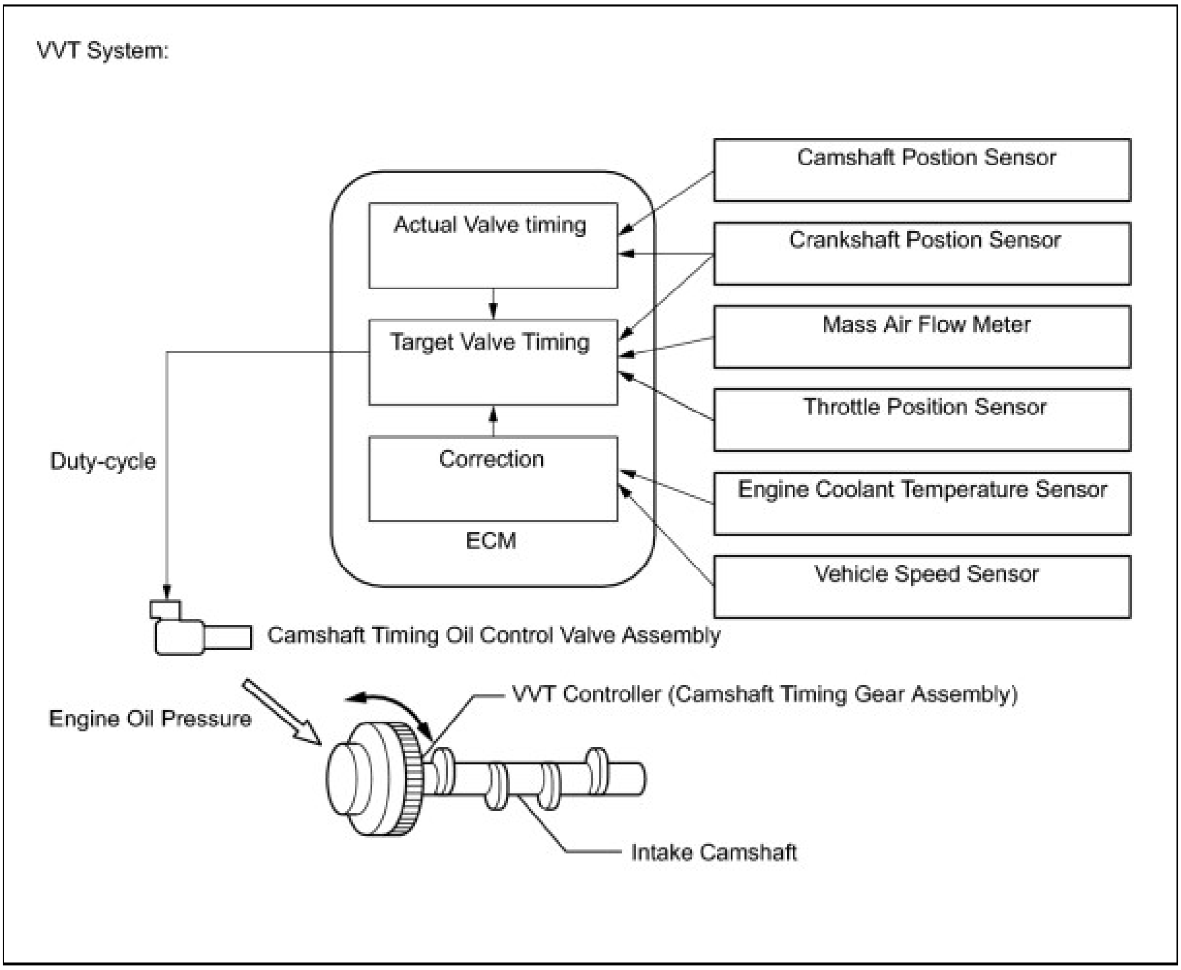
Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PDW08VX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0010: Camshaft Position "A" Actuator Circuit (Bank 1) (2010 Corolla)		

DTC	**P0010**	**Camshaft Position "A" Actuator Circuit (Bank 1)**

DESCRIPTION

The VVT (variable valve timing) system adjusts the intake valve timing to improve driveability. The engine oil pressure turns the VVT controller to adjust the valve timing. The camshaft timing oil control valve is a solenoid valve and switches the engine oil line. The valve moves when the ECM applies 12 V to the solenoid. The ECM changes the energizing time to the solenoid (duty-cycle) in accordance with the camshaft position, crankshaft position, throttle position, etc.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0010	Open or short in camshaft timing oil control valve assembly circuit (1 trip detection logic)	• Open or short in camshaft timing oil control valve assembly circuit • Camshaft timing oil control valve assembly • ECM

MONITOR DESCRIPTION

This DTC is designed to detect an open or short in the camshaft timing oil control valve circuit. If the camshaft timing oil control valve assembly duty-cycle is excessively high or low while the engine is running, the ECM will illuminate the MIL and set the DTC.

MONITOR STRATEGY

Related DTCs	P0010: VVT camshaft timing oil control valve assembly range check (bank 1)
Required Sensors/Components (Main)	VVT camshaft timing oil control valve assembly
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
All of following conditions met	-
Starter	OFF
Ignition switch	ON
Time after ignition switch OFF to ON	0.5 seconds or more

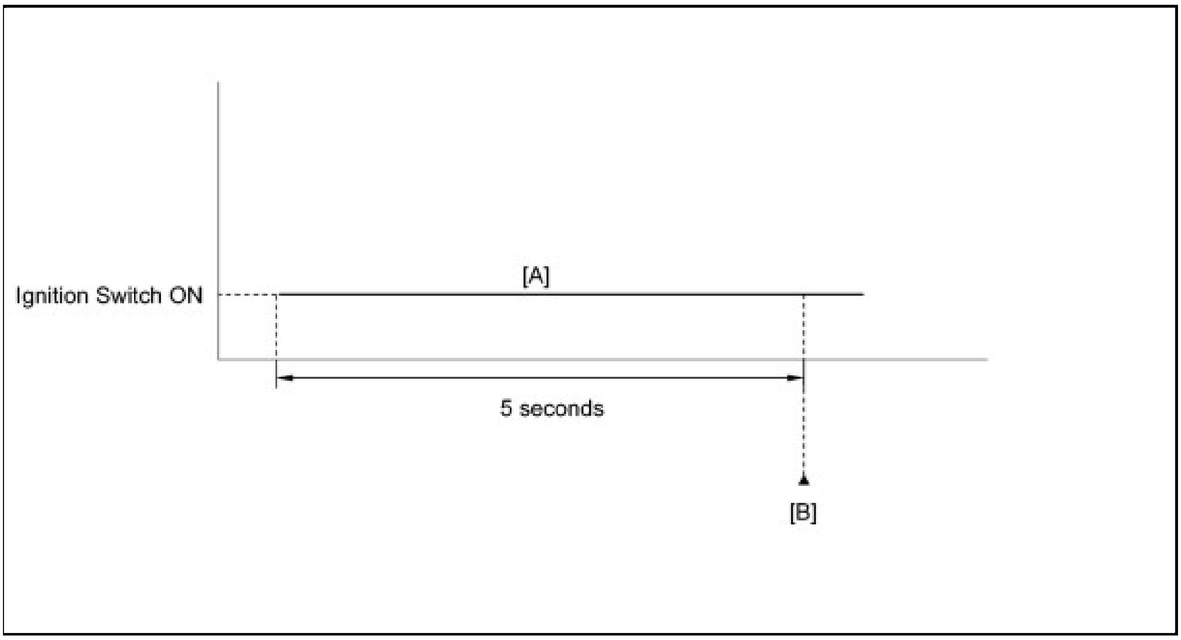
TYPICAL MALFUNCTION THRESHOLDS

One of following conditions met	-
A. All of following conditions met	-
Battery voltage	11 to 13 V
Target duty ratio	Less than 70%
Output signal duty ratio	100%
B. All of following conditions met	-
Battery voltage	13 V or more
Target duty ratio	Less than 80%
Output signal duty ratio	100%
C. Both of following conditions met	-
Current cut status	Not cut
Output signal duty ratio	3% or less

COMPONENT OPERATING RANGE

VVT camshaft timing oil control valve assembly duty ratio	3 to 100%

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .

4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait 5 seconds [A].
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0010.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

    HINT:

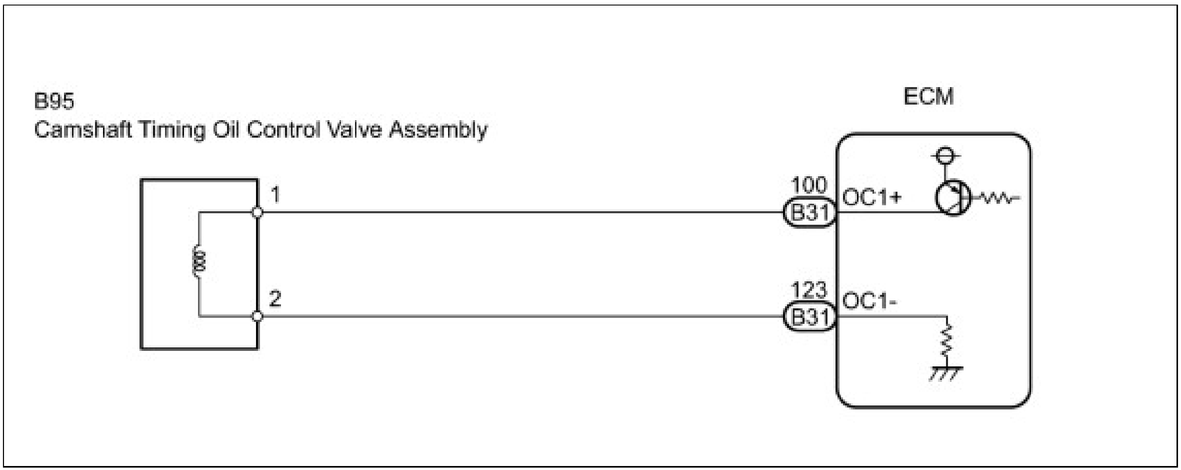
    If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ DTC OUTPUT

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs after recording the freeze frame data and DTC INFO .

(e) Turn the ignition switch off.

(f) Start the engine and allow the engine to idle.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

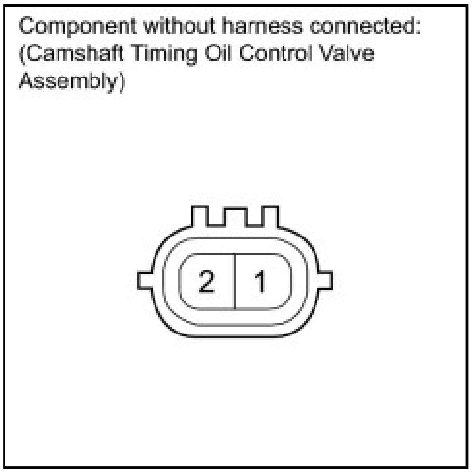
Result:

RESULT	PROCEED TO
P0010	A
No output	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

2.	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**



(a) Disconnect the camshaft timing oil control valve assembly connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	6.9 to 7.9 Ω

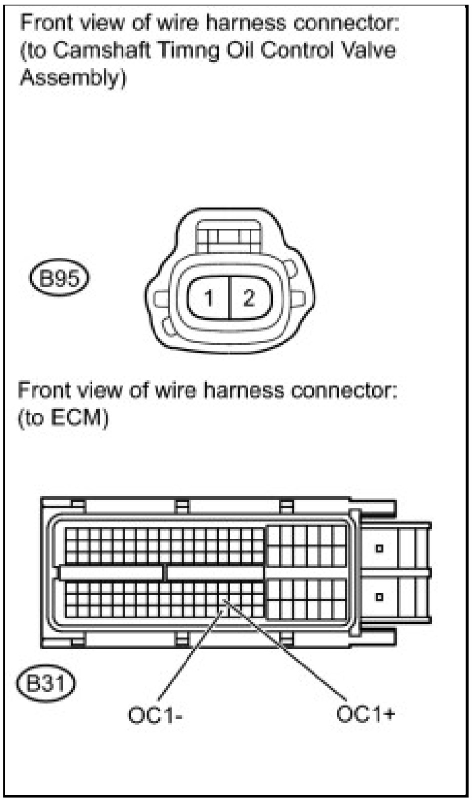
(c) Reconnect the camshaft timing oil control valve assembly connector.

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY - ECM)**

(a) Disconnect the camshaft timing oil control valve assembly connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B95-1 - B31-100 (OC1+)	Always	Below 1 Ω
B95-2 - B31-123 (OC1-)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B95-1 or B31-100 (OC1+) - Body ground	Always	10 kΩ or higher
B95-2 or B31-123 (OC1-) - Body ground	Always	10 kΩ or higher

(d) Reconnect the camshaft timing oil control valve assembly connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY - ECM)**

OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	From: 200901
Model Year: 2010	Model: Corolla	Doc ID: RM000000PDU09HX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0011,P0012: Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1) (2010 Corolla)		

DTC	P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)

DTC	P0012	Camshaft Position "A" - Timing Over-Retarded (Bank 1)

DESCRIPTION

Refer to DTC P0010 .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0011	Valve timing is not adjusted in valve timing advance range (1 trip detection logic)	• Valve timing • Camshaft timing oil control valve assembly • Oil control valve filter • Camshaft timing gear assembly • ECM
P0012	Valve timing is not adjusted in valve timing retard range (2 trip detection logic)	

MONITOR DESCRIPTION

The ECM optimizes the intake valve timing using the VVT (Variable Valve Timing) system to control the intake camshaft. The VVT system includes the ECM, the camshaft timing oil control valve assembly and the VVT controller (camshaft timing gear assembly). The ECM sends a target duty-cycle control signal to the camshaft timing oil control valve assembly. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft. If the difference between the target and actual intake valve timing is large, and changes in the actual intake valve timing are small, the ECM interprets this as a VVT controller stuck malfunction and sets a DTC.

Example:
A DTC is set when the following conditions "A" and "B" are met:

a. It takes 5 seconds or more to change the valve timing by 5°CA (Condition "A").
b. After above condition is met, the camshaft timing oil control valve is forcibly activated during 10 seconds (Condition "B").

DTC P0011 (Advanced Cam Timing) is subject to 1 trip detection logic.
DTC P0012 (Retarded Cam Timing) is subject to 2 trip detection logic.
These DTCs indicate that the VVT controller cannot operate properly due to camshaft timing oil control valve assembly malfunctions or the presence of foreign objects in the camshaft timing oil control valve.

The monitor will run if all of the following conditions are met:

- The engine is warm (the engine coolant temperature is 75°C [167°F] or more).
- The vehicle has been driven at more than 40 mph (64 km/h) for 3 minutes.
- The engine has idled for 3 minutes.

MONITOR STRATEGY

Related DTCs	P0011: Advanced camshaft timing P0012: Retarded camshaft timing
Required Sensors/Components (Main)	VVT camshaft timing oil control valve assembly and VVT controller
Required Sensors/Components (Related)	Crankshaft position sensor Camshaft position sensor Engine coolant temperature sensor
Frequency of Operation	Once per driving cycle
Duration	Within 10 seconds
MIL Operation	Advanced camshaft timing: Immediate Retarded camshaft timing: 2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0016 (VVT System Bank 1 - Misalignment) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor)
Battery voltage	11 V or more
Engine RPM	550 to 4000 rpm
Engine coolant temperature	75 to 100°C (167 to 212°F)

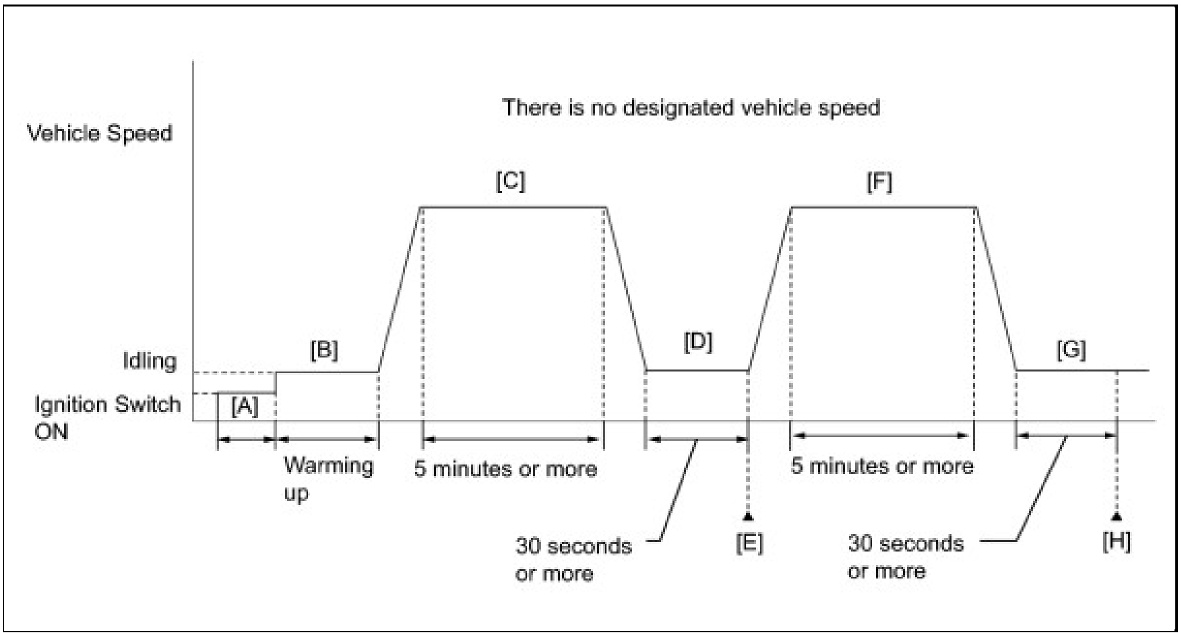
TYPICAL MALFUNCTION THRESHOLDS

All of following conditions are met	-

Deviation of actual valve timing and target valve timing	More than 5°CA (crankshaft angle)
Valve timing	No change at advanced (retarded) valve timing

If the difference between the target and actual camshaft timing is greater than the specified value, the ECM operates the VVT actuator.
Then, the ECM monitors the camshaft timing change for 5 seconds.

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
7. Drive the vehicle for 5 minutes or more [C].
8. Idle the engine for 30 seconds or more [D].
9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0011 or P0012.
11. Check the DTC judgment result [E].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [F] through [H].

12. Drive the vehicle for 5 minutes or more [F].
13. Idle the engine for 30 seconds or more [G].
14. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
15. Input the DTC: P0011 or P0012.
16. Check the DTC judgment result again [H].
17. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
18. Read Pending DTCs [H].

HINT:

If a pending DTC is output, the system is malfunctioning.

19. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0010 INFO .

INSPECTION PROCEDURE

HINT:

- DTC P0011 or P0012 may be set when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain set even if the system returns to normal after a short time. Foreign objects are filtered out by the oil filter.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0011 OR P0012)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0011 or P0012	A
P0011 or P0012 and other DTCs	B

HINT:

If any DTCs other than P0011 or P0012 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE)

(a) Connect the Techstream to the DLC3

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(f) Check the engine speed while operating the camshaft timing oil control valve using the Techstream.

OK:

TESTER OPERATION	SPECIFIED CONDITION
Camshaft timing oil control valve OFF	Normal engine speed
Camshaft timing oil control valve ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve switched from OFF to ON)

NG ▶ CHECK VALVE TIMING (CHECK FOR LOOSE OR JUMPED TEETH ON TIMING CHAIN)

OK
▼

3.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0011 OR P0012)

(a) Connect the Techstream to the DLC3

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Start the engine and warm it up.

(f) Drive the vehicle for more than 10 minutes.

(g) Select the following menu items: Powertrain / Engine and ECT / Trouble Codes / Pending.

(h) Read DTCs.

Result:

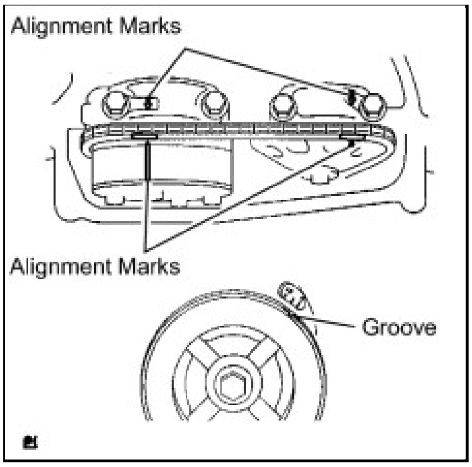
RESULT	PROCEED TO
No output	A
P0011 or P0012	B

B ▶ CHECK VALVE TIMING (CHECK FOR LOOSE OR JUMPED TEETH ON TIMING CHAIN)

A ▶ CHECK FOR INTERMITTENT PROBLEMS

4.	CHECK VALVE TIMING (CHECK FOR LOOSE OR JUMPED TEETH ON TIMING CHAIN)

(a) Remove the cylinder head cover INFO .



(b) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.

(c) Check that the alignment marks of the camshaft timing gears are aligned with the alignment marks of the bearing cap as shown in the illustration.

If not, turn the crankshaft 1 revolution (360°), then align the marks as above.

OK:
Alignment marks on camshaft timing gears are aligned as shown in the illustration.

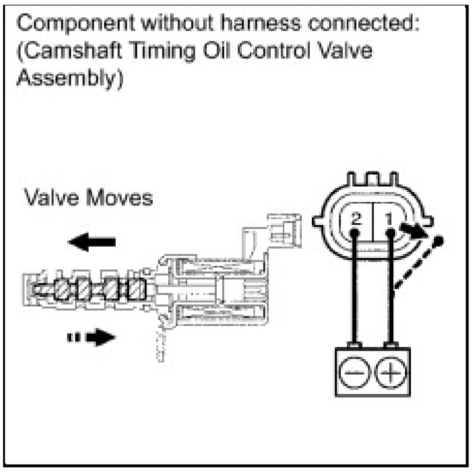
(d) Reinstall the cylinder head cover INFO .

NG ▶ **ADJUST VALVE TIMING**

OK
▼

5.	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**

(a) Remove the camshaft timing oil control valve assembly INFO .



(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	6.9 to 7.9 Ω

(c) Apply positive battery voltage to terminal 1 and connect the negative battery terminal to terminal 2. Check the valve operation.

OK:

Valve moves quickly.

(d) Reinstall the camshaft timing oil control valve assembly INFO .

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**

OK

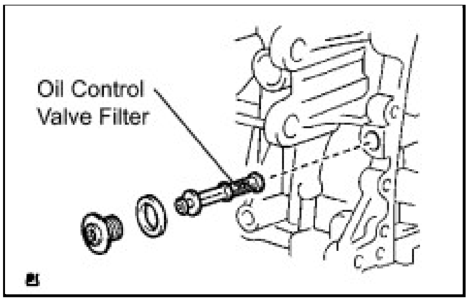
▼

6.	**INSPECT OIL CONTROL VALVE FILTER**

(a) Remove the oil control valve filter INFO .

OK:

Filter is not clogged.



(b) Reinstall the oil control valve filter .

NG **REPLACE OIL CONTROL VALVE FILTER**

OK

7.	REPLACE CAMSHAFT TIMING GEAR ASSEMBLY

(a) Replace the camshaft timing gear assembly .

NEXT

8.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs .

(e) Start the engine and warm it up.

(f) Drive the vehicle for more than 10 minutes.

(g) Select the following menu items: Powertrain / Engine and ECT / Trouble Codes / Pending.

(h) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P0011 or P0012	B

HINT:

DTC P0011 or P0012 is output when foreign objects in engine oil are caught in some parts of the system. These codes will remain set for a short time even after the system returns to normal. These foreign objects may then be captured by the oil filter, thus eliminating the source of the problem.

B ▶ REPLACE ECM

A ▶ END

Last Modified: 3-10-2010	6.4 S	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PDF07VX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: DIAGNOSTIC TROUBLE CODE CHART (2010 Corolla)		

DIAGNOSTIC TROUBLE CODE CHART

HINT:

Parameters listed in the chart may be different than your readings depending on the type of instrument and other factors.

If any DTCs are displayed during a check mode DTC check, check the circuit for the DTCs listed in the table below. For details of each DTC, refer to the page indicated.

HINT:

- *1: MIL flashes when a catalyst damaging misfire is detected.
- *2: DTC only applies to models for Mexico.

SFI SYSTEM

DTC CODE	DETECTION ITEM	TROUBLE AREA	MIL	MEMORY	DTC FOR MEXICO MODELS	SEE PAGE
P0010	Camshaft Position "A" Actuator Circuit (Bank 1)	-Open or short in camshaft timing oil control valve assembly circuit -Camshaft timing oil control valve assembly -ECM	Comes on	DTC stored	Applies	INFO
P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)	-Valve timing -Camshaft timing oil control valve assembly -Oil control valve filter -Camshaft timing gear assembly -ECM	Comes on	DTC stored	Applies	INFO
P0012	Camshaft Position "A" - Timing Over-Retarded (Bank 1)	-Valve timing -Camshaft timing oil control valve assembly -Oil control valve filter -Camshaft timing gear assembly -ECM	Comes on	DTC stored	Applies	INFO
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1	-Mechanical system (Timing chain has jumped a tooth or chain	Comes on	DTC stored	Applies	INFO

DTC CODE	DETECTION ITEM	TROUBLE AREA	MIL	MEMORY	DTC FOR MEXICO MODELS	SEE PAGE
	Sensor A)	stretched) -Camshaft timing oil control valve assembly -Camshaft timing gear assembly -ECM				
P0031	Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)	-Open in air fuel ratio sensor heater circuit -Air fuel ratio sensor heater (sensor 1) -ECM	Comes on	DTC stored	Applies	INFO
P0032	Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)	-Short in air fuel ratio sensor heater circuit -Air fuel ratio sensor heater (sensor 1) -ECM	Comes on	DTC stored	Applies	INFO
P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)	-Open in heated oxygen sensor (sensor 2) heater circuit -Heated oxygen sensor (sensor 2) heater -ECM	Comes on	DTC stored	Applies	INFO
P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)	-Short in heated oxygen sensor (sensor 2) heater circuit -Heated oxygen sensor (sensor 2) heater -ECM	Comes on	DTC stored	Applies	INFO
P0101	Mass Air Flow Circuit Range / Performance Problem	-Mass air flow meter -Intake system -PCV hose connections	Comes on	DTC stored	-	INFO
P0102	Mass or Volume Air Flow Circuit Low Input	-Open or short in mass air flow meter circuit -Mass air flow meter -ECM	Comes on	DTC stored	Applies	INFO
P0103	Mass or Volume Air Flow Circuit High Input	-Open or short in mass air flow meter circuit -Mass air flow meter -ECM	Comes on	DTC stored	Applies	INFO
P0111	Intake Air Temperature Sensor Gradient Too High	-Mass air flow meter	Comes on	DTC stored	-	INFO
P0112	Intake Air	-Short in intake air	Comes on	DTC	Applies	INFO

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PDV094X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0016: Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A) (2010 Corolla)		

DTC	**P0016**	**Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)**

DESCRIPTION

The ECM optimizes the valve timing by using the VVT (Variable Valve Timing) system to control the intake camshaft. The VVT system includes the ECM, the camshaft timing oil control valve assembly and the VVT controller (camshaft timing gear assembly). The ECM sends a target duty-cycle control signal to the camshaft timing oil control valve assembly. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0016	Deviations in crankshaft and camshaft position sensor signals (2 trip detection logic)	• Mechanical system (Timing chain has jumped a tooth or chain stretched) • Camshaft timing oil control valve assembly • Camshaft timing gear assembly • ECM

MONITOR DESCRIPTION

To monitor the correlation of the intake camshaft position and crankshaft position, the ECM checks the VVT learning value while the engine is idling. The VVT learning value is calibrated based on the camshaft position and crankshaft position. The intake valve timing is set to the most retarded angle while the engine is idling. If the VVT learning value is out of the specified range in consecutive driving cycles, the ECM illuminates the MIL and sets the DTC.

This DTC indicates that the intake camshaft has been installed toward the crankshaft at an incorrect angle, caused by factors such as the timing chain having jumped a tooth.

This monitor begins to run after the engine has idled for 5 minutes.

MONITOR STRATEGY

Related DTCs	P0016: Camshaft Timing Misalignment at idling
Required Sensors/Components (Main)	VVT controller (camshaft timing gear assembly)

Required Sensors/Components (Related)	Camshaft position sensor Crankshaft position sensor
Frequency of Operation	Once per driving cycle
Duration	Less than 1 minute
MIL Operation	2 driving cycles
Sequence of Operation	None

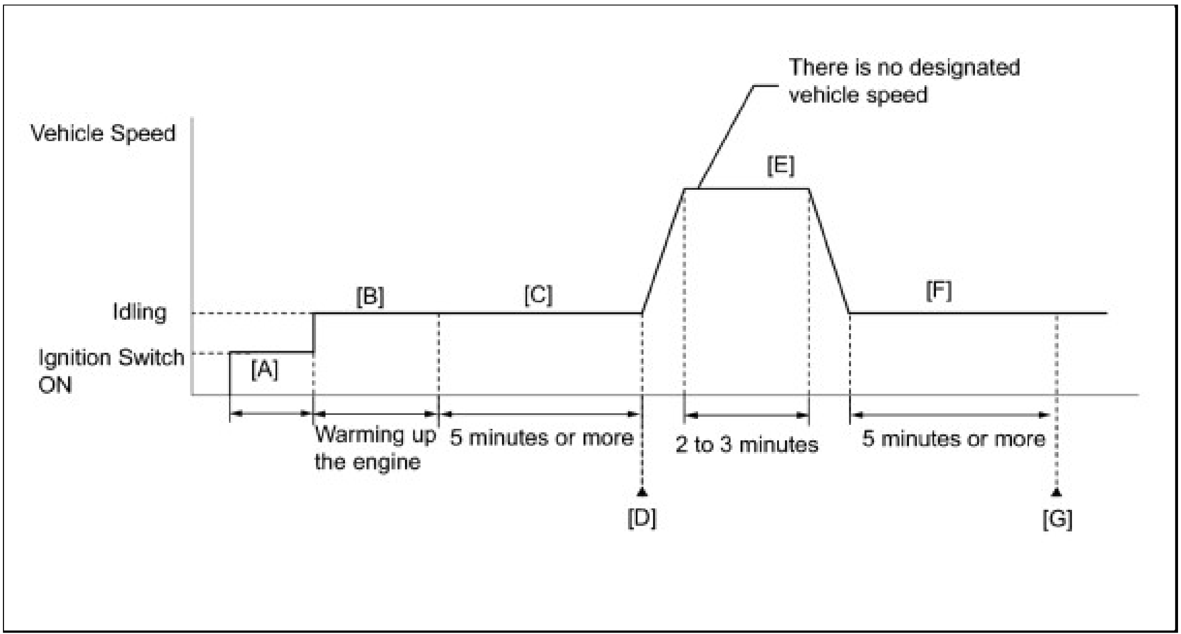
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0016 (VVT System Bank 1 - Misalignment) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor)
Engine RPM	550 to 1000 rpm

TYPICAL MALFUNCTION THRESHOLDS

One of following conditions is met	-
VVT learning value at maximum retarded valve timing	Less than 27°CA (crankshaft angle)
VVT learning value at maximum retarded valve timing	More than 49°CA (crankshaft angle)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
7. Idle the engine for 5 minutes or more [C].
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P0016 or P0017.
10. Check the DTC judgment result [D].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [E] through [G].

11. Drive the vehicle for 2 to 3 minutes [E].
12. Idle the engine for 5 minutes or more [F].
13. Check the DTC judgment result [G].
14. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
15. Read Pending DTCs [G].

HINT:

If a pending DTC is output, the system is malfunctioning.

16. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0335 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0016)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0016	A
P0016 and other DTCs	B

HINT:

If any DTCs other than P0016 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(f) Enter the following menus: Powertrain / Engine and ECT / Data List / VVT Change Angle (Bank1) and VVT OCV Duty (Bank1).

(g) Check that the VVT change angle varies when operating the camshaft timing oil control valve using the Techstream.

OK:
The VVT change angle value and engine speed vary.

NG ▶ INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

OK ▼

3.	ADJUST VALVE TIMING INFO

NEXT ▶ CHECK WHETHER DTC OUTPUT RECURS (DTC P0016)

4.	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY INFO

NG ▶ REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

OK ▼

5.	INSPECT OIL CONTROL VALVE FILTER INFO

NG ▶ REPLACE OIL CONTROL VALVE FILTER

OK ▼

6.	REPLACE CAMSHAFT TIMING GEAR ASSEMBLY

(a) Replace camshaft timing gear assembly INFO .

NEXT ▼

7.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0016)

(a) In order to erase the ECM learned values for valve timing, disconnect the cable from the negative (-) battery terminal for 1 minute.

(b) Reconnect the cable to the negative (-) battery terminal.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Clear the DTCs INFO .

(g) Start the engine and idle it for 5 minutes.

(h) Drive the vehicle with a city driving pattern for approximately 10 minutes.

(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P0016	B

B ▶ **REPLACE ECM**

A ▶ **END**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000WC10A2X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0031,P0032: Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1) (2010 Corolla)		

DTC	**P0031**	**Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)**

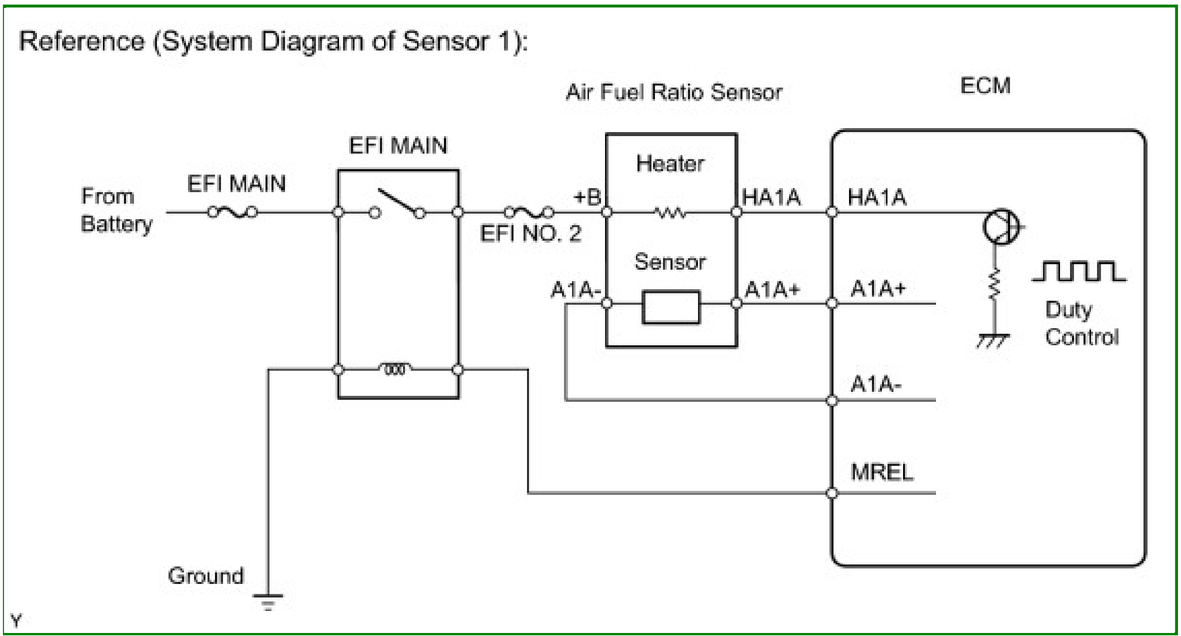
DTC	**P0032**	**Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)**

DESCRIPTION

Refer to DTC P2195 INFO .

HINT:

- When either of these DTCs is set, the ECM enters fail-safe mode. The ECM turns off the air fuel ratio sensor heater in fail-safe mode. Fail-safe mode continues until the ignition switch is turned off.
- Although the DTC titles say the oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the Three-way catalytic converter and located near the engine assembly.
- The ECM uses pulse width modulation to adjust the current through the heater. The air fuel ratio sensor heater circuit uses a relay on the +B side of the circuit.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0031	Air fuel ratio sensor heater current less than 0.8 A (1 trip detection logic)	• Open in air fuel ratio sensor heater circuit • Air fuel ratio sensor heater (sensor 1) • ECM
P0032	Air fuel ratio sensor heater current fail (1 trip detection logic)	• Short in air fuel ratio sensor heater circuit • Air fuel ratio sensor heater (sensor 1) • ECM

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

MONITOR DESCRIPTION

The ECM uses information from the air fuel ratio sensor to regulate the air fuel ratio and keep it close to the stoichiometric level. This maximizes the ability of the three-way catalytic converter to purify the exhaust gases.

The air fuel ratio sensor detects oxygen levels in the exhaust gas and transmits the information to the ECM. The inner surface of the sensor element is exposed to the outside air. The outer surface of the sensor element is exposed to the exhaust gas. The sensor element is made of platinum coated zirconia and includes an integrated heating element.

The zirconia element generates a small voltage when there is a large difference in the oxygen concentrations between the exhaust gas and outside air. The platinum coating amplifies this voltage generation.

The air fuel ratio sensor is more efficient when heated. When the exhaust gas temperature is low, the sensor cannot generate useful voltage signals without supplementary heating. The ECM regulates the supplementary heating using a duty-cycle approach to adjust the average current in the sensor heater element. If the heater current is outside the normal range, the signal transmitted by the air fuel ratio sensor becomes inaccurate, as a result, the ECM is unable to regulate air-fuel ratio properly.

When the current in the air fuel ratio sensor heater is outside the normal operating range, the ECM interprets this as a malfunction in the sensor heater and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0031: Air fuel ratio sensor heater open/short (Low electrical current) P0032: Air fuel ratio sensor heater open/short (High

	electrical current)
Required Sensors/Components (Main)	Air fuel ratio sensor heater
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	10 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P0031

Battery voltage	10.5 V or more
Air fuel ratio sensor heater duty-cycle ratio	50% or more
Time after engine start	10 seconds or more

P0032

Battery voltage	Less than 20 V
Time after engine start	10 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0031

Air fuel ratio sensor heater current	Less than 0.8 A

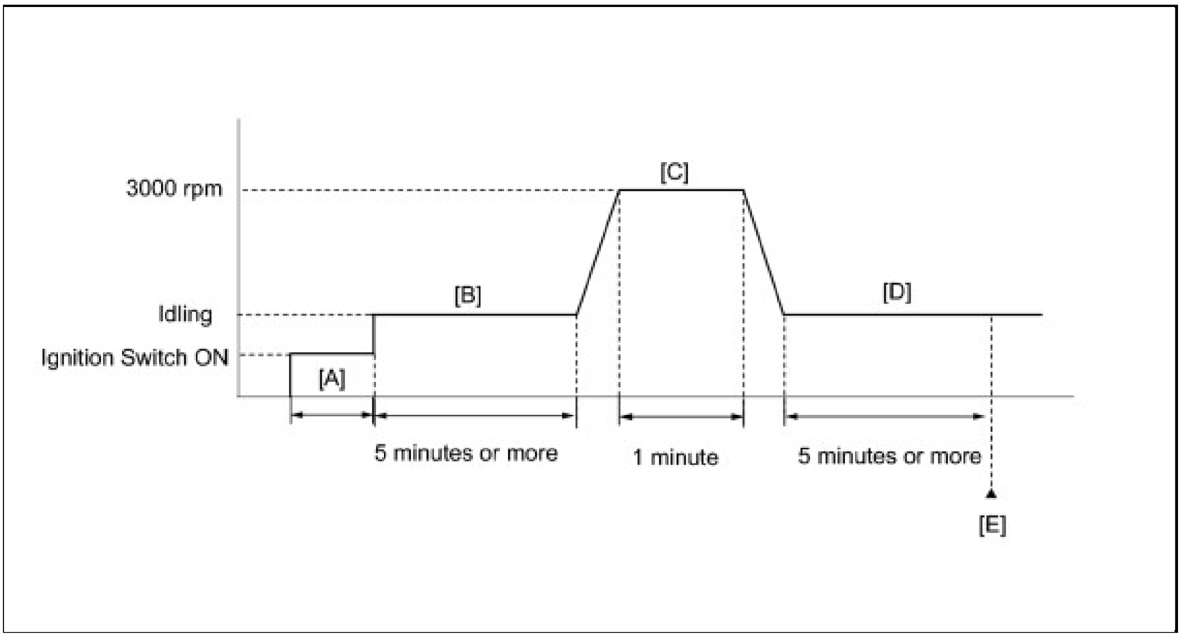
P0032

Hybrid IC high current limiter port	Fail

COMPONENT OPERATING RANGE

Air fuel ratio sensor heater resistance	1.8 to 3.4 Ω at 20°C (68°F)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and idle it for 5 minutes or more [B].
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of 3000 rpm for 1 minute [C].
8. Idle the engine for 5 minutes or more [D].
9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0031 or P0032.
11. Check the DTC judgment result [E].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	DTC judgment completed System normal
ABNORMAL	DTC judgment completed System abnormal
INCOMPLETE	DTC judgment not completed Perform driving pattern after confirming DTC enabling conditions

TECHSTREAM DISPLAY	DESCRIPTION
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

12. If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] through [E] again.
13. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
14. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

15. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P2195 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

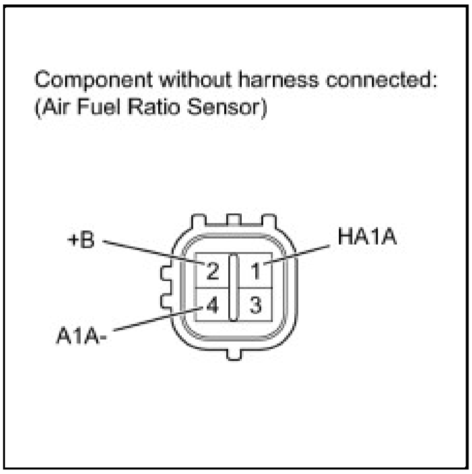
PROCEDURE

1.	**INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)**

(a) Disconnect the air fuel ratio sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (HA1A) - 2 (+B)	20°C (68°F)	1.8 to 3.4 Ω
1 (HA1A) - 4 (A1A-)	Always	10 kΩ or higher

(c) Reconnect the air fuel ratio sensor connector.

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK

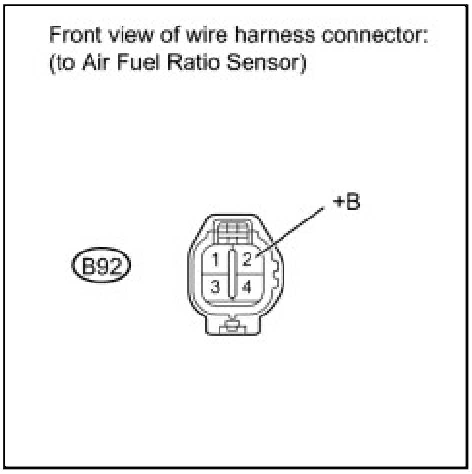
2.	CHECK TERMINAL VOLTAGE (POWER SOURCE)

(a) Disconnect the air fuel ratio sensor connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:



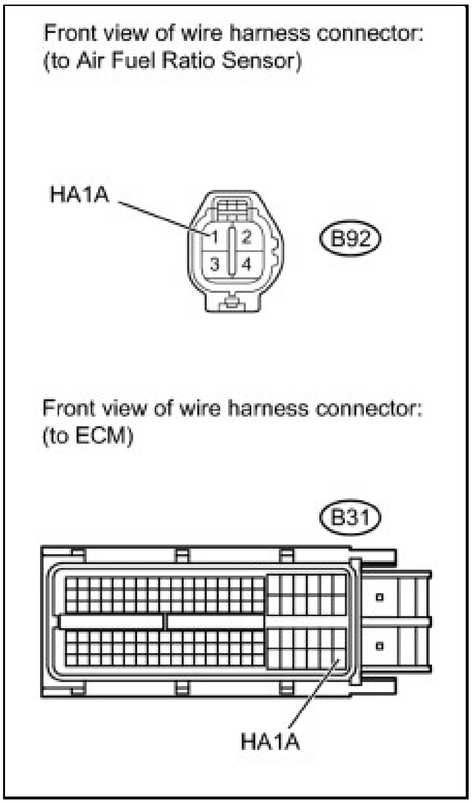
TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
B92-2 (+B) - Body ground	Ignition switch ON	11 to 14 V

(d) Reconnect the air fuel ratio sensor connector.

NG ▶ **INSPECT FUSE (EFI NO. 2 FUSE)**

OK

3.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)



(a) Disconnect the air fuel ratio sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B92-1 (HA1A) - B31-109 (HA1A)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B92-1 (HA1A) or B31-109 (HA1A) - Body ground	Always	10 kΩ or higher

(d) Reconnect the air fuel ratio sensor connector.

(e) Reconnect the ECM connector.

NG **REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)**

OK

4.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0031 OR P0032)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs .

(e) Start the engine.

(f) Allow the engine to idle for 1 minute or more.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

Result:

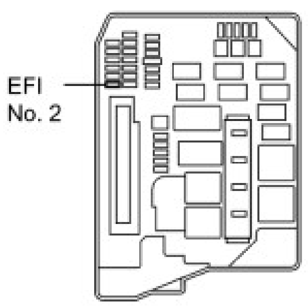
RESULT	PROCEED TO
No output	A
P0031 or P0032	B

B ▶ REPLACE ECM

A ▶ CHECK FOR INTERMITTENT PROBLEMS

5.	INSPECT FUSE (EFI NO. 2 FUSE)

Engine Room Relay Block:



(a) Remove the EFI No. 2 fuse from the engine room relay block.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI No. 2 fuse	Always	Below 1 Ω

(c) Reinstall the EFI No. 2 fuse.

NG REPLACE FUSE (EFI NO. 2 FUSE)

OK REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ENGINE ROOM RELAY BLOCK)

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PFA09XX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0037,P0038,P0141: Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2) (2010 Corolla)		

DTC	**P0037**	**Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)**

DTC	**P0038**	**Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)**

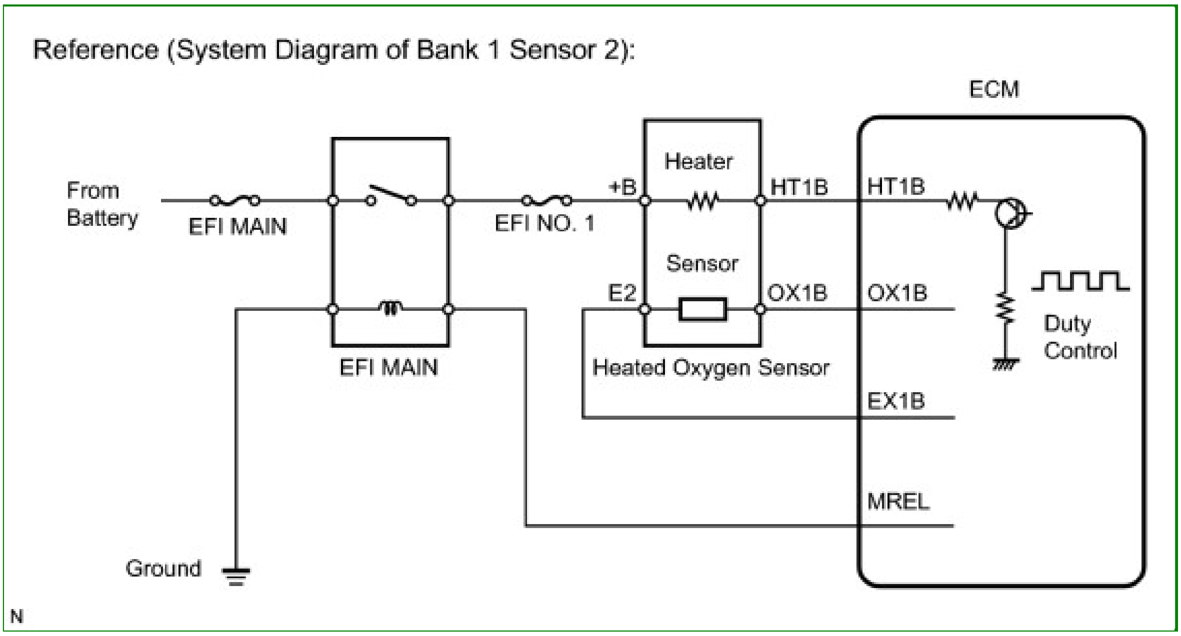
DTC	**P0141**	**Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)**

DESCRIPTION

Refer to DTC P0136 INFO .

HINT:

- Sensor 2 refers to the sensor mounted behind the three-way catalytic converter and located far from the engine assembly.
- When any of these DTCs are set, the ECM enters fail-safe mode. The ECM turns off the heated oxygen sensor heater in fail-safe mode. Fail-safe mode continues until the ignition switch is turned off.
- The ECM uses pulse width modulation to adjust the current through the heater. The heated oxygen sensor heater circuit uses a relay on the +B side of the circuit.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0037	Heated oxygen sensor (sensor 2) heater current less than 0.3 A (1 trip detection logic)	• Open in heated oxygen sensor (sensor 2) heater circuit • Heated oxygen sensor (sensor 2) heater • ECM
P0038	Heated oxygen sensor (sensor 2) heater current more than 2 A (1 trip detection logic)	• Short in heated oxygen sensor (sensor 2) heater circuit • Heated oxygen sensor (sensor 2) heater • ECM
P0141	Cumulative heater resistance correction value exceeds the acceptable threshold (2 trip detection logic)	• Open or short in heated oxygen sensor (sensor 2) heater circuit • Heated oxygen sensor (sensor 2) heater • ECM

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

MONITOR DESCRIPTION

The sensing portion of the heated oxygen sensor has a zirconia element which is used to detect the oxygen concentration in the exhaust gas. If the zirconia element is at the appropriate temperature, and the difference between the oxygen concentrations surrounding the inside and outside surfaces of the sensor is large, the zirconia element generates voltage signals. In order to increase the oxygen concentration detecting capacity of the zirconia element, the ECM supplements the heat from the exhaust with heat from a heating element inside the sensor.

Heated oxygen sensor heater range check (P0037 and P0038):

The ECM monitors the current applied to the heated oxygen sensor heater to check the heater for malfunctions. If the current is below the threshold value, the ECM will determine that there is an open circuit in the heater. If the current is above the threshold value, the ECM will determine that there is a short circuit in the heater.

Example:

The ECM sets DTC P0038 when the current in the heated oxygen sensor heater is more than 2 A. Conversely, when the heater current is less than 0.3 A, DTC P0037 is set.

Heated oxygen sensor heater performance (P0141):

After the accumulated heater ON time exceeds 100 seconds, the ECM calculates the heater resistance using the battery voltage and the current applied to the heater. If the resistance is above the threshold value, the ECM will determine that there is a malfunction in the heated oxygen sensor heater and set DTC P0141.

MONITOR STRATEGY

Related DTCs	P0037: Heated oxygen sensor heater (sensor 2) open/short (Low electrical current) P0038: Heated oxygen sensor heater (sensor 2) open/short (High electrical current) P0141: Heated oxygen sensor heater performance (sensor 2)
Required sensors/Components (Main)	Heated oxygen sensor heater (sensor 2)
Required sensors/Components (Related)	-
Frequency of operation	Continuous: P0037, P0038 Once per driving cycle: P0141
Duration	0.5 seconds: P0037, P0038 1 second: P0038 10 seconds: P0141
MIL operation	Immediate: P0037, P0038 2 driving cycles: P0141
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P0037

Battery voltage	10.5 to 20 V

P0038 (Case 1)

Battery voltage	10.5 V or more
Engine	Running
Starter	OFF

P0038 (Case 2)

Battery voltage	10.5 to 20 V

P0141

One of the following conditions is met:	Condition A or B
A. All of the following conditions are met:	Condition 1, 2, 3, 4 and 5
1. Battery voltage	10.5 V or more
2. Fuel cut	OFF
3. Time after fuel cut ON to OFF	30 seconds or more
4. Accumulated heater ON time	100 seconds or more
5. Learned heater OFF current operation	Completed
B. Duration that rear heated oxygen sensor impedance is less than 15 kΩ	2 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0037

Heater current	Less than 0.3 A

P0038

Learned heater OFF current	More than 2 A

P0141 (Heater Performance Monitor Check)

Accumulated heater resistance	Varies with sensor element temperature (Example: More than 23 Ω)

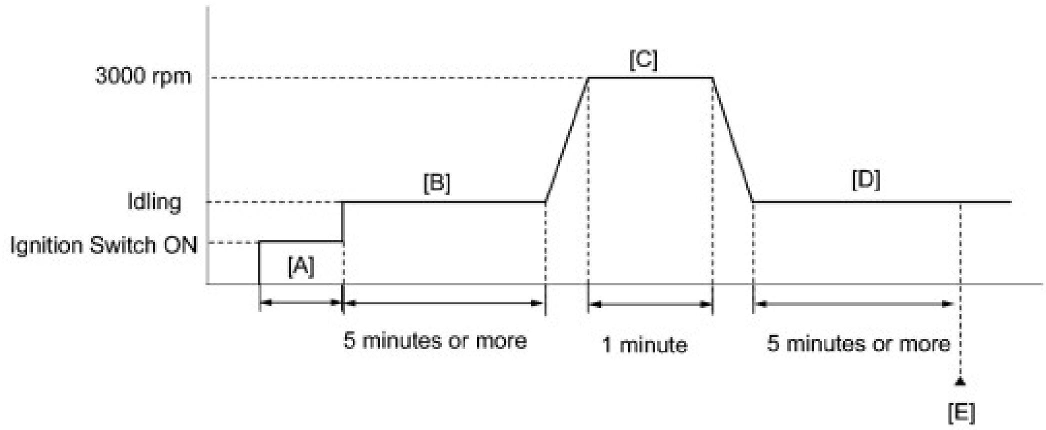
COMPONENT OPERATING RANGE

Heated oxygen sensor heater current	0.4 to 1 A (when engine idles, HO2 sensor warmed up and battery voltage 11 to 14 V)

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and idle it for 5 minutes or more [B].
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of 3000 rpm for 1 minute [C].
8. Idle the engine for 5 minutes or more [D].
9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0037, P0038 or P0141.
11. Check the DTC judgment result [E].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	DTC judgment completed System normal
ABNORMAL	DTC judgment completed System abnormal
INCOMPLETE	DTC judgment not completed Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	Unable to perform DTC judgment Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

12. If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] through [E]

again.

13. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
14. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

15. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0136.

INSPECTION PROCEDURE

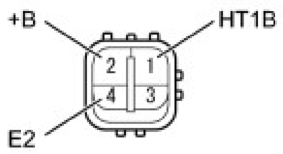
HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)**

Component without harness connected:
(Heated Oxygen Sensor)



(a) Disconnect the heated oxygen sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (HT1B) - 2 (+B)	20°C (68°F)	11 to 16 Ω
1 (HT1B) - 4 (E2)	Always	10 kΩ or higher

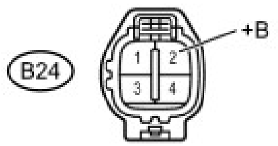
(c) Reconnect the heated oxygen sensor connector.

NG ▶ **REPLACE HEATED OXYGEN SENSOR**

OK ▼

2.	CHECK TERMINAL VOLTAGE (POWER SOURCE)

Front view of wire harness connector:
(Heated Oxygen Sensor)



(a) Disconnect the heated oxygen sensor connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
B24-2 (+B) - Body ground	Ignition switch ON	11 to 14 V

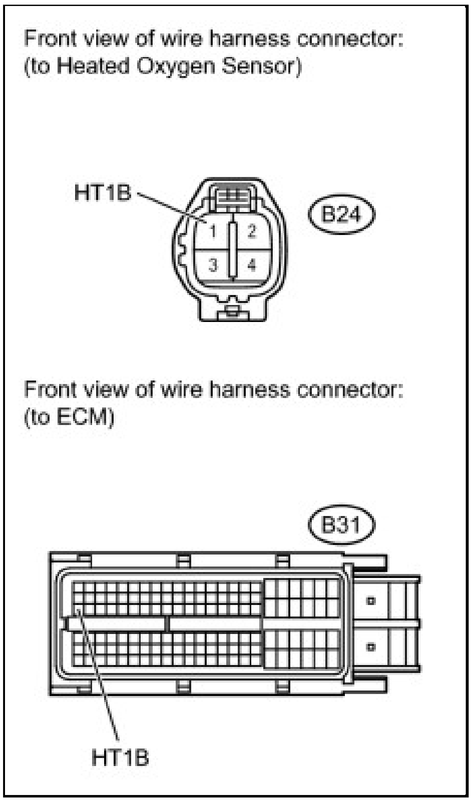
(d) Reconnect the heated oxygen sensor connector.

NG ▶ **INSPECT FUSE (EFI NO. 1)**

OK ▼

3.	CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)

(a) Disconnect the heated oxygen sensor connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B24-1 (HT1B) - B31-47 (HT1B)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B24-1 (HT1B) or B31-47 (HT1B) - Body ground	Always	10 kΩ or higher

(d) Reconnect the heated oxygen sensor connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (HEATED OXYGEN SENSOR - ECM)**

OK

▼

4.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0037, P0038 OR P0141)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs 

.

(e) Start the engine.

(f) Allow the engine to idle for 1 minute or more.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P0037, P0038 or P0141	B

B ▶ REPLACE ECM

A ▶ CHECK FOR INTERMITTENT PROBLEMS

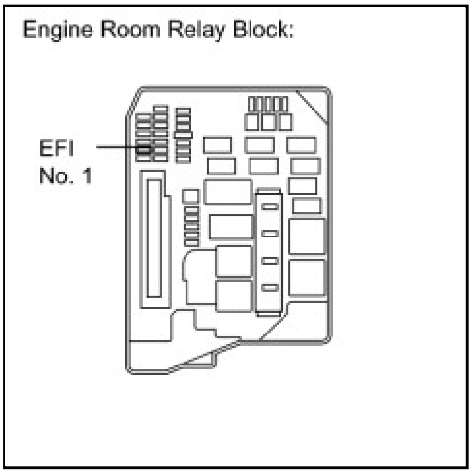
5.	INSPECT FUSE (EFI NO. 1)

(a) Remove the EFI No. 1 fuse from the engine room relay block.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI No. 1 fuse	Always	Below 1 Ω



(c) Reinstall the EFI No. 1 fuse.

NG ▶ REPLACE FUSE (EFI NO. 1 FUSE)

OK ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (HEATED OXYGEN

SENSOR -
ENGINE
ROOM
RELAY
BLOCK)

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PF404MX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0101: Mass Air Flow Circuit Range / Performance Problem (2010 Corolla)		

DTC	**P0101**	**Mass Air Flow Circuit Range / Performance Problem**

DESCRIPTION

Refer to DTC P0102 .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0101	Conditions (a), (b), (c), (d) and (e) continue for more than 10 seconds (2 trip detection logic): (a) Engine running (b) Engine coolant temperature 70°C (158°F) or higher (c) Throttle position sensor voltage 0.24 to 2 V (d) Average engine load value ratio less than 0.85, or more than 1.18 (varies with estimated engine load) Average engine load value ratio = Average engine load based on mass air flow meter output / Average engine load estimated from driving conditions (e) Average air-fuel ratio less than -20%, or more than 20%	• Mass air flow meter • Intake system • PCV hose connections

MONITOR DESCRIPTION

The mass air flow meter is a sensor that measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and to provide an appropriate air-fuel ratio. Inside the mass air flow meter, there is a heated platinum wire which is exposed to the flow of intake air. By applying a specific electrical current to the wire, the ECM heats it to a specific temperature. The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to the mass air flow meter. The voltage level is proportional to the airflow through the sensor, and the ECM uses it to calculate the intake air volume.

The ECM monitors the average engine load value ratio to check the mass air flow meter for malfunctions. The average engine load value ratio is obtained by comparing the average engine load calculated from the mass air flow meter output to the average engine load estimated from the driving conditions, such as the engine speed and the throttle opening angle. If the average engine load value ratio is below the threshold value, the ECM determines that the intake air volume is low, and if the average engine load value ratio is above the threshold value, the ECM determines that the intake air volume is high.

If this is detected in 2 consecutive driving cycles, the MIL is illuminated and the DTC is set.

MONITOR STRATEGY

Related DTCs	P0101: Mass air flow meter rationality
Required Sensors/Components (Main)	Mass air flow meter
Required Sensors/Components (Related)	Crankshaft position sensor Camshaft position sensor Engine coolant temperature sensor Throttle position sensor
Frequency of Operation	Continuous
Duration	10 times
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

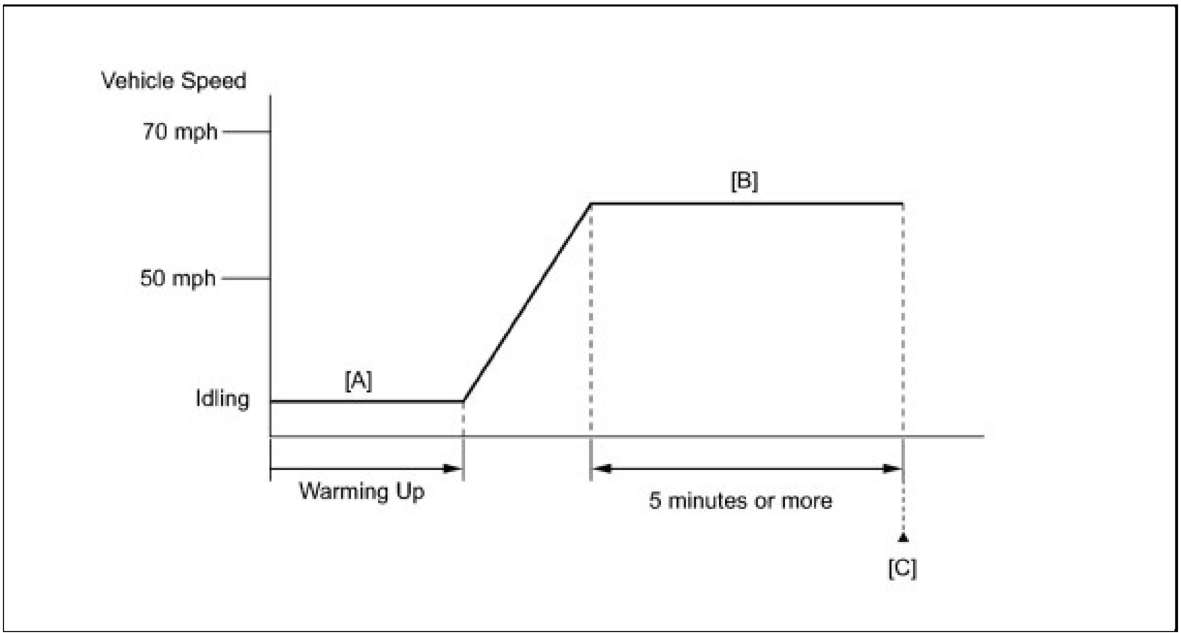
Monitor runs whenever following DTCs are not present	None
Throttle position (Throttle position sensor voltage)	0.24 to 2 V
Time after engine starts	5 seconds
Battery voltage	10.5 V or more
Estimated Load	30 to 70 %
Engine coolant temperature	70°C (158°F) or more
Intake air temperature sensor circuit	OK
Engine coolant temperature sensor circuit	OK
Crankshaft position sensor circuit	OK
Throttle position sensor circuit	OK
Canister pressure sensor circuit	OK
EVAP leak detection pump	OK
EVAP vent valve	OK

TYPICAL MALFUNCTION THRESHOLDS

Both of following conditions 1 and 2 met	-
1. Averaged engine load value ratio	Less than 0.85, or more than 1.18 (varies with estimated engine load)

2. Averaged air-fuel ratio	Less than -20%, or more than 20%

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
5. Turn the ignition switch off.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or higher [A].
8. Drive the vehicle at approximately 50 mph (80 km/h) to 70 mph (112 km/h) for 5 minutes or more [B].

   HINT:

   Drive while keeping the engine load as stable as possible.

9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0101.
11. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal

TECHSTREAM DISPLAY	DESCRIPTION
ABNORMAL	DTC judgment completed System abnormal
INCOMPLETE	DTC judgment not completed Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	Unable to perform DTC judgment Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C] again.

12. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
13. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

14. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0102 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0101)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0101	A
P0101 and other DTCs	B

HINT:

If any DTCs other than P0101 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leak INFO .

OK:
No leak in intake system.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK ▼

3.	CHECK PCV HOSE CONNECTIONS

(a) Check the PCV hose.

OK:

PCV hose is connected correctly and is not damaged.

NG ▶ **REPAIR OR REPLACE PCV HOSE**

OK ▶ **REPLACE MASS AIR FLOW METER**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000U5B09CX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0102,P0103: Mass or Volume Air Flow Circuit Low Input (2010 Corolla)		

DTC	**P0102**	**Mass or Volume Air Flow Circuit Low Input**

DTC	**P0103**	**Mass or Volume Air Flow Circuit High Input**

DESCRIPTION

The mass air flow meter is a sensor that measures the amount of air flowing through the throttle valve.

The ECM uses this information to determine the fuel injection time and to provide the appropriate air fuel ratio.

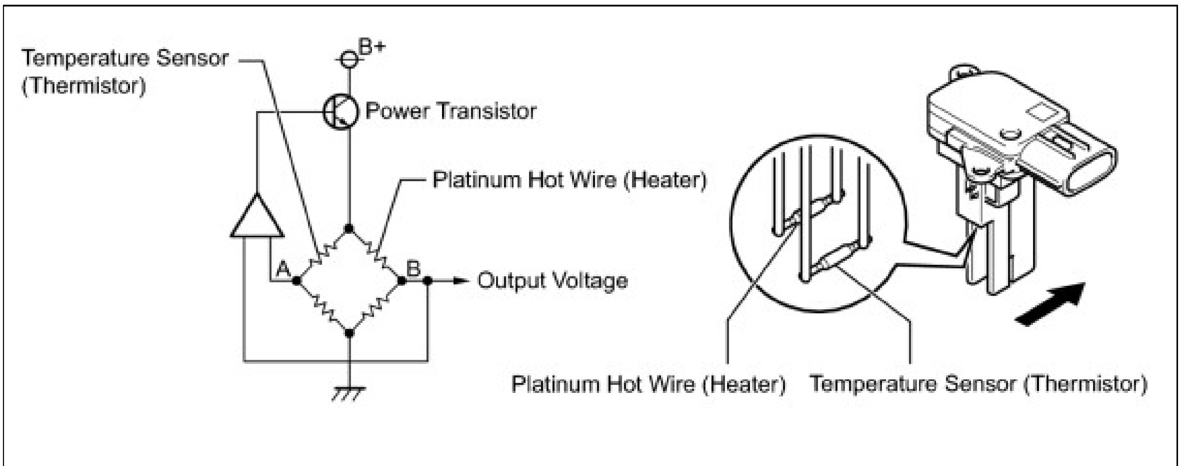
Inside the mass air flow meter, there is a heated platinum wire which is exposed to the flow of intake air.

By applying a specific electrical current to the wire, the ECM heats it to a given temperature. The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to these components in the mass air flow meter. The voltage level is proportional to the air flow through the sensor, and the ECM uses it to calculate the intake air volume.

The circuit is constructed so that the platinum hot wire and the temperature sensor create a bridge circuit, and the power transistor is controlled so that the potentials of A and B remain equal to maintain the predetermined temperature.

HINT:

When any of these DTCs are set, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is calculated by the ECM, according to the engine RPM and throttle valve position. Fail-safe mode continues until a pass condition is detected.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0102	Mass air flow meter voltage less than 0.2 V for 3 seconds (1 trip detection logic)	• Open or short in mass air flow meter circuit • Mass air flow meter • ECM
P0103	Mass air flow meter voltage more than 4.9 V for 3 seconds (1 trip detection logic)	• Open or short in mass air flow meter circuit • Mass air flow meter • ECM

HINT:

When any of these DTCs are set, check the air-flow rate by entering the following menus: Powertrain / Engine and ECT / Data List / All Data / MAF.

MASS AIR FLOW RATE (GM/SEC)	CONDITION	MALFUNCTION
Approximately 0.0	• Engine not running • 30 seconds after ignition switch tuned to ON	• Open in mass air flow meter power source circuit • Open or short in VG circuit
0.48 or more		• Open in E2G circuit

NOTICE:

- Perform the inspection with the vehicle indoors and on a level surface.
- Perform the inspection of the mass air flow meter while it is installed to the air cleaner case (installed to the vehicle).
- During the test, do not use an exhaust air duct on the exhaust tail pipe assembly.

MONITOR DESCRIPTION

If there is a defect in the mass air flow meter or an open or short circuit, the voltage level deviates from the normal operating range. The ECM interprets this deviation as a malfunction in the mass air flow meter circuit and sets a DTC.

Example:

When the sensor output voltage remains less than 0.2 V, or more than 4.9 V, for more than 3 seconds, the ECM sets a DTC.

If the malfunction is not repaired successfully, a DTC is set 3 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0102: Mass air flow meter range check (Low voltage) P0103: Mass air flow meter range check (High voltage)
Required Sensors/Components (Main)	Mass air flow meter
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	3 seconds
MIL Operation	Immediate: Engine RPM less than 4000 rpm 2 driving cycles: Engine RPM 4000 rpm or more
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0102

Mass air flow meter voltage	Less than 0.2 V

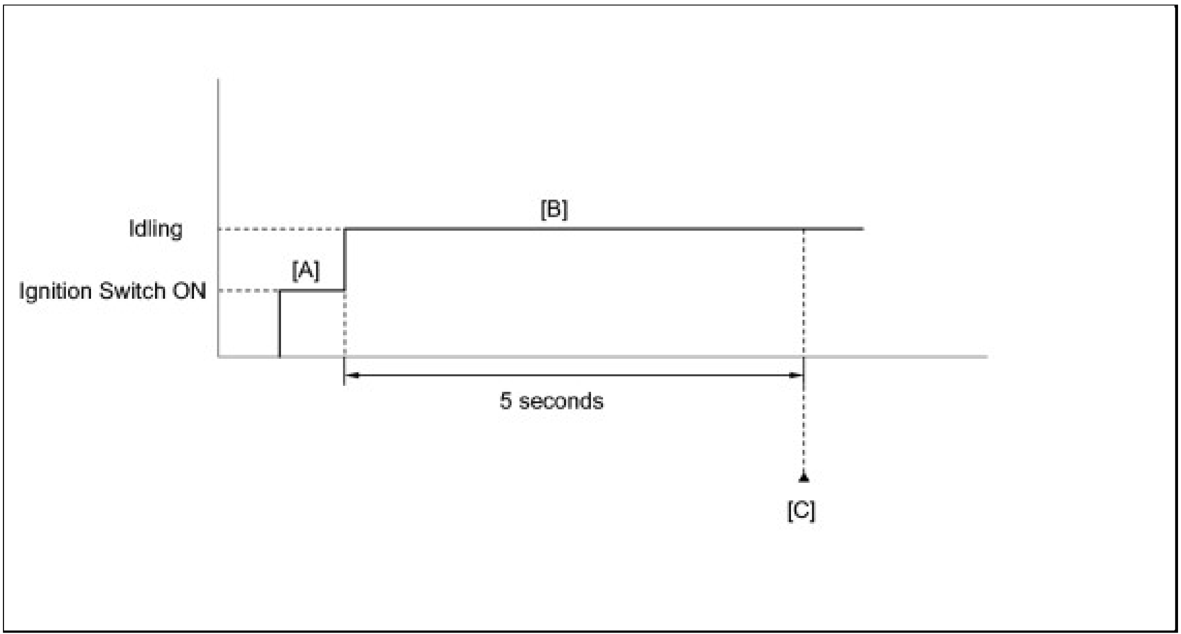
P0103

Mass air flow meter voltage	More than 4.9 V

COMPONENT OPERATING RANGE

Mass air flow meter voltage	Between 0.2 V and 4.9 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Idle the engine for 5 seconds [B].
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P0102 or P0103.
10. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	DTC judgment completed System normal
ABNORMAL	DTC judgment completed System abnormal
INCOMPLETE	DTC judgment not completed Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	Unable to perform DTC judgment Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C] again.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

HINT:

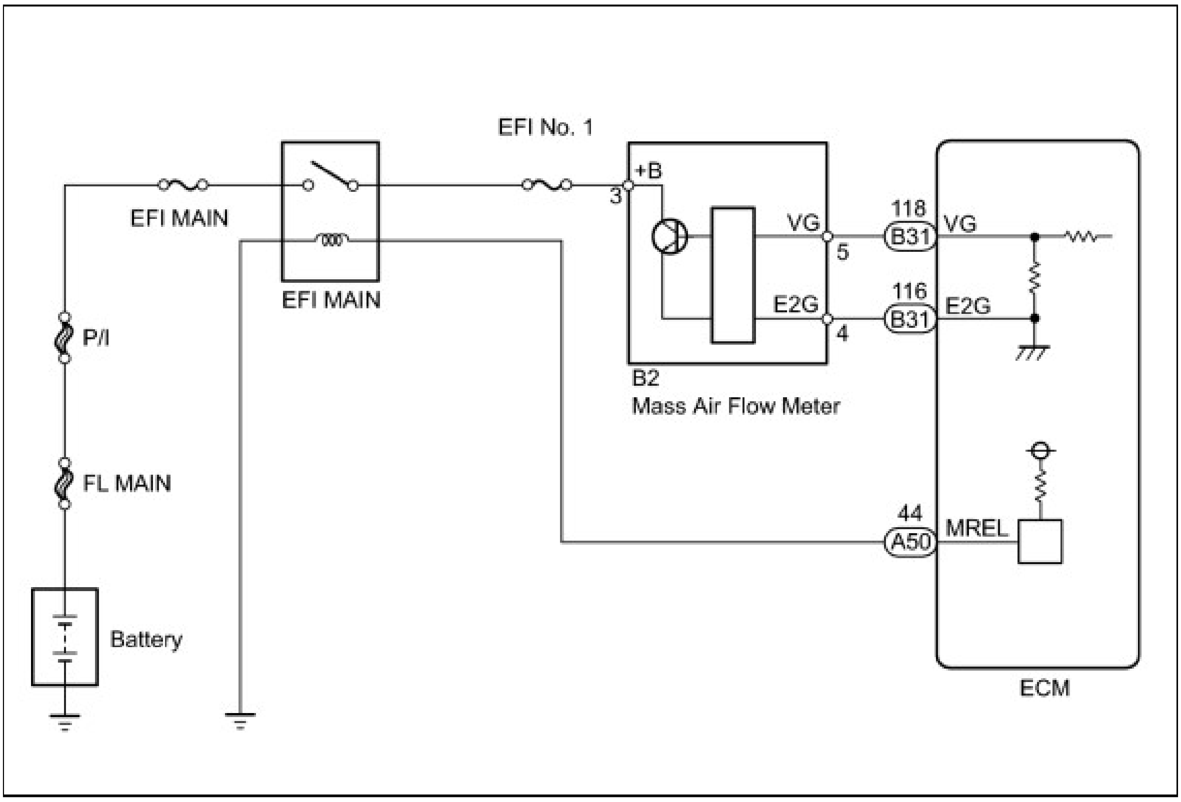
If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, as well as other data from the time the malfunction.

PROCEDURE

1.	READ DTC OUTPUT

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / DTC.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC P0102 is output	A
DTC P0103 is output	B

HINT:

***: The value must change when the throttle valve is open or closed with the engine running.**

B ▶ **CHECK HARNESS AND CONNECTOR (SENSOR GROUND)**

A ▼

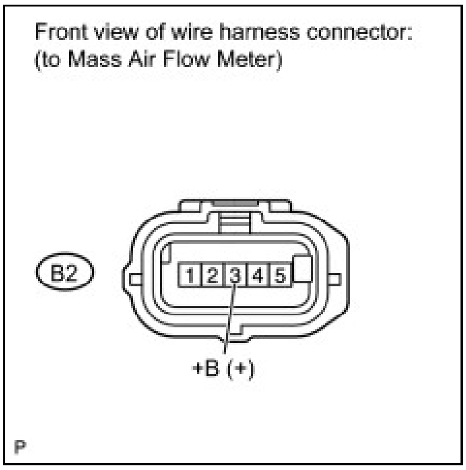
2.	INSPECT MASS AIR FLOW METER (POWER SOURCE VOLTAGE)

(a) Disconnect the mass air flow meter connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:



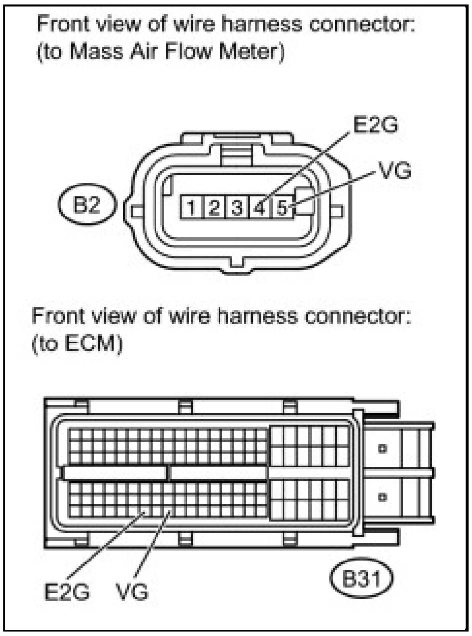
TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
B2-3 (+B) - Body ground	Ignition switch ON	11 to 14 V

(d) Reconnect the mass air flow meter connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY (EFI MAIN RELAY - MASS AIR FLOW METER))**

OK ▼

3.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)



(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B2-5 (VG) - B31-118 (VG)	Always	Below 1 Ω
B2-4 (E2G) - B31-116 (E2G)		

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED

		CONDITION
B2-5 (VG) or B31-118 (VG) - Body ground	Always	10 kΩ or higher

(d) Reconnect the mass air flow meter connector.

(e) Reconnect the ECM connector.

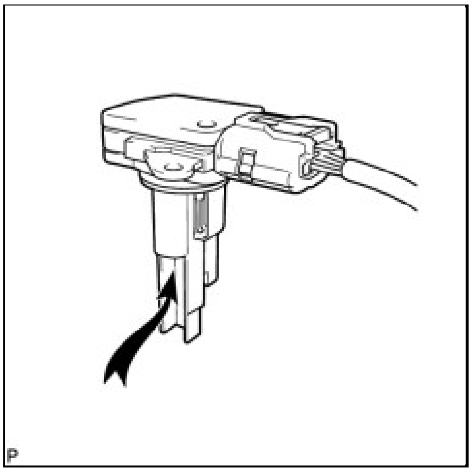
NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (MASS AIR FLOW METER - ECM)**

OK ▼

4.	**INSPECT MASS AIR FLOW METER**

(a) Perform On-vehicle Inspection .

(b) Perform Inspection .



(c) Inspect the function of the mass air flow meter.

(1) Remove the mass air flow meter with the connector connected.

(2) Connect the Techstream to the DLC3.

(3) Turn the engine switch to ON.

(4) Turn the Techstream on.

(5) Enter the following menus: Powertrain / Engine / Data List / MAF.

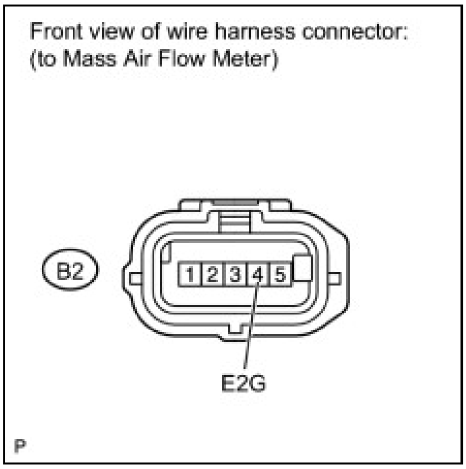
(6) Blow air to the mass air flow meter and check that the intake air amount reading changes.

OK:
The reading changes.

NG ▶ REPLACE MASS AIR FLOW METER

OK ▶ REPLACE ECM

5.	CHECK HARNESS AND CONNECTOR (SENSOR GROUND)



(a) Disconnect the mass air flow meter connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B2-4 (E2G) - Body ground	Always	Below 1 Ω

(c) Reconnect the mass air flow meter connector.

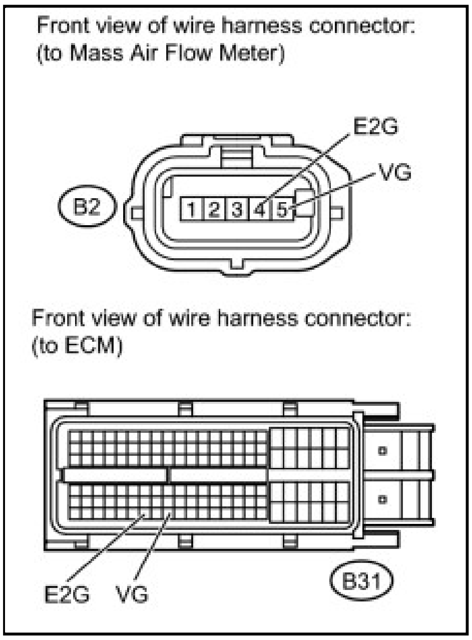
NG ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

OK ▶ REPLACE MASS AIR FLOW METER

6.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.



(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B2-5 (VG) - B31-118 (VG)	Always	Below 1 Ω
B2-4 (E2G) - B31-116 (E2G)		

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B2-5 (VG) or B31-118 (VG) - Body ground	Always	10 kΩ or higher

(d) Reconnect the mass air flow meter connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (MASS AIR FLOW METER - ECM)**

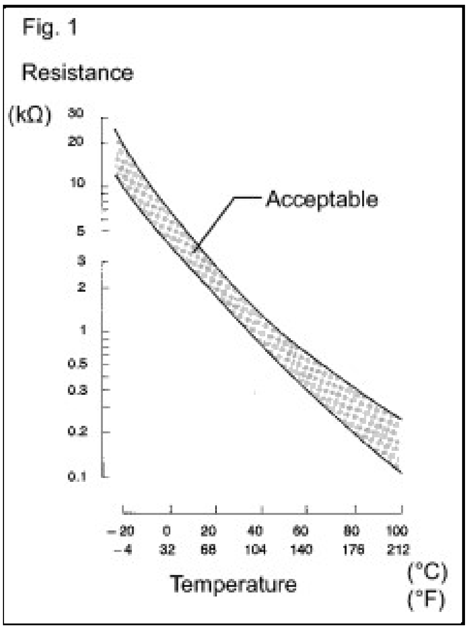
OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PF3094X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0112,P0113: Intake Air Temperature Circuit Low Input (2010 Corolla)		

DTC	**P0112**	**Intake Air Temperature Circuit Low Input**

DTC	**P0113**	**Intake Air Temperature Circuit High Input**

DESCRIPTION



The intake air temperature sensor, mounted on the mass air flow meter, monitors the intake air temperature. The intake air temperature sensor has a built-in thermistor with a resistance that varies according to the temperature of the intake air. When the intake air temperature becomes low, the resistance of the thermistor increases. When the temperature becomes high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes (see Fig. 1).
The intake air temperature sensor is powered by a 5 V supply from the THA terminal of the ECM, via resistor R which is located inside the ECM.
Resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes, according to changes in the intake air temperature, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve driveability.

HINT:

When any of DTCs P0112 and P0113 are set, the ECM enters fail-safe mode. During fail-safe mode, the intake air temperature is estimated to be 20°C (68°F) by the ECM. Fail-safe mode continues until a pass condition is

detected.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0112	Short in intake air temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM
P0113	Open in intake air temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM

HINT:

When any of these DTCs are set, check the intake air temperature by entering the following menus: Powertrain / Engine and ECT / All Data / Intake Air.

TEMPERATURE DISPLAYED	MALFUNCTION
-40°C (-40°F)	Open circuit
140°C (284°F) or higher	Short circuit

MONITOR DESCRIPTION

The ECM monitors the sensor voltage and uses this value to calculate the intake air temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a malfunction in the intake air temperature sensor and sets a DTC.

Example:

If the sensor output voltage is more than 4.91 V for 0.5 seconds or more, the ECM determines that there is an open in the intake air temperature sensor circuit, and sets DTC P0113. Conversely, if the output voltage is less than 0.18 V for 0.5 seconds or more, the ECM determines that there is a short in the sensor circuit, and sets DTC P0112.

If the malfunction is not repaired successfully, a DTC is set 0.5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0112: Intake air temperature sensor range check (Low voltage) P0113: Intake air temperature sensor range check (High voltage)
Required Sensors/Components (Main)	Intake air temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0112

Intake air temperature sensor voltage	Less than 0.18 V [More than 140°C (284°F)]

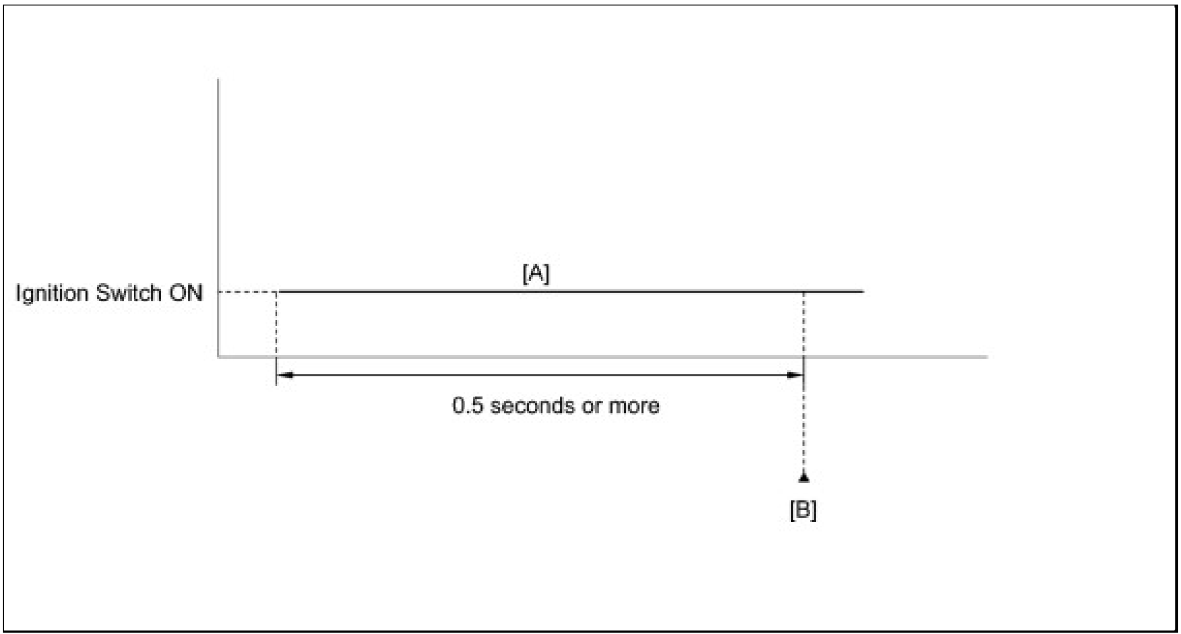
P0113

Intake air temperature sensor voltage	More than 4.91 V [Less than -40°C (-40°F)]

COMPONENT OPERATING RANGE

Intake air temperature sensor voltage	0.18 to 4.91 V [-40 to 140°C (-40 to 284°F)]

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait 0.5 seconds or more [A].
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0112 or P0113.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

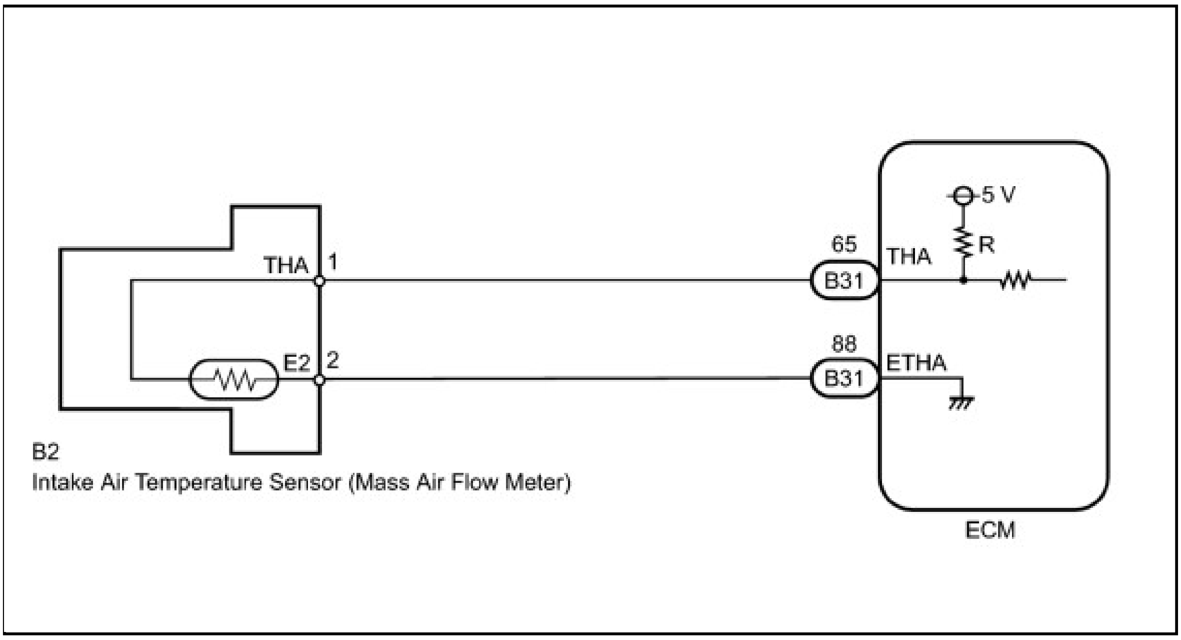
If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs  .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (INTAKE AIR TEMPERATURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Intake Air.

(e) Read the value displayed on the Techstream.

OK:
Same as actual intake air temperature.
Result:

RESULT	PROCEED TO
-40°C (-40°F)	A
140°C (284°F) or higher	B
Same as actual intake air temperature	C

HINT:

- If there is an open circuit, the Techstream indicates -40°C (-40°F).
- If there is a short circuit, the Techstream indicates 140°C (284°F) or higher.

C ▶ **CHECK FOR INTERMITTENT PROBLEMS**

B ▶ **READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)**

A ▼

2.	READ VALUE USING TECHSTREAM (CHECK FOR OPEN IN WIRE HARNESS)

(a) Disconnect the mass air flow meter connector.

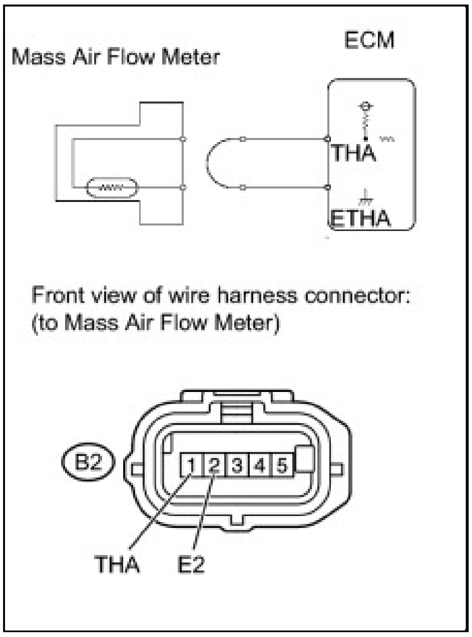
(b) Connect terminals 1 (THA) and 2 (E2) of the mass air flow meter wire harness side connector.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Intake Air.



(g) Read the value displayed on the Techstream.

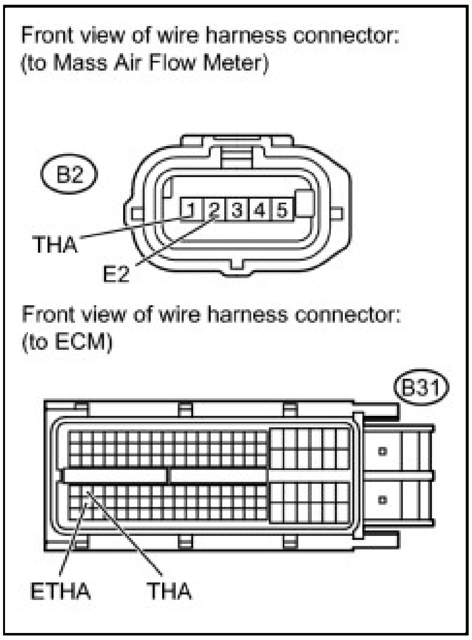
Standard Value:
140°C (284°F) or higher

(h) Reconnect the mass air flow meter connector.

NG ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)**

OK ▶ **REPLACE MASS AIR FLOW METER**

3.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)



(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B2-1 (THA) - B31-65 (THA)	Always	Below 1 Ω
B2-2 (E2) - B31-88 (ETHA)	Always	Below 1 Ω

(d) Reconnect the mass air flow meter connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR**

REPLACE HARNESS OR CONNECTOR (MASS AIR FLOW METER - ECM)

OK ▶ REPLACE ECM

4.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)

(a) Disconnect the mass air flow meter connector.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

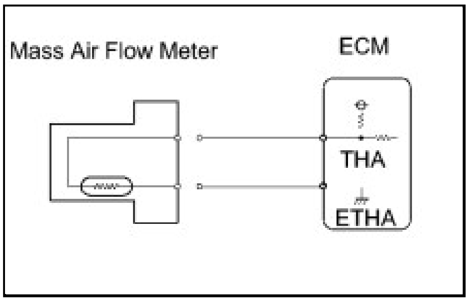
(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Intake Air.

(f) Read the value displayed on the Techstream.

Standard Value:

-40°C (-40°F)

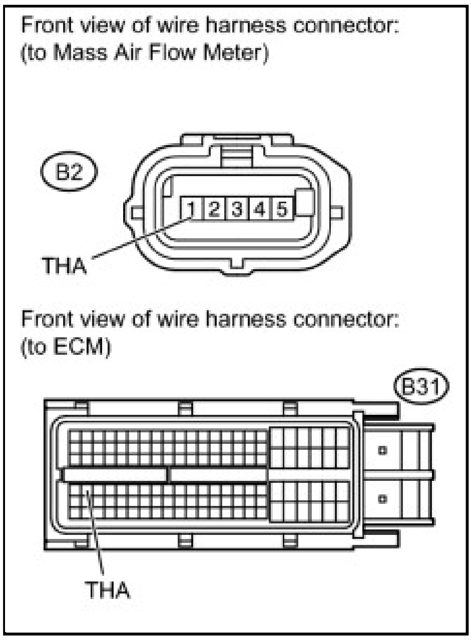


(g) Reconnect the mass air flow meter connector.

NG ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

OK ▶ REPLACE MASS AIR FLOW METER

5.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)



(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B2-1 (THA) or B31-65 (THA) - Body ground	Always	10 kΩ or higher

(d) Reconnect the mass air flow meter connector.

(e) Reconnect the ECM connector.

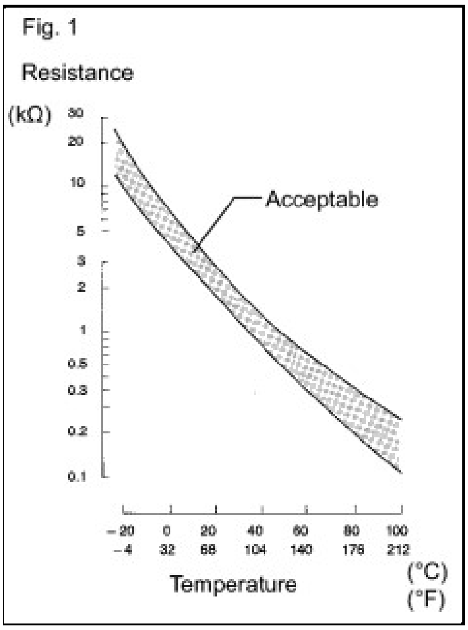
NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (MASS AIR FLOW METER - ECM)**

OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000001WPH02PX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0111: Intake Air Temperature Sensor Gradient Too High (2010 Corolla)		

DTC	**P0111**	**Intake Air Temperature Sensor Gradient Too High**

DESCRIPTION



The intake air temperature sensor, part of the mass air flow meter, monitors the intake air temperature. The intake air temperature sensor has a built-in thermistor with a resistance that varies according to the temperature of the intake air. When the intake air temperature becomes low, the resistance of the thermistor increases. When the temperature becomes high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes (See Fig. 1).
The intake air temperature sensor is powered by a 5 V supply from the THA terminal of the ECM, via resistor R which is located inside the ECM.
Resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes, according to changes in the intake air temperature, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve driveability.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0111	When either of following conditions is met (2 trip detection logic): • In duration between engine warmed up and next engine starts, change in intake air temperature sensor output bellow threshold	Mass air flow meter

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
	• During engine warming up after cold engine starts, change in intake air temperature sensor output bellow threshold	

MONITOR DESCRIPTION

After a warm engine is stopped

The ECM monitors the intake air temperature variation in the period from when the engine was warmed up on the previous trip until the next engine start. If the change in engine coolant temperature sensor output is less than the threshold, it is determined that a malfunction has occurred in the intake air temperature sensor. When this is detected, the MIL is illuminated and the DTC is set.

After a cold engine is started

The monitor runs when the engine is started cold after 5 hours or more have elapsed since the engine stopped. If the intake air temperature sensor output variation until the engine has warmed up completely is less than the threshold, it is determined that a malfunction has occurred in the intake air temperature sensor. When this is detected in 2 consecutive driving cycles, the MIL is illuminated and the DTC is set.

MONITOR STRATEGY

Related DTCs	P0111: Intake air temperature sensor rationality (After engine stop) P0111: Intake air temperature sensor rationality (After cold engine start)
Required Sensors/Components (Main)	Intake air temperature sensor
Required Sensors/Components (Sub)	-
Frequency of Operation	Once per driving cycle
Duration	5 hours or more
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

After Engine Stop

Time after engine start	10 seconds or more
Battery voltage	10.5 V or more
Engine coolant temperature sensor circuit	OK
Engine coolant temperature before engine stop	70°C (158°F) or more
Time that mass air flow is low before engine stop	2100 seconds
Accumulated mass air flow amount before engine stop	1864 g or more
Key-off duration	30 minutes

After Cold Engine Start

Key-off duration	5 hours
Time after engine start	10 seconds or more
Engine coolant temperature sensor circuit	OK
Engine coolant temperature	70°C (158°F) or more
Accumulated mass air flow amount	1864 g or more
Either of following conditions 1 or 2 is met:	-
1. Duration while engine load is low	120 seconds or more
2. Duration while engine load is high	10 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

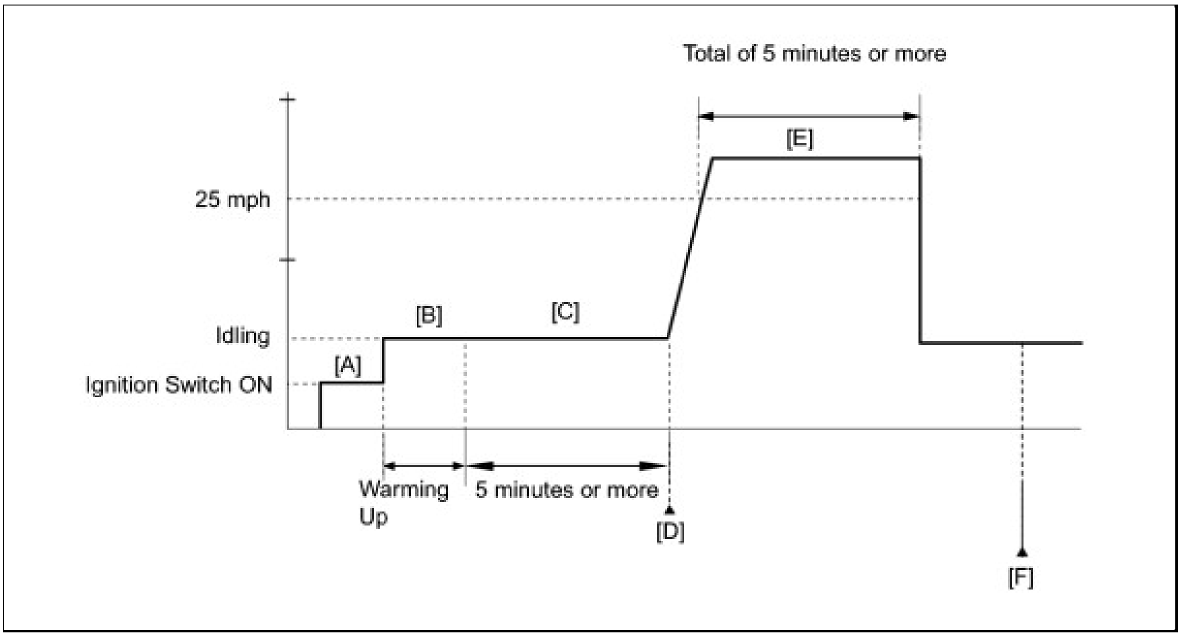
After Engine Stop

Intake air temperature change	Less than 1°C (33.8°F)

After Cold Engine Start

Intake air temperature change	Less than 1°C (33.8°F)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
7. Idle the engine for 5 minutes or more [C].

   HINT:

   During steps [A] through [C], if the change in the intake air temperature is below 1°C (1.8°F), the intake air temperature sensor (mass air flow meter) is malfunctioning. It is not necessary to continue this procedure.

8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P0111.
10. Check the DTC judgment result [D].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions

TECHSTREAM DISPLAY	DESCRIPTION
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:
When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [E] and [F].

11. Drive the vehicle at 25 mph (40 km/h) or more for a total of 5 minutes or more [E].
12. Check the DTC judgment result again [F].

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [E] and [F] again.

13. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
14. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

15. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0112 INFO .

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0111)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0111 and other DTCs	A
P0111	B

HINT:

If any DTCs other than P0111 are output, troubleshoot those DTCs first.

B **REPLACE MASS AIR FLOW METER**

A **GO TO DTC CHART**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PF509VX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0115,P0117,P0118: Engine Coolant Temperature Circuit Malfunction (2010 Corolla)		

DTC	**P0115**	**Engine Coolant Temperature Circuit Malfunction**

DTC	**P0117**	**Engine Coolant Temperature Circuit Low Input**

DTC	**P0118**	**Engine Coolant Temperature Circuit High Input**

DESCRIPTION

A thermistor, whose resistance value varies according to the engine coolant temperature, is built into the engine coolant temperature sensor.

The structure of the sensor and its connection to the ECM are similar to that of the intake air temperature sensor.

HINT:

When any of DTCs P0115, P0117 and P0118 are set, the ECM enters fail-safe mode. During fail-safe mode, the engine coolant temperature is estimated to be 80°C (176°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0115	Open or short in engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0117	Short in engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0118	Open in engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in engine coolant temperature sensor circuit

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		• Engine coolant temperature sensor • ECM

HINT:

When any of these DTCs are set, check the engine coolant temperature by entering the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

TEMPERATURE DISPLAYED	MALFUNCTION
-40°C (-40°F)	Open circuit
140°C (284°F)	Short circuit

MONITOR DESCRIPTION

The engine coolant temperature sensor is used to monitor the engine coolant temperature. The engine coolant temperature sensor has a thermistor with a resistance that varies according to the temperature of the engine coolant. When the coolant temperature becomes low, the resistance in the thermistor increases. When the temperature becomes high, the resistance drops. These variations in resistance are reflected in the output voltage from the sensor. The ECM monitors the sensor voltage and uses this value to calculate the engine coolant temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the engine coolant temperature sensor circuit and sets a DTC.

Example:

If the sensor output voltage is more than 4.91 V for 0.5 seconds or more, the ECM determines that there is an open in the engine coolant temperature sensor circuit, and sets DTC P0118. Conversely, if the voltage output is less than 0.14 V for 0.5 seconds or more, the ECM determines that there is a short in the sensor circuit, and sets DTC P0117.

If the malfunction is not repaired successfully, a DTC is set 0.5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0115: Engine coolant temperature sensor range check (Fluctuating) P0117: Engine coolant temperature sensor range check (Low voltage) P0118: Engine coolant temperature sensor range check (High voltage)
Required Sensors/Components (Main)	Engine coolant temperature sensor

Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0115

Engine coolant temperature sensor voltage	Less than 0.14 V, or more than 4.91 V

P0117

Engine coolant temperature sensor voltage	Less than 0.14 V [More than 140°C (284°F)]

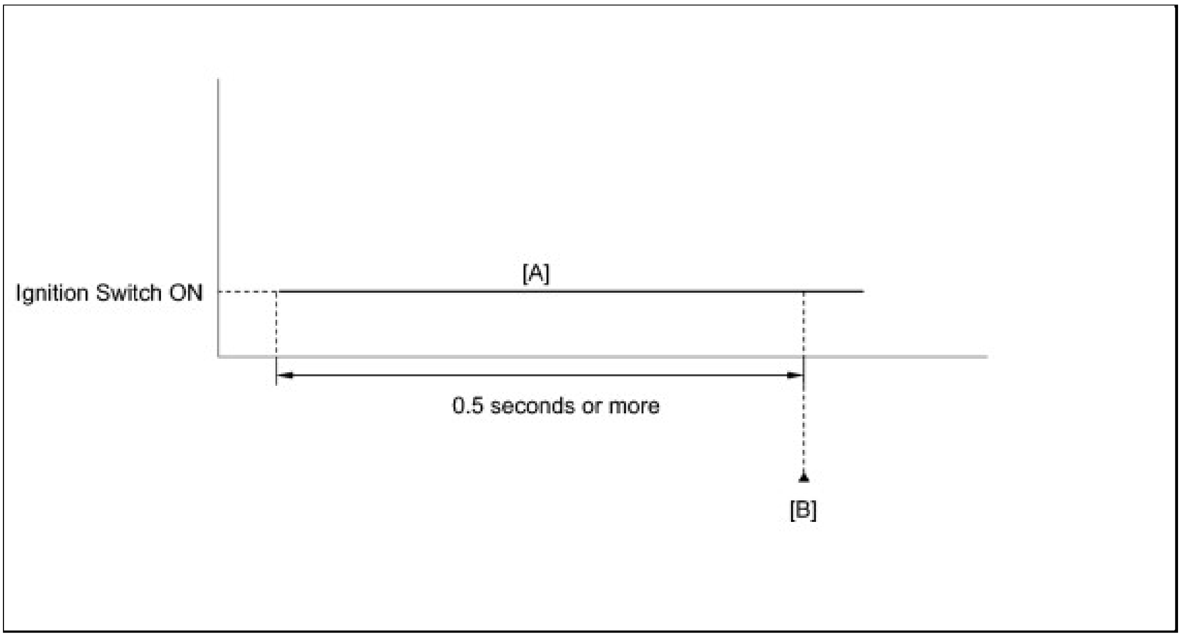
P0118

Engine coolant temperature sensor voltage	More than 4.91 V [Less than -40°C (-40°F)]

COMPONENT OPERATING RANGE

Engine coolant temperature sensor voltage	0.14 to 4.91 V [-40 to 140°C (-40 to 284°F)]

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Wait 0.5 seconds or more [A].
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0115, P0117 or P0118.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

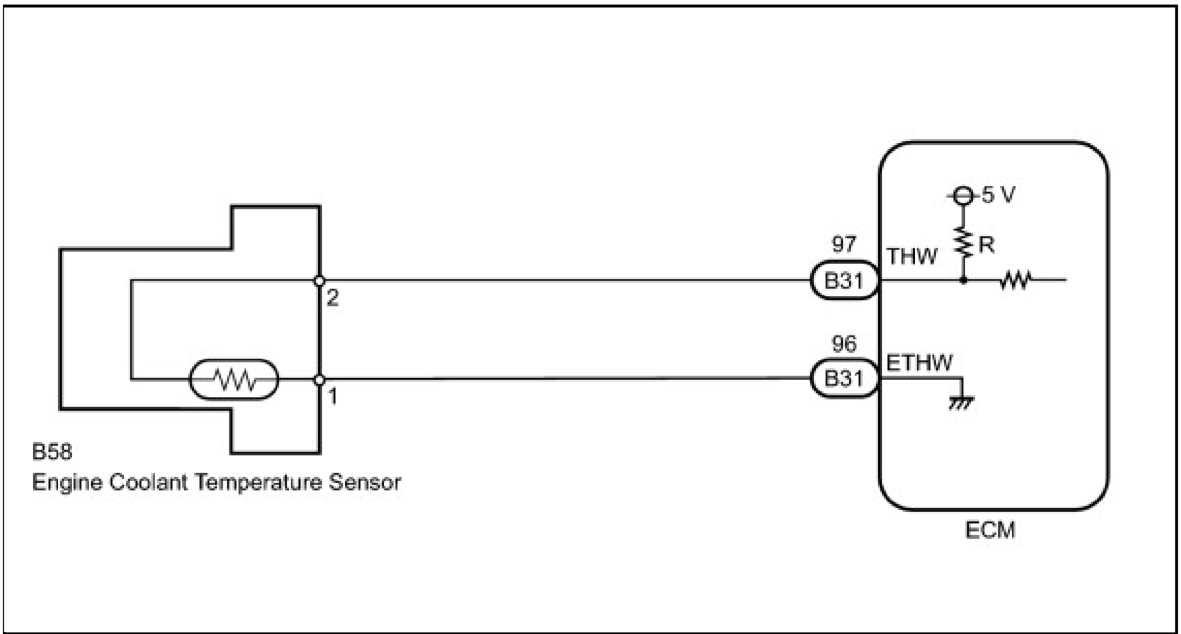
If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (ENGINE COOLANT TEMPERATURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(e) Read the value displayed on the Techstream.

Standard Value:
Between 80°C and 100°C (176°F and 212°F) with a warm engine.
Result:

RESULT	PROCEED TO
-40°C (-40°F)	A
140°C (284°F)	B
Between 80°C and 100°C (176°F and 212°F)	C

HINT:

- If there is an open circuit, the Techstream indicates -40°C (-40°F).
- If there is a short circuit, the Techstream indicates 140°C (284°F).

C ▶ **CHECK FOR INTERMITTENT PROBLEMS**

B ▶ **READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)**

A ▼

2.	**READ VALUE USING TECHSTREAM (CHECK FOR OPEN IN WIRE HARNESS)**

(a) Disconnect the engine coolant temperature sensor connector.

(b) Connect terminals 1 and 2 of the engine coolant temperature sensor connector on the wire harness side.

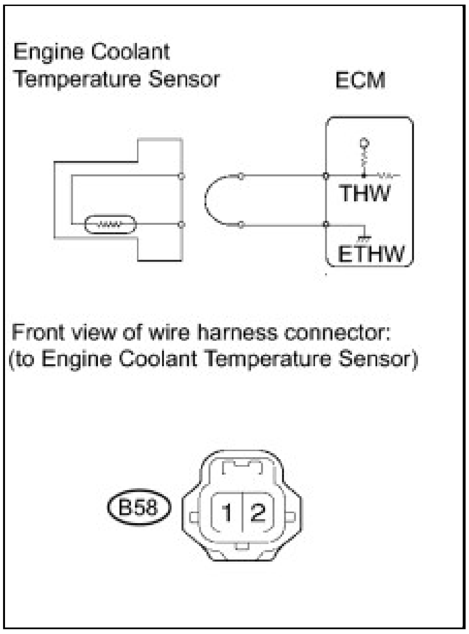
(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT

/ Data List / Coolant Temp.



(g) Read the value displayed on the Techstream.

Standard Value:

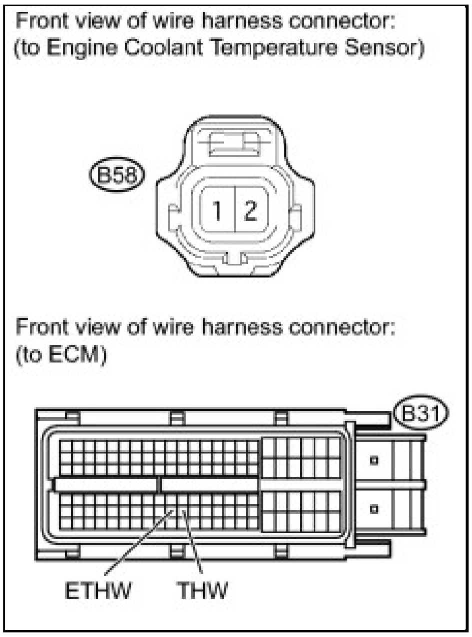
140°C (284°F).

(h) Reconnect the engine coolant temperature sensor connector.

NG ▶ **CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)**

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

3.	CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)



(a) Disconnect the engine coolant temperature sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B58-2 - B31-97 (THW)	Always	Below 1 Ω
B58-1 - B31-96 (ETHW)	Always	Below 1 Ω

(d) Reconnect the engine coolant temperature sensor connector.

(e) Reconnect the ECM connector.

NG	REPAIR OR REPLACE HARNESS OR CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)
OK	REPLACE ECM

4.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)

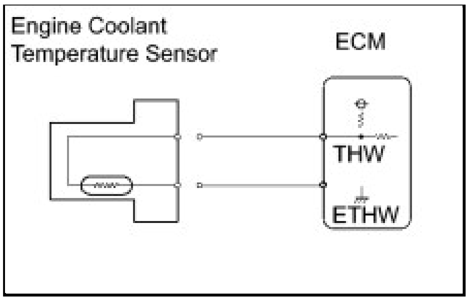
(a) Disconnect the engine coolant temperature sensor connector.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / All Data / Coolant Temp.



(f) Read the value displayed on the Techstream.

Standard Value:
-40°C (-40°F)

(g) Reconnect the engine coolant temperature sensor connector.

NG	CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)
OK	REPLACE ENGINE

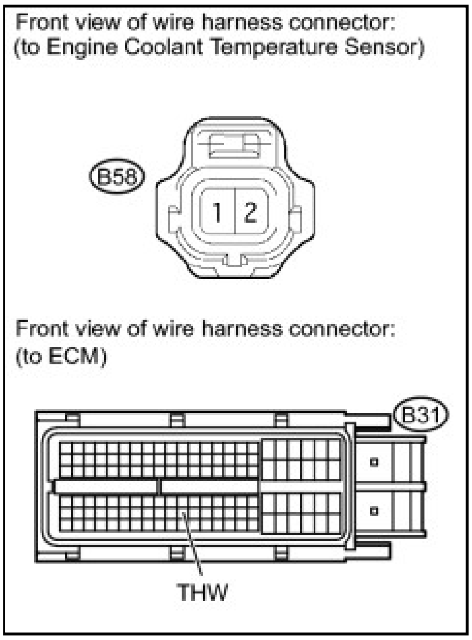
COOLANT TEMPERATURE SENSOR

5.	CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)

(a) Disconnect the engine coolant temperature sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B58-2 or B31-97 (THW) - Body ground	Always	10 kΩ or higher

(d) Reconnect the engine coolant temperature sensor connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)**

OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000WBY06ZX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0136-P0139: Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2) (2010 Corolla)		

DTC	**P0136**	**Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)**

DTC	**P0137**	**Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 2)**

DTC	**P0138**	**Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)**

DTC	**P0139**	**Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 2)**

DESCRIPTION

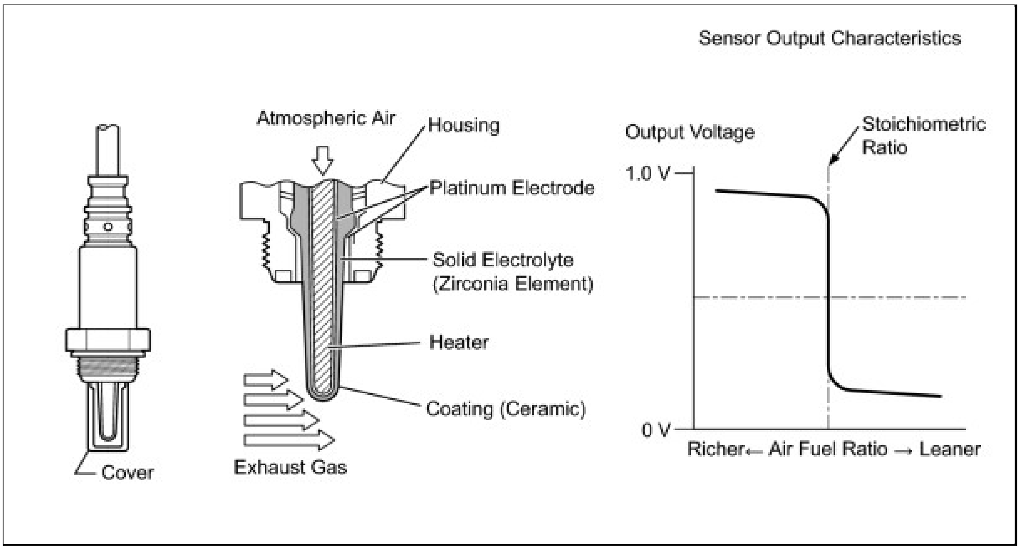
A three-way catalytic converter (TWC) is used in order to convert the carbon monoxide (CO), hydrocarbon (HC), and nitrogen oxide (NOx) into less harmful substances. To allow the three-way catalytic converter to function effectively, it is necessary to keep the air fuel ratio of the engine near the stoichiometric air fuel ratio. For the purpose of helping the ECM to deliver accurate air fuel ratio control, the heated oxygen sensor is used.

The heated oxygen sensor is located behind the three-way catalytic converter, and detects the oxygen concentration in the exhaust gas. Since the sensor is integrated with the heater that heats the sensing portion, it is possible to detect the oxygen concentration even when the intake air volume is low (the exhaust gas temperature is low).

When the air fuel ratio becomes lean, the oxygen concentration in the exhaust gas is great. The heated oxygen sensor informs the ECM that the post three-way catalytic converter air fuel ratio is lean (low voltage, i.e. less than 0.45 V).

Conversely, when the air fuel ratio is richer than the stoichiometric air-fuel level, the oxygen concentration in the exhaust gas becomes small. The heated oxygen sensor informs the ECM that the post-TWC air fuel ratio is rich (high voltage, i.e. more than 0.45 V). The heated oxygen sensor has the property of changing its output voltage drastically when the air fuel ratio is close to the stoichiometric level.

The ECM uses the supplementary information from the HO2 sensor to determine whether the air fuel ratio after the three-way catalytic converter is rich or lean, and adjusts the fuel injection time accordingly. Thus, if the heated oxygen sensor is working improperly due to internal malfunctions, the ECM is unable to compensate for deviations in the primary air fuel ratio control.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0136	• Abnormal voltage output: During active air fuel ratio control, following conditions (a) and (b) met for certain period of time (2 trip detection logic) (a) Heated oxygen sensor voltage does not decrease to less than 0.21 V (b) Heated oxygen sensor voltage does not increase to more than 0.59 V • Low impedance: Sensor impedance less than 5 Ω for more than 30 seconds when ECM presumes sensor to being warmed up and operating normally (2 trip detection logic)	• Open or short in heated oxygen sensor (bank 1 sensor 2) circuit • Heated oxygen sensor (bank 1 sensor 2) • Heated oxygen sensor heater (bank 1 sensor 2) • Air fuel ratio sensor (bank 1 sensor 1) • Gas leaks from exhaust system
P0137	• Low voltage (open): During active air fuel ratio control, following conditions (a) and (b) met for certain period of time (2 trip detection logic) (a) Heated oxygen sensor voltage output less than 0.21 V (b) Target air fuel ratio rich • High impedance: Sensor impedance 15 kΩ or more for more than 90 seconds when ECM presumes sensor to be warmed up and operating normally (2 trip detection logic)	• Open in heated oxygen sensor (bank 1 sensor 2) circuit • Heated oxygen sensor (bank 1 sensor 2) • Heated oxygen sensor heater (bank 1 sensor 2) • Air fuel ratio sensor (bank 1 sensor 1) • Gas leaks from exhaust system
P0138	• High voltage (short): During active air fuel ratio control, following conditions (a) and (b) met for certain period of time (2 trip detection logic) (a) Heated oxygen sensor voltage output 0.59 V or more (b) Target air fuel ratio lean	• Short in heated oxygen sensor (bank 1 sensor 2) circuit • Heated oxygen sensor (bank 1 sensor 2) • ECM

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
	• Extremely high voltage (short): HO2 sensor voltage output exceeds 1.2 V for more than 10 seconds (2 trip detection logic)	
P0139	• Heated oxygen sensor (sensor 2) voltage does not drop to below 0.2 V immediately after fuel cut starts (2 trip detection logic) • The heated oxygen sensor (sensor 2) voltage does not drop from 0.35 V to 0.2 V immediately after fuel cut starts (2 trip detection logic)	• Short in heated oxygen sensor (bank 1 sensor 2) circuit • Heated oxygen sensor (bank 1 sensor 2) • ECM

for Mexico Models

DTC NO.	DTC DETECTION CONDITIONS	TROUBLE AREAS
P0136	Not applicable	None
P0137	• Low voltage (open): During active air-fuel ratio control, both of the following conditions are met for a certain period of time (2 trip detection logic): (a) The Heated oxygen sensor voltage output is below 0.21 V. (b) The target air-fuel ratio is rich.	• Open in Heated oxygen sensor (sensor 2) circuit • Heated oxygen sensor (sensor 2) • Heated oxygen sensor heater (sensor 2) • EFI relay • Gas leak from exhaust system
P0138	Not applicable	None
P0139	Not applicable	None

MONITOR DESCRIPTION

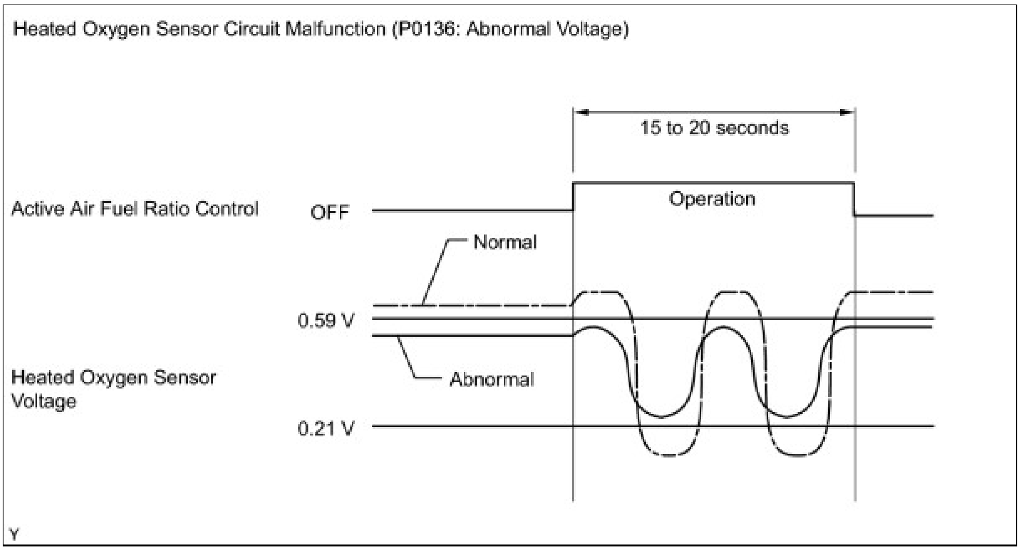
1. Active Air Fuel Ratio Control

The ECM usually performs air fuel ratio feedback control so that the air fuel ratio sensor output indicates a near stoichiometric air fuel ratio. This vehicle includes active air fuel ratio control in addition to regular air fuel ratio control. The ECM performs active air fuel ratio control to detect any deterioration in the three-way catalytic converter and heated oxygen sensor malfunctions (refer to the diagram below).

Active air fuel ratio control is performed for approximately 15 to 20 seconds while driving with a warm engine. During active air fuel ratio control, the air fuel ratio is forcibly regulated to become lean or rich by the ECM. If the ECM detects a malfunction, a DTC is set.

2. Abnormal Voltage Output of Heated Oxygen (HO2) Sensor (DTC P0136)

While the ECM is performing active air fuel ratio control, the air fuel ratio is forcibly regulated to become rich or lean. If the sensor is not functioning properly, the voltage output variation is small. For example, when the heated oxygen sensor voltage does not decrease to less than 0.21 V or does not increase to more than 0.59 V during active air fuel ratio control, the ECM determines that the sensor voltage output is abnormal and sets DTCs P0136.



3. Open or Short in Heated Oxygen Sensor Circuit (DTCs P0137 or P0138)

During active air fuel ratio control, the ECM calculates the oxygen storage capacity* of the three-way catalytic converter by forcibly regulating the air fuel ratio to become rich or lean.

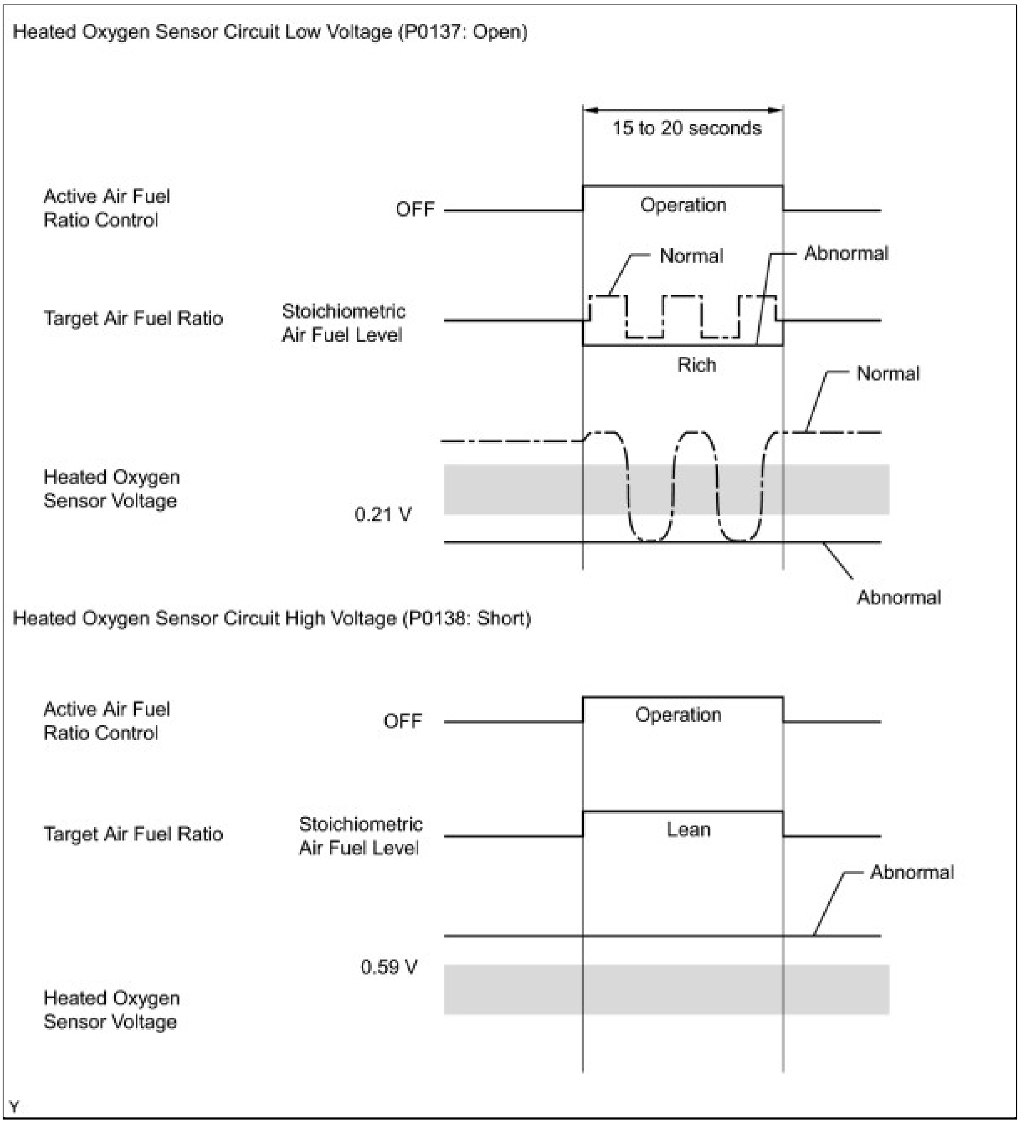
If the heated oxygen sensor has an open or short, or the voltage output of the sensor noticeably decreases, the oxygen storage capacity indicates an extraordinarily high value. Even if the ECM attempts to continue regulating the air fuel ratio to become rich or lean, the heated oxygen sensor output does not change.

While performing active air fuel ratio control, when the target air fuel ratio is rich and the heated oxygen sensor voltage output is 0.21 V or less (lean), the ECM interprets this as an abnormally low sensor output voltage and sets DTC P0137. When the target air fuel ratio is lean and the voltage output is 0.59 V or more (rich) during active air fuel ratio control, the ECM determines that the sensor voltage output is abnormally high, and sets DTC P0138.

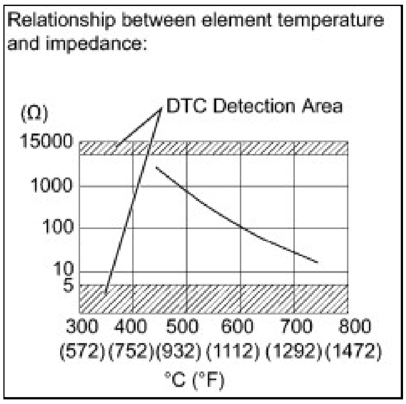
HINT:

DTC P0138 is also set if the heated oxygen sensor voltage output is more than 1.2 V for 10 seconds or more.

***: The three-way catalytic converter has the capability to store oxygen. The oxygen storage capacity and the emission purification capacity of the three-way catalytic converter are mutually related. The ECM determines whether the catalyst has deteriorated, based on the calculated oxygen storage capacity value INFO .**



4. High or Low Impedance of Heated Oxygen Sensor (DTCs P0136 or P0137)



During normal air fuel ratio feedback control, there are small variations in the exhaust gas oxygen concentration. In order to continuously monitor the slight variation of the heated oxygen sensor signal while the engine is running, the impedance* of the sensor is measured by the ECM. The ECM determines that there is a malfunction in the sensor when the measured impedance deviates from the standard range.

*: The effective resistance in an alternating current electrical circuit.

HINT:

- The impedance cannot be measured using an ohmmeter.
- DTC P0136 indicates the deterioration of the heated oxygen sensor. The ECM sets the DTCs by calculating the impedance of the sensor when the typical enabling conditions are satisfied (2 driving cycles).
- DTC P0137 indicates an open or short circuit in the heated oxygen sensor (2 driving cycles). The ECM sets the DTCs when the impedance of the sensor exceeds the threshold of 15 kΩ.

5. Abnormal Voltage Output of Heated Oxygen Sensor During Fuel-cut (DTC P0139)

The sensor output voltage drops to below 0.2 V (extremely Lean status) immediately when the vehicle decelerates and fuel cut is operating. If the voltage does not drop to below 0.2 V for 7 seconds or more, or voltage does not drop from 0.35 V to 0.2 V for 1 seconds, the ECM determines that the sensor response has deteriorated, illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0136: Heated oxygen sensor output voltage (Output voltage) P0136: Heated oxygen sensor impedance (Low) P0137: Heated oxygen sensor output voltage (Low voltage) P0137: Heated oxygen sensor impedance (High) P0138: Heated oxygen sensor output voltage (High voltage) P0138: Heated oxygen sensor output voltage (Extremely high) P0139: Heated oxygen sensor output voltage during fuel cut
Required Sensors/Components (Main)	Heated oxygen sensor (sensor 2)
Required Sensors/Components (Related)	Crankshaft position sensor Engine coolant temperature sensor Mass air flow meter Throttle position sensor
Frequency of Operation	Once per driving cycle: Active air fuel ratio control detection, Heated oxygen sensor output voltage during fuel cut Continuous: Other
Duration	20 seconds: Heated oxygen sensor output (Output voltage, High voltage, Low voltage) 30 seconds: Heated oxygen sensor impedance (Low) 90 seconds: Heated oxygen sensor impedance (High) 10 seconds: Heated oxygen sensor voltage (Extremely high) 7 seconds: Heated oxygen sensor voltage during fuel cut
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All:

Monitor runs whenever following DTCs are not present	P0016 (VVT System Bank 1 - Misalignment) P0031, P0032 (Air Fuel Ratio Sensor Heater - Sensor 1) P0037, P0038 (Heated Oxygen Sensor Heater - Sensor 2) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121 P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0451, P0452, P0453 (EVAP System)

	P0500 (Vehicle Speed Sensor) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)

Heated Oxygen Sensor Output Voltage (Output Voltage, High Voltage and Low Voltage):

Active air fuel ratio control	Executing
Active air fuel ratio control begins when all of following conditions are met:	-
Battery voltage	11 V or more
Engine coolant temperature	75°C (167°F) or more
Idling	OFF
Engine RPM	Less than 4000 rpm
Air fuel ratio sensor status	Activated
Fuel system status	Closed loop
Fuel cut	OFF
Engine load	10 to 80%
Shift position	A/T models: 4th or more M/T models: 3th or more

Heated Oxygen Sensor Impedance (Low):

Battery voltage	11 V or more
Estimated sensor temperature	Less than 700°C (1292°F)
ECM monitor	Completed
DTC P0607	Not set

Heated Oxygen Sensor Impedance (High):

Battery voltage	11 V or more
Estimated sensor temperature	450°C (842°F) or more, less than 750°C (1382°F)
DTC P0607	Not set

Heated Oxygen Sensor Output Voltage (Extremely High):

Battery voltage	11 V or more
Time after engine start	2 seconds or more

Heated oxygen sensor voltage during fuel cut:

Engine coolant temperature	75°C (167°F) or more
Catalyst temperature	400°C (752°F) or more
Fuel cut	Executing

TYPICAL MALFUNCTION THRESHOLDS

Heated Oxygen Sensor Output Voltage (Output voltage):

Either of following conditions are met:	1 or 2
1. All of following conditions (a), (b) and (c) are met	-
(a) Commanded air fuel ratio	14.3 or less
(b) Rear heated oxygen sensor voltage	0.21 to 0.59 V
(c) Oxygen storage capacity of catalyst	2.0 g or more
2. All of following conditions (d), (e) and (f) are met	-
(d) Commanded air fuel ratio	14.9 or more
(e) Rear heated oxygen sensor voltage	0.21 to 0.59 V
(f) Oxygen storage capacity of catalyst	2.0 g or more

Heated Oxygen Sensor Output Voltage (Low output voltage):

All of following conditions (a), (b) and (c) are met	-
(a) Commanded air fuel ratio	14.3 or less
(b) Rear heated oxygen sensor voltage	Less than 0.21 V
(c) Oxygen Storage Capacity of Catalyst	2.0 g or more

Heated Oxygen Sensor Output Voltage (High output voltage):

All of following conditions (a), (b) and (c) are met	-
(a) Commanded air fuel ratio	14.9 or more
(b) Rear heated oxygen sensor voltage	More than 0.59 V
(c) Oxygen Storage Capacity of Catalyst	2.0 g or more

Heated Oxygen Sensor Impedance (Low):

Duration of following condition	30 seconds or more
Heated oxygen sensor impedance	Less than 5 Ω

Heated Oxygen Sensor Impedance (High):

Duration of following condition	90 seconds or more
Heated oxygen sensor impedance	15 kΩ or more

Heated Oxygen Sensor Output Voltage (Extremely High):

Duration of following condition	10 seconds or more
Heated oxygen sensor voltage	1.2 V or more

Heated Oxygen Sensor Voltage During Fuel-cut:

Duration until rear heated oxygen sensor voltage drops to 0.2 V after fuel cut	7 seconds or more
Duration that rear oxygen sensor voltage drops from 0.35 V to 0.2 V during fuel cut	1 seconds or more

COMPONENT OPERATING RANGE

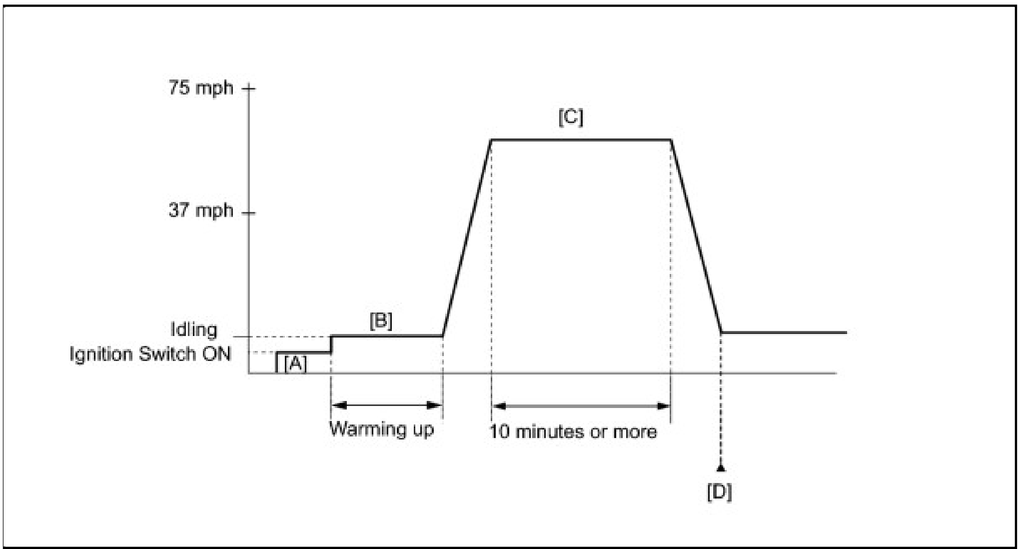
Duration of following condition	30 seconds or more
Heated oxygen sensor voltage	Less than 1.2 V

MONITOR RESULT

Refer to CHECKING MONITOR STATUS INFO .

CONFIRMATION DRIVING PATTERN

P0136, P0137 and P0138



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
7. With the transmission in 4th gear or higher, drive the vehicle at 37 to 75 mph (60 to 120 km/h) for 10 minutes or more [C].
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P0136, P0137 or P0138.
10. Check the DTC judgment result [D].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions

TECHSTREAM DISPLAY	DESCRIPTION
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [C] and [D].

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

HINT:

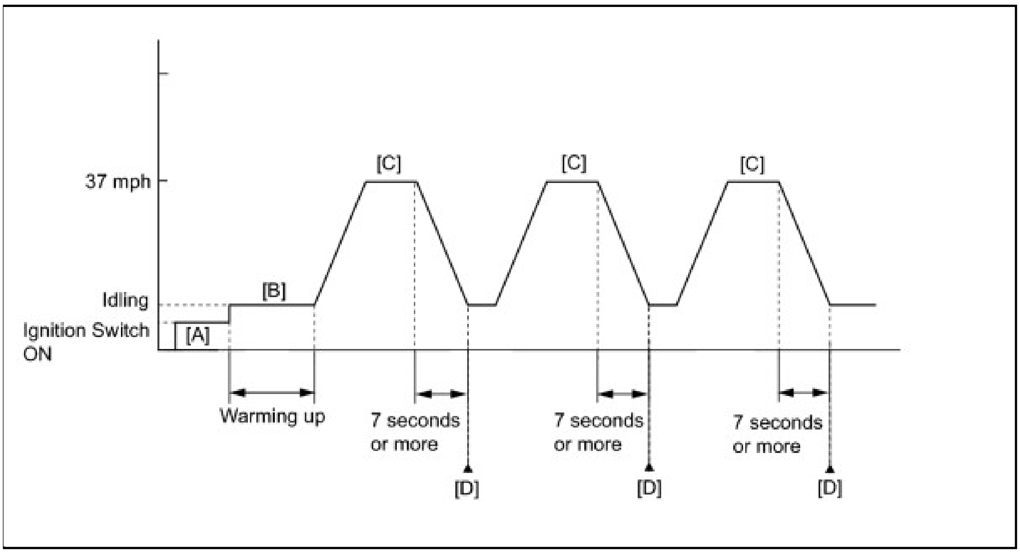
If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

P0139



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
7. Drive the vehicle at 37 mph (60 km/h), and then decelerate the vehicle by releasing the accelerator pedal for 7 seconds or more to perform the fuel cut [C].
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P0139.

10. Check the DTC judgment result [D].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, move the shift lever to 2 and then perform steps [C] through [D] again.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

HINT:

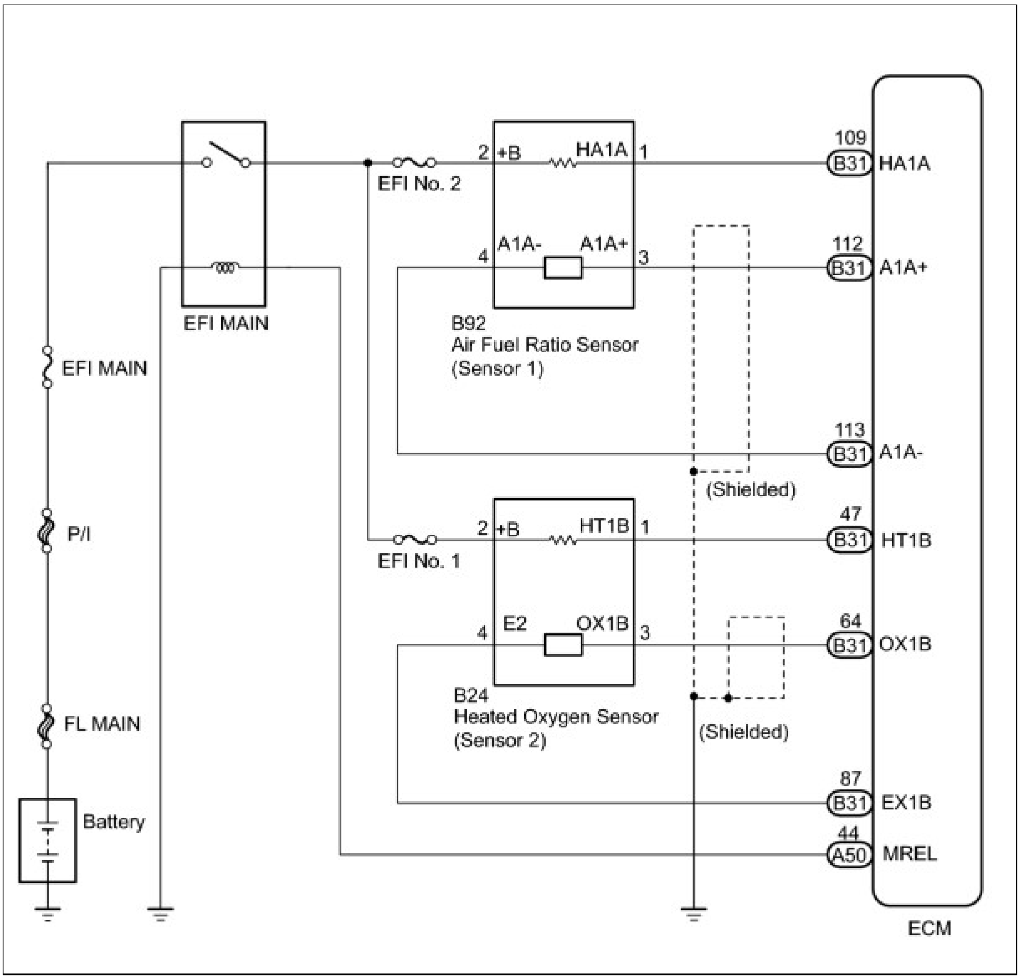
If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F sensor function provided in the Active Test. The Control the Injection Volume for A/F sensor function can help to determine whether the air fuel ratio sensor, heated oxygen (HO2) sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
5. Select the following menu items: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.
6. Perform the Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).
7. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1 S1 and O2S B1 S2) displayed on the Techstream.

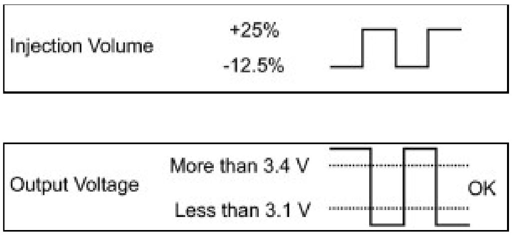
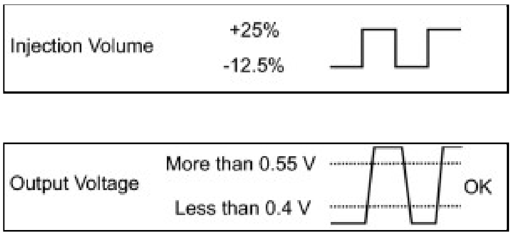
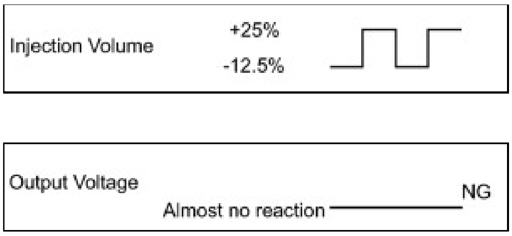
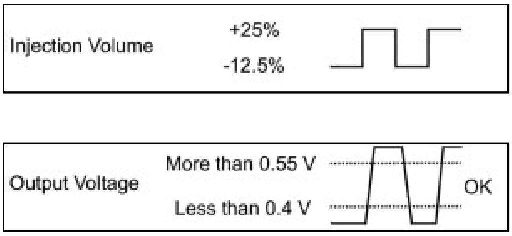
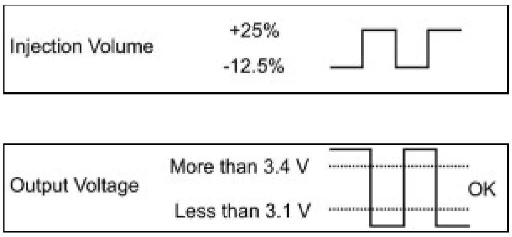
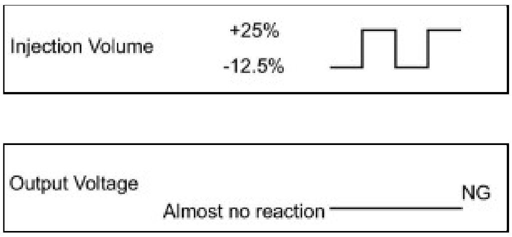
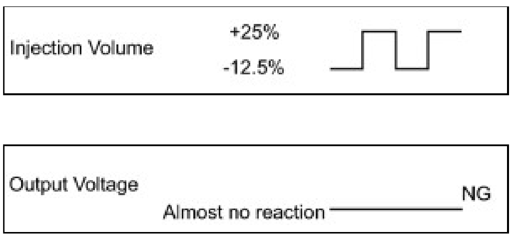
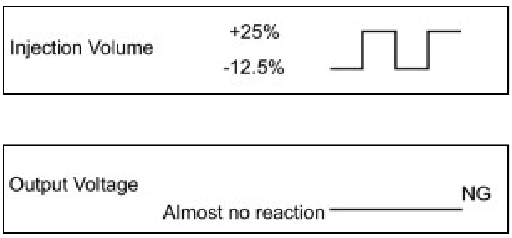
HINT:

- The Control the Injection Volume for A/F sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATE	VOLTAGE
AFS Voltage B1 S1 (Air fuel ratio)	+25%	Rich	Less than 3.1 V
	-12.5%	Lean	More than 3.4 V
O2S B1 S2 (Heated oxygen)	+25%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
1			-
2			• A/F sensor • A/F sensor heater • A/F sensor circuit
3			• HO2 sensor • HO2 sensor heater • HO2 sensor circuit
4			• Injector • Fuel pressure • Gas leak from exhaust system

- Following the Control the Injection Volume for A/F sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, select the following menu items: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1 S1 and O2S B1 S2; then press the

graph button on the Data List view.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ DTC OUTPUT (DTC P0136, P0137, P0138 OR P0139)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Select the following menu items: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0138	A
P0137	B
P0136	C
P0139	D

D ▶ **READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)**

C ▶ **READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)**

B ▶ **CHECK FOR EXHAUST GAS LEAK**

A ▼

2.	READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Select the following menu items: Powertrain / Engine and ECT / Data List / A/F Control System / O2S B1

S2.

(e) Allow the engine to idle.

(f) Read the heated oxygen sensor output voltage while idling.

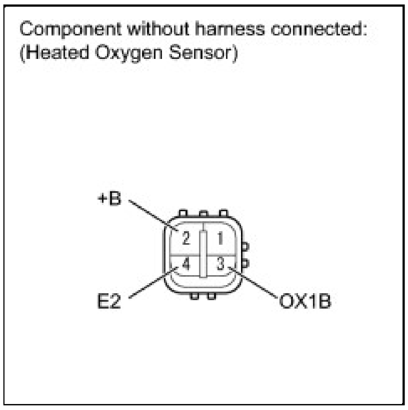
Result:

RESULT	PROCEED TO
1.0 V or more	A
Less than 1.0 V	B

B ▶ PERFORM ACTIVE TEST USING TECHSTREAM

A ▼

3.	**INSPECT HEATED OXYGEN SENSOR (CHECK FOR SHORT)**



(a) Disconnect the heated oxygen sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (+B) - 4 (E2)	Always	10 kΩ or higher
2 (+B) - 3 (OX1B)		

(c) Reconnect the heated oxygen sensor connector.

NG ▶ REPLACE HEATED OXYGEN SENSOR

OK ▼

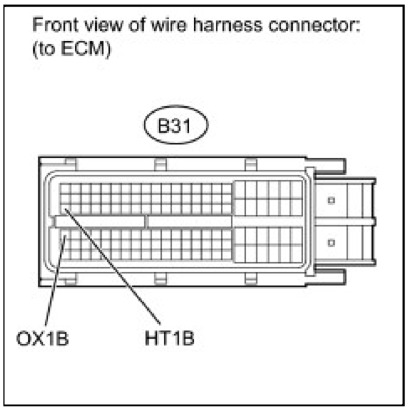
4.	**CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT)**

(a) Turn the ignition switch to off and wait for 5 minutes or more.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B31-47 (HT1B) - B31-64 (OX1B)	Always	10 kΩ or higher

(d) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

5.	PERFORM ACTIVE TEST USING TECHSTREAM

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up.

(e) Select the following menu items: Powertrain / Engine and ECT / Active Test / Control the Injection Volume.

(f) Change the fuel injection volume using the Techstream, and monitor the voltage output of air fuel ratio and heated oxygen sensors displayed on the Techstream.

HINT:

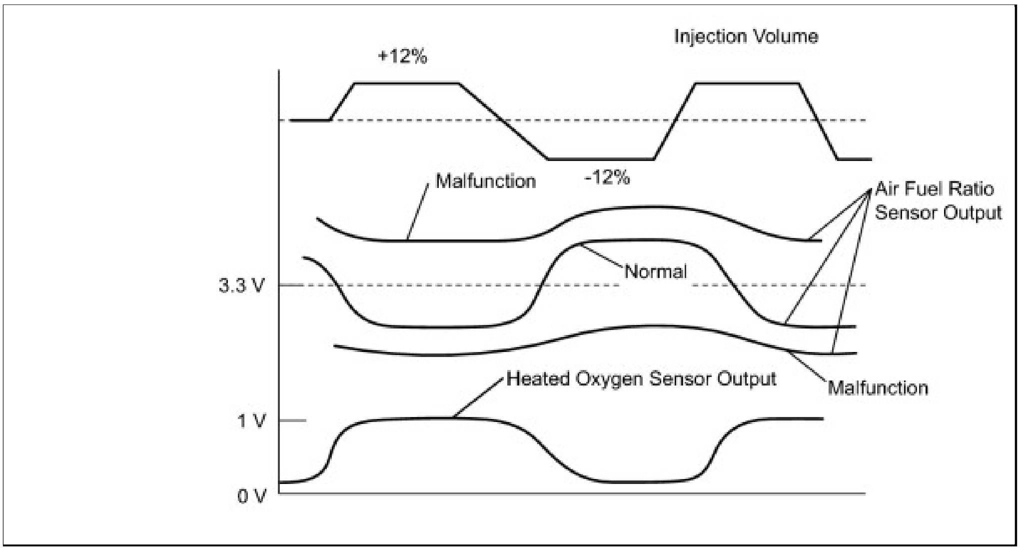
- Change the fuel injection volume within the range of -12% and +12%. The injection volume can be changed in 1% graduations within the range.
- The A/F sensor is displayed as AFS Voltage B1 S1, and the HO2 sensor is displayed as O2S B1 S2 on the Techstream.

Result:

TECHSTREAM DISPLAY (SENSOR)	VOLTAGE VARIATION	PROCEED TO
AFS Voltage B1 S1 (A/F)	Alternates between more and less than 3.3 V	OK
	Remains at more than 3.3 V	NG
	Remains at less than 3.3 V	NG

HINT:

A normal heated oxygen sensor voltage (O2S B1 S2) reacts in accordance with increases and decreases in fuel injection volumes. When the air fuel ratio sensor voltage remains at either less or more than 3.3 V despite the heated oxygen sensor indicating a normal reaction, the air fuel ratio sensor is malfunctioning.



NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK

▼

6.	**INSPECT AIR FUEL RATIO SENSOR**

HINT:

This air fuel ratio sensor test is to check the air fuel ratio sensor current during the fuel-cut. When the sensor is normal, the sensor current will indicate below 3.0 mA in this test.

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

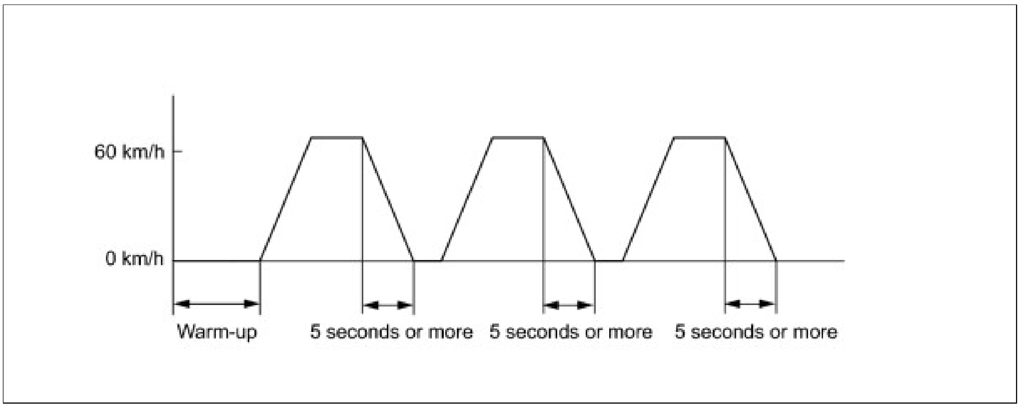
(c) Turn the Techstream on.

(d) Drive the vehicle according to the drive pattern listed below:

(1) Warm up the engine until the engine coolant temperature reaches 75°C (167°F) or more.

(2) Drive the vehicle at 60 km/h (40 mph) or more and decelerate the vehicle for 5 seconds or more.

(3) Repeat the deceleration above at least 3 times.



(e) Select the following menu items: Powertrain / Engine and ECT / Monitor / O2 Sensor / Details.

(f) Confirm that RANGE B1S1 is either Pass or Fail. If the Techstream shows Incomplete, re-check RANGE B1S1 after performing the drive pattern.

(g) Select the RANGE B1S1.

(h) Read the Test Value.

Standard current:
Less than 3.0 mA

HINT:

If the Techstream shows Incomplete again, increase the vehicle speed and use second gear to decelerate the vehicle. Refer to the CONFIRMATION DRIVING PATTERN.

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK ▶ **REPLACE HEATED OXYGEN SENSOR**

7.	READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Select the following menu items: Powertrain / Engine and ECT / Data List / A/F Control System / O2S B1 S2.

(f) After warming up the engine, run the engine at an engine speed of 2500 rpm for 3 minutes.

(g) Read the output voltage of the heated oxygen sensor when the engine rpm is suddenly increased.

HINT:

Quickly accelerate the engine to 4000 rpm 3 times using the accelerator pedal.

Standard:
Fluctuates between 0.4 V or less and 0.5 V or more.

NG ▶ **CHECK FOR EXHAUST GAS LEAK**

OK

▼

8.	**PERFORM ACTIVE TEST USING TECHSTREAM (INJECTION VOLUME)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine and warm it up.

(e) Select the following menu items: Powertrain / Engine and ECT / Active Test / Control the Injection Volume.

(f) Change the fuel injection volume using the Techstream, and monitor the voltage output of air fuel ratio and heated oxygen sensors displayed on the Techstream.

HINT:

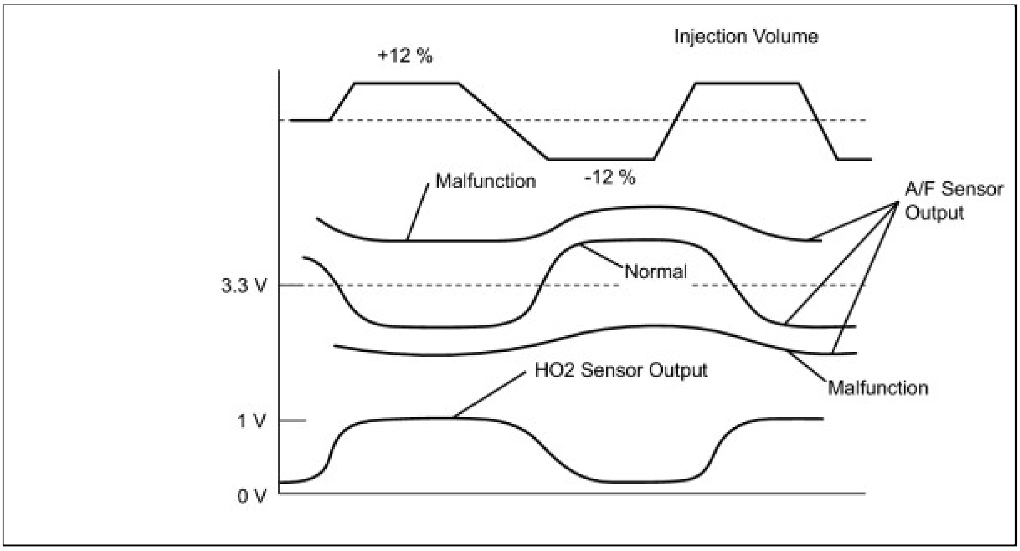
- Change the fuel injection volume within the range of -12% and +12%. The injection volume can be changed in 1% graduations within the range.
- The A/F sensor is displayed as AFS Voltage B1 S1, and the HO2 sensor is displayed as O2S B1 S2 on the Techstream.

Result:

TECHSTREAM DISPLAY (SENSOR)	VOLTAGE VARIATION	PROCEED TO
AFS Voltage B1 S1 (A/F)	Alternates between more and less than 3.3 V	OK
	Remains at more than 3.3 V	NG
	Remains at less than 3.3 V	NG

HINT:

A normal heated oxygen sensor voltage (O2S B1 S2) reacts in accordance with increases and decreases in fuel injection volumes. When the air fuel ratio sensor voltage remains at either less or more than 3.3 V despite the heated oxygen sensor indicating a normal reaction, the air fuel ratio sensor is malfunctioning.



NG ▶ REPLACE AIR FUEL RATIO SENSOR

OK ▶ CHECK ENGINE TO DETERMINE CAUSE OF EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO

9.	**CHECK FOR EXHAUST GAS LEAK**

OK:
No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST GAS LEAK POINT

OK ▼

10.	**INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)** INFO

NG ▶ REPLACE HEATED OXYGEN SENSOR

OK ▼

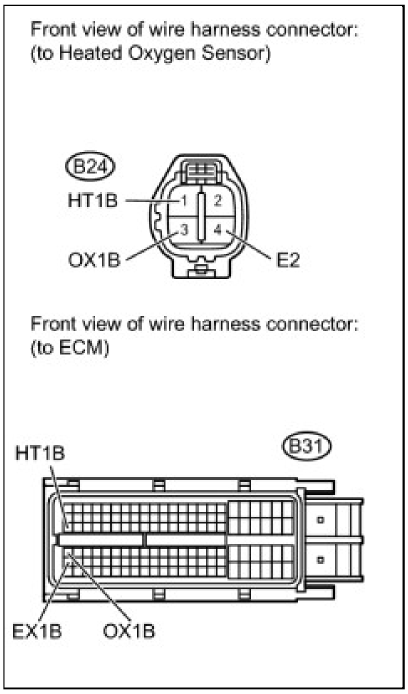
11.	**CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)**

(a) Disconnect the heated oxygen sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open):



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B24-1 (HT1B) - B31-47 (HT1B)	Always	Below 1 Ω
B24-3 (OX1B) - B31-64 (OX1B)		
B24-4 (E2) - B31-87 (EX1B)		

Standard resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B24-1 (HT1B) or B31-47 (HT1B) - Body ground	Always	10 kΩ or higher
B24-3 (OX1B) or B31-64 (OX1B) - Body ground		

(d) Reconnect the heated oxygen sensor connector.

(e) Reconnect the ECM connector.

NG **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

12.	**REPLACE HEATED OXYGEN SENSOR**

(a) Replace the heated oxygen sensor INFO .

NEXT

13.	**PERFORM CONFIRMATION DRIVING PATTERN**

HINT:

Refer to the Confirmation Driving Pattern for P0136, P0137 and P0138.

NEXT

14.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0136, P0137 OR P0138)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Select the following menu items: Powertrain / Engine and ECT / Utility / All Readiness.

(e) Input DTCs: P0136, P0137 and P0138. Check the DTC MONITOR is Normal. If DTC MONITOR is Incomplete, perform the drive pattern increasing the vehicle speed and using second gear to decelerate the vehicle.

Result:

RESULT	PROCEED TO
NORMAL (No DTC output)	A
ABNORMAL (P0136, P0137 or P0138 detected)	B

B REPLACE AIR FUEL RATIO SENSOR

A END

15.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

NEXT

16.	PERFORM CONFIRMATION DRIVING PATTERN

HINT:

Refer to the Confirmation Driving Pattern for P0136, P0137 and P0138.

NEXT

17.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0136 OR P0138)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Select the following menu items: Powertrain / Engine and ECT / Utility / All Readiness.

(e) Input DTCs: P0136 or P0138. Check the DTC MONITOR is Normal. If DTC MONITOR is Incomplete, perform the drive pattern increasing the vehicle speed and using second gear to decelerate the vehicle.

Result:

RESULT	PROCEED TO
NORMAL (No DTC output)	A
ABNORMAL (P0136 or P0138 detected)	B

B ▶ REPLACE HEATED OXYGEN SENSOR

A ▶ END

18.	READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Select the following menu items: Powertrain / Engine and ECT / Data List / A/F Control System / O2S B1 S2.

(e) Allow the engine to idle.

(f) Read the heated oxygen sensor output voltage while idling.

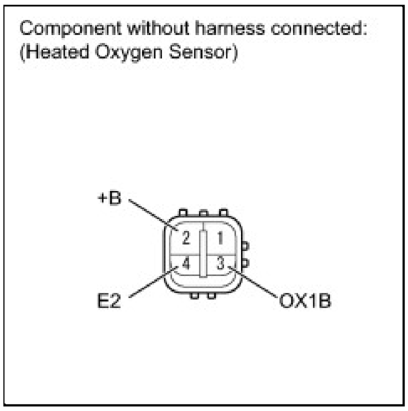
Result:

RESULT	PROCEED TO
1.0 V or higher	A
Below 1.0 V	B

B ▶ CHECK WHETHER DTC OUTPUT RECURS (DTC P0139 IS OUTPUT AGAIN)

A

19.	INSPECT HEATED OXYGEN SENSOR (CHECK FOR SHORT)



(a) Disconnect the heated oxygen sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard resistance:

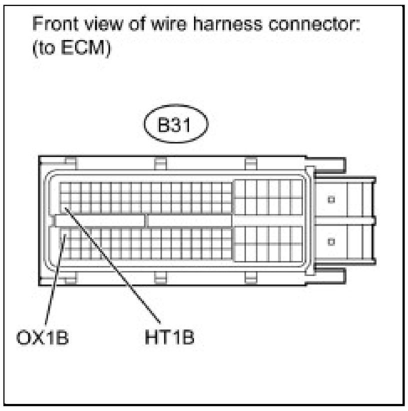
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (+B) - 4 (E2)	Always	10 kΩ or higher
2 (+B) - 3 (OX1B)		

(c) Reconnect the heated oxygen sensor connector.

NG ▶ **REPLACE HEATED OXYGEN SENSOR**

OK

20.	CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT)



(a) Turn the ignition switch off and wait for 5 minutes or more.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

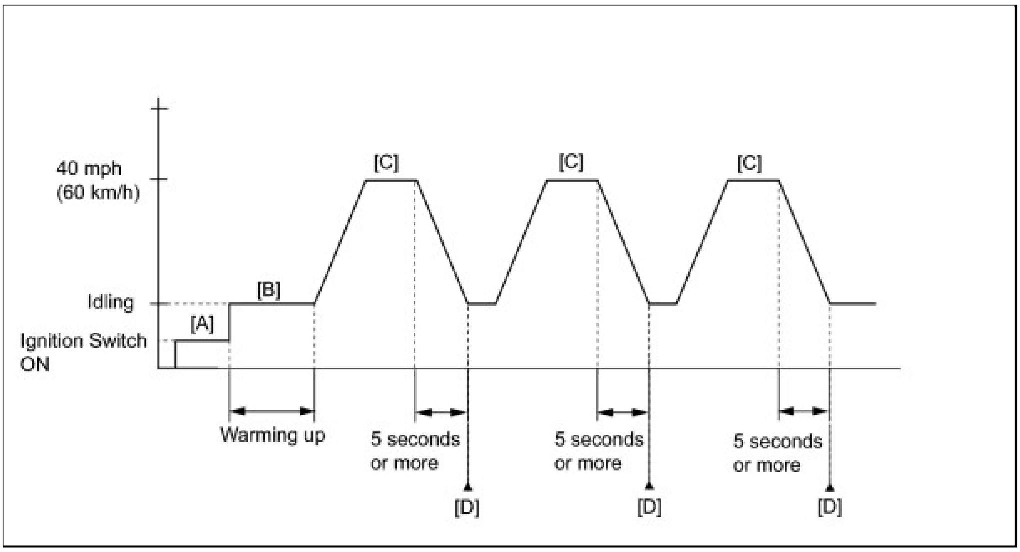
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B31-47 (HT1B) - B31-64 (OX1B)	Always	10 kΩ or higher

(d) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

21.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0139 IS OUTPUT AGAIN)



(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Clear the DTC (even if no DTC are stored, perform the clear DTC procedure) INFO .

(d) Turn the ignition switch off.

(e) Turn the ignition switch to ON and turn the Techstream on [A].

(f) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more [B].

(g) Drive the vehicle at 37 mph (60 km/h), and then decelerate the vehicle by releasing the accelerator pedal for 5 seconds or more to perform the fuel cut [C].

(h) Select the following menu items: Powertrain / Engine and ECT / Utility / All Readiness.

(i) Input DTC: P0139. Check the DTC MONITOR is NORMAL. If DTC MONITOR is INCOMPLETE, perform the drive pattern increasing the vehicle speed and using second gear to decelerate the vehicle.

Result:

RESULT	PROCEED TO
ABNORMAL (P0139 detected)	A
NORMAL (No DTC output)	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▶ **REPLACE HEATED OXYGEN SENSOR**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PFB0A7X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0116: Engine Coolant Temperature Circuit Range / Performance Problem (2010 Corolla)		

DTC	**P0116**	**Engine Coolant Temperature Circuit Range / Performance Problem**

DESCRIPTION

Refer to DTC P0115 INFO .

<table>
<tr><th>DTC NO.</th><th>DTC DETECTION CONDITION</th><th>TROUBLE AREA</th></tr>
<tr><td rowspan="2">P0116</td><td>When either of following conditions met (2 trip detection logic)
• During engine warming up after cold engine starts, change in Engine Coolant Temperature (ECT) sensor output bellow threshold
• In duration between warmed engine stopped and next cold engine starts, change in ECT sensor output bellow threshold</td><td rowspan="2">• Thermostat
• Engine coolant temperature sensor</td></tr>
<tr><td>For Mexico Models:
Case 1:
Engine Coolant Temperature (ECT) between 35°C and 60°C (95°F and 140°F) when engine started, and conditions (a) and (b) met (2 trip detection logic)
• (a) Vehicle driven at varying speeds (accelerated and decelerated)
• (b) ECT remains within 3°C (37.4°F) of initial ECT
Case 2:
ECT more than 60°C (140°F) when engine started, and conditions (a) and (b) met (6 trip detection logic)
• (a) Vehicle driven at varying speeds (accelerated and decelerated)
• (b) ECT measurements remain within 1°C (33.8°F) of initial ECT on 6 successive occasions</td></tr>
</table>

MONITOR DESCRIPTION

The engine coolant temperature sensor is used to monitor the engine coolant temperature. The engine coolant temperature sensor has a built-in thermistor with a resistance that varies according to the temperature of the engine coolant. When the engine coolant temperature becomes low, the resistance of the thermistor increases. When the temperature becomes high, the resistance drops. These variations in the resistance are reflected in the voltage output from the engine coolant temperature sensor.

The ECM monitors the sensor voltage and uses this value to calculate the engine coolant temperature. If the sensor voltage output deviates from the normal operating range, the ECM interprets this deviation as a malfunction in the engine coolant temperature sensor and sets the DTC.

Examples:

- Upon starting the engine, the engine coolant temperature is between 35°C and 60°C (95°F and 140°F). If the engine coolant temperature remains within 3°C (37°F) of the stating temperature after driving for 250 seconds, the DTC is set (2 trip detection logic).
- Upon starting the engine, the engine coolant temperature is over 60°C (140°F). If the engine coolant temperature remains within 1°C (34°F) of the starting temperature after driving for 250 seconds, the DTC is set (6 trip detection logic).

ECT sensor high side stuck monitor (only for Mexico models)

The ECM monitors the sensor voltage and uses this value to calculate the ECT. If the sensor voltage output deviates from the normal operating range, the ECM interprets this deviation as a malfunction in the ECT sensor and sets the DTC.

Examples:

- Upon starting the engine, the ECT is between 35°C and 60°C (95°F and 140°F). If after driving for 250 seconds, the ECT remains within 3°C (37.4°F) of the starting temperature, the DTC is set (2 trip detection logic).
- Upon starting the engine, the ECT is over 60°C (140°F). If after driving for 250 seconds, the ECM remains within 1°C (33.8°F) of the starting temperature, the DTC is set (6 trip detection logic).

MONITOR STRATEGY

Related DTCs	P0116: Engine coolant temperature sensor cold start monitor P0116: Engine coolant temperature sensor soak monitor
Required Sensors/Components (Main)	Engine coolant temperature sensor
Required Sensors/Components (Related)	None
Frequency of Operation	Once per driving cycle
Duration	5 hours or more
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Engine Coolant Temperature Sensor Cold Start Monitor

Monitor runs whenever following DTCs are not present	None

Battery voltage	10.5 V or more
Time after engine start	1 second or more
Engine coolant temperature at engine start	Less than 60°C (140°F)
Intake air temperature sensor circuit	OK
Soak time	0 or more
Accumulated mass air flow	490 g or more
Engine	Running
Fuel cut	OFF
Difference between engine coolant temperature at engine start and intake air temperature	Less than 40°C (104°F)

Engine Coolant Temperature Sensor Soak Monitor

Monitor runs whenever following DTCs are not present	None
Battery voltage	10.5 V or more
Engine	Running
Soak time	5 hours or more
Either (a) or (b) condition met	-
(a) Engine coolant temperature	60°C (140°F) or more
(b) Accumulated MAF	846 g or more

TYPICAL MALFUNCTION THRESHOLDS

Engine Coolant Temperature Sensor Cold Start Monitor

Engine coolant temperature sensor value change	Less than 5°C (41°F)

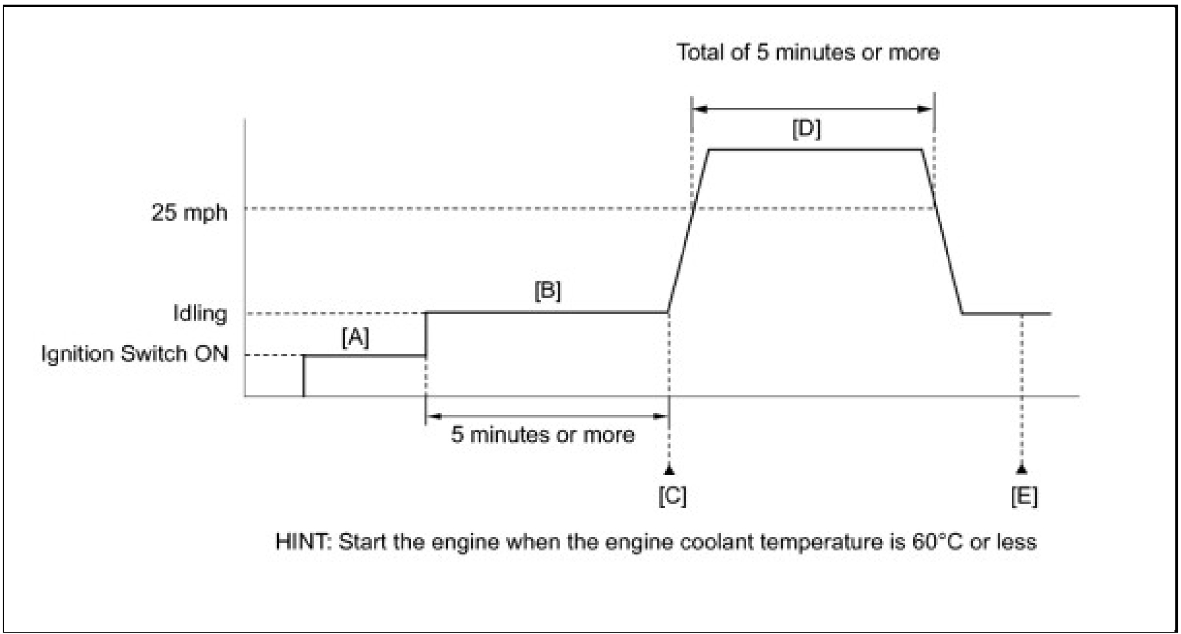
Engine Coolant Temperature Sensor Soak Monitor

Difference between current engine coolant temperature sensor value and previous engine coolant temperature sensor value when engine stopped	Less than 5°C (41°F)

COMPONENT OPERATING RANGE

Engine coolant temperature	Engine coolant temperature sensor value changes in accordance with actual engine coolant temperature

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Enter the following menu items: Powertrain / Engine / Data List / Coolant Temp.
4. Check that the coolant temperature is 60°C (140°F) or less.
5. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
6. Turn the ignition switch off.
7. Turn the ignition switch to ON and turn the Techstream on [A].
8. Start the engine and idle it for 5 minutes or more [B].

   HINT:

   If the engine coolant temperature does not change by 5°C (9°F) or higher, the engine coolant temperature sensor is malfunctioning. It is not necessary to continue this procedure.

9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0116.
11. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	DTC judgment completed System normal
ABNORMAL	DTC judgment completed System abnormal

TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [D] and [E].

12. Drive the vehicle at 25 mph (40 km/h) or more for a total of 5 minutes or more [D].

    HINT:

    In the event of the drive pattern being interrupted (possibly due to factors such as traffic conditions), the drive pattern can be resumed.

13. Check the DTC judgment result again [E].

    HINT:

    If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [D] and [E] again.

14. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
15. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

16. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- If any of DTCs P0115, P0117, P0118 or P0125 are set simultaneously with DTC P0116, the engine coolant temperature sensor may have an open or a short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition

information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0116)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0116	A
P0116 and other DTCs	B

B ▶ GO TO DTC CHART

A ▼

2.	INSPECT THERMOSTAT

(a) Remove the thermostat INFO .

(b) Measure the valve opening temperature of the thermostat.

Standard Value:
80 to 84°C (176 to 183°F)

HINT:

In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

(c) Reinstall the thermostat INFO .

NG ▶ REPLACE THERMOSTAT

OK ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PF609UX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0120-P0123,P0220,P0222,P0223,P2135: Throttle / Pedal Position Sensor / Switch "A" Circuit Malfunction (2010 Corolla)		

DTC	**P0120**	**Throttle / Pedal Position Sensor / Switch "A" Circuit Malfunction**

DTC	**P0121**	**Throttle / Pedal Position Sensor / Switch "A" Circuit Range / Performance Problem**

DTC	**P0122**	**Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input**

DTC	**P0123**	**Throttle / Pedal Position Sensor / Switch "A" Circuit High Input**

DTC	**P0220**	**Throttle / Pedal Position Sensor / Switch "B" Circuit**

DTC	**P0222**	**Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input**

DTC	**P0223**	**Throttle / Pedal Position Sensor / Switch "B" Circuit High Input**

DTC	**P2135**	**Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation**

DESCRIPTION

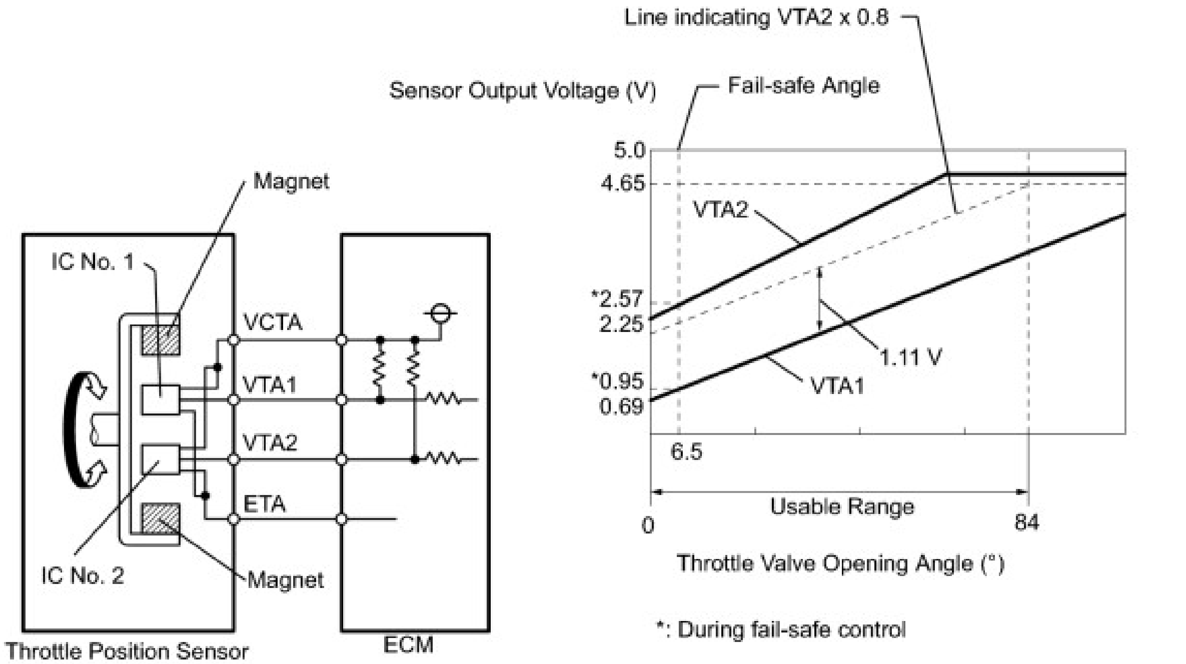
HINT:

- These DTCs relate to the throttle position sensor.

The throttle position sensor is mounted on the throttle body, and detects the opening angle of the throttle valve. This sensor is a non-contact type. It uses Hall-effect elements in order to yield accurate signals even in extreme conditions.

The throttle position sensor has 2 sensor circuits, each of which transmits a signal, VTA1 and VTA2. VTA1 is used to detect the throttle valve angle and VTA2 is used to detect malfunctions in VTA1. The sensor signal voltages vary between 0 V and 5 V in proportion to the throttle valve opening angle, and are transmitted to the VTA terminals of the ECM.

As the valve closes, the sensor output voltage decreases and as the valve opens, the sensor output voltage increases. The ECM calculates the throttle valve opening angle according to these signals and controls the throttle actuator in response to driver inputs. These signals are also used in calculations such as air-fuel ratio correction, power enrichment correction and fuel-cut control.



Note:

The throttle valve opening angle detected by the sensor terminal VTA1 is expressed as a percentage.

Between 10% and 22%: Throttle valve fully closed

Between 64% and 96%: Throttle valve fully open

Approximately 19%: Fail safe angle (6.5°)

Features of sensor output:

The difference in voltage between VTA1 and VTA2 x 0.8 is approximately 1.11 V.

(VTA2 × 0.8 is approximately equal to VTA1 + 1.11 V)

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0120	Output voltage of VTA1 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds or more when accelerator pedal depressed (1 trip detection logic)	• Throttle position sensor (built into throttle body)

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		• ECM
P0121	Difference between VTA1 and VTA2 voltages less than 0.8 V, or more than 1.6 V for 2 seconds (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Throttle position sensor circuit • ECM
P0122	Output voltage of VTA1 0.2 V or less for 2 seconds or more when accelerator pedal depressed (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	Output voltage of VTA1 4.54 V or more for 2 seconds or more when accelerator pedal depressed (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Open in VTA1 circuit • Open in E2 circuit • Short between VC and VTA1 circuits • ECM
P0220	Output voltage of VTA2 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds or more when accelerator pedal depressed (1 trip detection logic)	• Throttle position sensor (built into throttle body) • ECM
P0222	Output voltage of VTA2 1.75 V or less for 2 seconds or more when accelerator pedal depressed (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Short in VTA2 circuit • Open in VC circuit • ECM

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0223	Output voltage of VTA2 4.8 V or more, and VTA1 between 0.2 V and 2.02 V, for 2 seconds or more when accelerator pedal depressed (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Open in VTA2 circuit • Open in E2 circuit • Short between VC and VTA2 circuits • ECM
P2135	Either condition (a) or (b) met (1 trip detection logic): (a) Difference between output voltages of VTA1 and VTA2 0.02 V or less for 0.5 seconds or more (b) Output voltage of VTA1 0.2 V or less, and VTA2 1.75 V or less, for 0.4 seconds or more	• Short between VTA1 and VTA2 circuits • Throttle position sensor (built into throttle body) • ECM

HINT:

- When any of these DTCs are set, check the throttle valve opening angle by entering the following menus: Powertrain / Engine and ECT / Data List / ETCS / Throttle Position No. 1 and Throttle Position No. 2.
- Throttle Position No. 1 denotes the VTA1 signal, and Throttle Position No. 2 denotes the VTA2 signal.

Reference (Normal Condition):

TECHSTREAM DISPLAY	ACCELERATOR PEDAL FULLY RELEASED	ACCELERATOR PEDAL FULLY DEPRESSED
Throttle Position No. 1	0.5 to 1.1 V	3.3 to 4.9 V
Throttle Position No. 2	2.1 to 3.1 V	4.6 to 5.0 V

MONITOR DESCRIPTION

P0120, P0122, P0123, P0220, P0223, P2135

The ECM uses the throttle position sensor to monitor the throttle valve opening angle. There are several checks that the ECM performs to confirm the proper operation of the throttle position sensor.

- A specific voltage difference is expected between the sensor terminals, VTA1 and VTA2, for each throttle valve opening angle. If the difference between VTA1 and VTA2 is incorrect, the

ECM interprets this as a malfunction in the sensor circuit, and sets a DTC.

- VTA1 and VTA2 each have a specific voltage range. If VTA1 or VTA2 is outside the normal operating range, the ECM interprets this as a malfunction in the sensor circuit, and sets a DTC.
- VTA1 and VTA2 should never be close to the same voltage level. If VTA1 is within 0.02 V of VTA2, the ECM determines that there is a short circuit in the sensor circuit, and sets a DTC.

If the malfunction is not repaired successfully, a DTC is set 10 seconds after the engine is next started.

P0121

This sensor transmits two signals: VTA1 and VTA2. VTA1 is used to detect the throttle opening angle and VTA2 is used to detect malfunctions in VTA1. The ECM performs several checks to confirm the proper operation of the TP sensor and VTA1.

For each throttle opening angle, a specific voltage difference is expected between the outputs of VTA1 and VTA2. If the output voltage difference between the two signals deviates from the normal operating range, the ECM interprets this as a malfunction in the TP sensor. The ECM illuminates the MIL and stores the DTC.

If the malfunction is not repaired successfully, the DTC is stored 2 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0120: Throttle position sensor 1 range check (Fluctuating) P0121: Throttle position sensor rationality P0122: Throttle position sensor 1 range check (Low voltage) P0123: Throttle position sensor 1 range check (High voltage) P0220: Throttle position sensor 2 range check (Fluctuating) P0222: Throttle position sensor 2 range check (Low voltage) P0223: Throttle position sensor 2 range check (High voltage) P2135: Throttle position sensor range check (Correlation)
Required Sensors/Components (Main)	Throttle position sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	Within 2 seconds: P0121 2 seconds: P0120, P0122, P0123, P0220, P0222 and P0223 0.5 seconds: P2135 Case 1

	0.4 seconds: P2135 Case 2
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0120, P0122, P0123, P0220, P0222, P0223, P2135

Monitor runs whenever following DTCs not present	None
Either of following conditions A or B met	-
A. Ignition switch ON	0.012 seconds or more
B. Electronic throttle actuator power	ON

P0121

Monitor runs whenever following DTCs not present	None
Either of following conditions A or B is met	-
A. Ignition switch	ON
B. Electronic throttle motor power	ON
Throttle position sensor malfunction (P0120, P0122, P0123, P0220, P0222, P0223, P2135)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P0120

VTA1 voltage	0.2 V or less, or 4.54 V or more

P0121

Either of following conditions is met	-
Difference of throttle position sensor voltage between VTA1 and (VTA2 x 0.8)	Higher than 1.6 V
Difference of throttle position sensor voltage between VTA1 and (VTA2 x 0.8)	Lower than 0.8 V

P0122

VTA1 voltage	0.2 V or less

P0123

VTA1 voltage	4.54 V or more

P0220

VTA2 voltage	1.75 V or less, or 4.8 V or more

P0222

VTA2 voltage	1.75 V or less

P0223

VTA2 voltage when VTA1 0.2 V or more, and 2.02 V or less	4.8 V or more

P2135 Case 1

Difference between VTA1 and VTA2 voltages	0.02 V or less

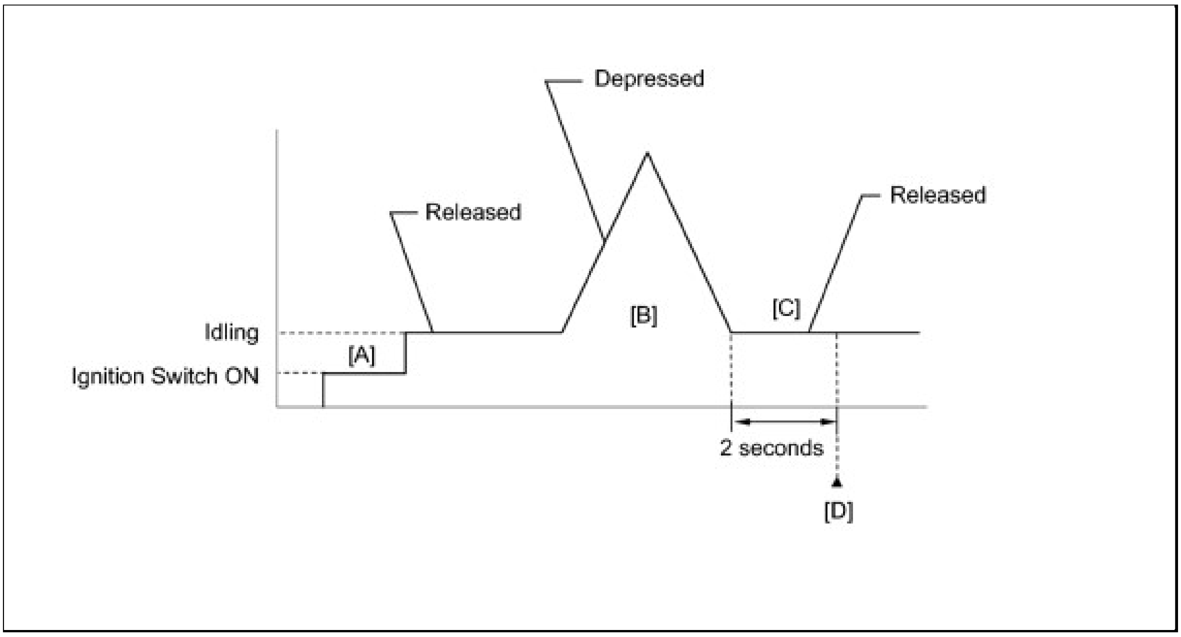
P2135 Case 2

VTA1 voltage	0.2 V or less
VTA2 voltage	1.75 V or less

COMPONENT OPERATING RANGE

VTA1 voltage	0.2 to 4.54 V
VTA2 voltage	1.75 to 4.8 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. With the vehicle stationary, fully depress and release the accelerator pedal [B].
8. Idle the engine for 2 seconds or more [C].
9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0120, P0121, P0122, P0123, P0220, P0222, P0223 or P2135.
11. Check the DTC judgment result [D].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [D] again.

12. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
13. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

14. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

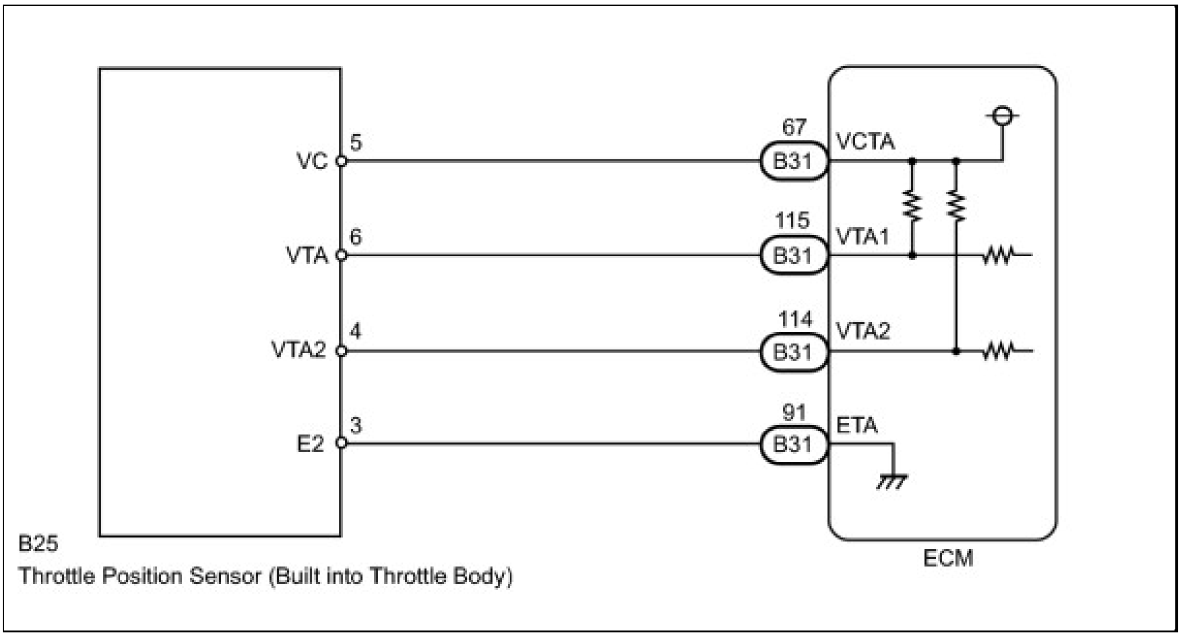
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When any of these DTCs, as well as other DTCs relating to Electronic Throttle Control System malfunctions, are set, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by 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 angle, to allow the vehicle to continue at a minimal speed. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned to off.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (THROTTLE POSITION SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / ETCS / Throttle Position No. 1 and Throttle Position No. 2.

(e) Read the values displayed on the Techstream.

Result:

WHEN ACCELERATOR PEDAL RELEASED		WHEN ACCELERATOR PEDAL DEPRESSED		TROUBLE AREA	PROCEED TO
THROTTLE POSITION NO. 1	THROTTLE POSITION NO. 2	THROTTLE POSITION NO. 1	THROTTLE POSITION NO. 2		
0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	VC circuit open	A
4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V	E2 circuit open	
0 to 0.2 V, or 4.5 to 5.0 V	2.1 V to 3.1 V (Fail-safe)	0 to 0.2 V, or 4.5 to 5.0 V	2.1 V to 3.1 V (Fail-safe)	VTA1 circuit open or ground short	
0.6 V to 1.4 V (Fail-safe)	0 to 0.2 V, or 4.5 to 5.0 V	0.6 V to 1.4 V (Fail-safe)	0 to 0.2 V, or 4.5 to 5.0 V	VTA2 circuit open or ground short	
0.5 to 1.1 V	2.1 to 3.1 V	3.2 to 4.8 V (Not fail-safe)	4.6 to 5.0 V (Not fail-safe)	Throttle position sensor circuit normal	B

HINT:

- DTC P0121 is stored when the voltages output from VTA1 and VTA2 are not consistent with the characteristics of the sensors. Therefore, check the Freeze Frame Data when this DTC is output. Use the following formula to confirm relative fluctuations in voltage.

  Features of sensor output:

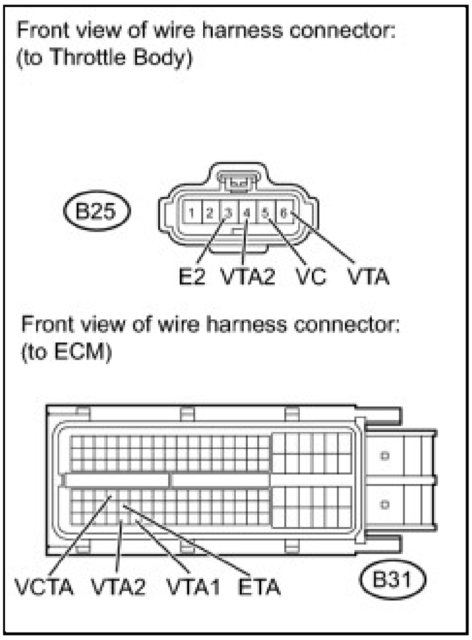
VTA2 x 0.8 is approximately equal to VTA1 + 1.11 V
VTA1: Throttle Position No. 1
VTA2: Throttle Position No. 2

- If DTC P0121 is output, proceed to the "CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)".

B ▶ **CHECK WHETHER DTC OUTPUT RECURS (THROTTLE POSITION SENSOR DTCS)**

A ▼

2.	CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)



(a) Disconnect the throttle body connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B25-5 (VC) - B31-67 (VCTA)	Always	Below 1 Ω
B25-6 (VTA) - B31-115 (VTA1)	Always	Below 1 Ω
B25-4 (VTA2) - B31-114 (VTA2)	Always	Below 1 Ω

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B25-3 (E2) - B31-91 (ETA)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B25-5 (VC) or B31-67 (VCTA) - Body ground	Always	10 kΩ or higher
B25-6 (VTA) or B31-115 (VTA1) - Body ground	Always	10 kΩ or higher
B25-4 (VTA2) or B31-114 (VTA2) - Body ground	Always	10 kΩ or higher

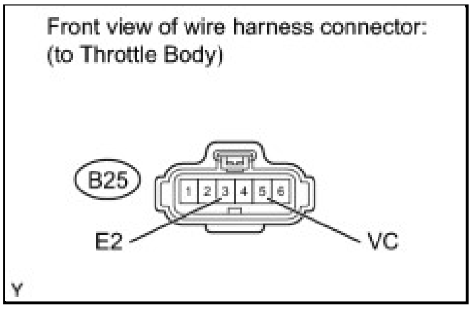
(d) Reconnect the throttle body connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (THROTTLE POSITION SENSOR - ECM)**

OK ▼

3.	INSPECT ECM (VC VOLTAGE)



(a) Disconnect the throttle body connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B25-5 (VC) - B25-3 (E2)	Ignition switch ON	4.5 to 5.5 V

(d) Reconnect the throttle body connector.

NG ▶ **REPLACE ECM**

OK

4.	REPLACE THROTTLE BODY

(a) Replace throttle body INFO .

NEXT

5.	CHECK WHETHER DTC OUTPUT RECURS (THROTTLE POSITION SENSOR DTCS)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Start the engine.

(f) Allow the engine to idle for 15 seconds or more.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

Result:

RESULT	PROCEED TO
P0120, P0121, P0122, P0123, P0220, P0222, P0223 and/or P2135	A
No output	B

B ▶ **END**

A ▶ **REPLACE ECM**

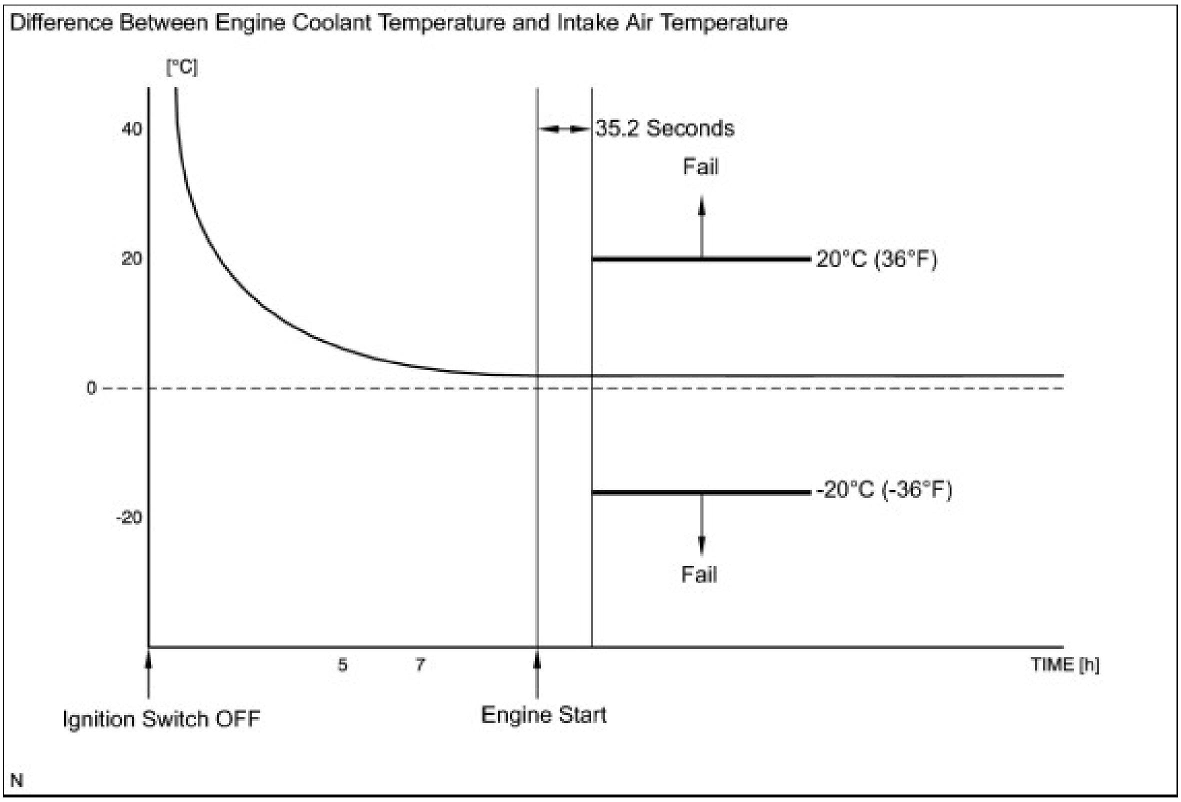
Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM0000010BK05BX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P011B: Engine Coolant Temperature / Intake Air Temperature Correlation (2010 Corolla)		

DTC	**P011B**	**Engine Coolant Temperature / Intake Air Temperature Correlation**

DESCRIPTION

The engine has two temperature sensors, an engine coolant temperature sensor and an intake air temperature sensor, to detect the temperature while the engine is operating. A thermistor, whose resistance value varies according to the temperature, is built into each sensor. When the temperature is low, the resistance of the thermistor is high. When the temperature is high, the resistance is low. These variations in resistance are transmitted to the ECM as voltage changes. Based on these temperature signals output from the sensors, the ECM determines the fuel injection duration and the ignition timing to control the engine.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P011B	• All of following conditions are met: (2 trip detection logic) a. Battery voltage 10.5 V or more b. 7 hours or more elapsed from engine stops on previous trip c. 35.2 seconds after cold engine starts d. Minimum intake air temperature after engine starts more than -10°C (14°F) e. Average engine coolant temperature before engine starts more than -10°C (14°F) f. Difference between readings of engine coolant temperature and intake air temperature greater than 20°C (68°F)	• Intake air temperature sensor (built into mass air flow meter) • Engine coolant temperature sensor • ECM



HINT:

- Waiting is required to prevent the temperature of the engine from affecting the readings. If the engine has been operated recently, it will not be possible to accurately compare the readings.
- For diagnosis, in order to duplicate the detection conditions of the DTC, it is necessary to park the vehicle for 7 hours. Parking the vehicle for 7 hours ensures that the actual temperature of the engine coolant temperature sensor and intake air temperature sensor are very similar. When the vehicle has been parked for less than 7 hours, differences in the readings may exist, this does not necessarily indicate a fault.

MONITOR DESCRIPTION

The ECM monitors the difference between the engine coolant temperature and the intake air temperature when the engine is started cold to detect the engine temperature conditions accurately. The monitor runs when the engine started cold after 7 hours or more has elapsed since the engine was stopped (ignition switch turned to OFF) on the previous trip. If the difference between the engine coolant temperature and the intake air temperature on a cold start exceeds 20°C (36°F), the ECM interprets this as a malfunction in the engine coolant temperature sensor circuit and intake air temperature sensor circuit, and sets the DTC.

MONITOR STRATEGY

Related DTCs	P011B: Engine coolant temperature / Intake air temperature sensor correlation
Required Sensors / Components (Main)	Engine coolant temperature / Intake air temperature sensor

Required Sensors / Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	7 hours or more
MIL Operation	2 driving cycles
Sequence of Operation	None

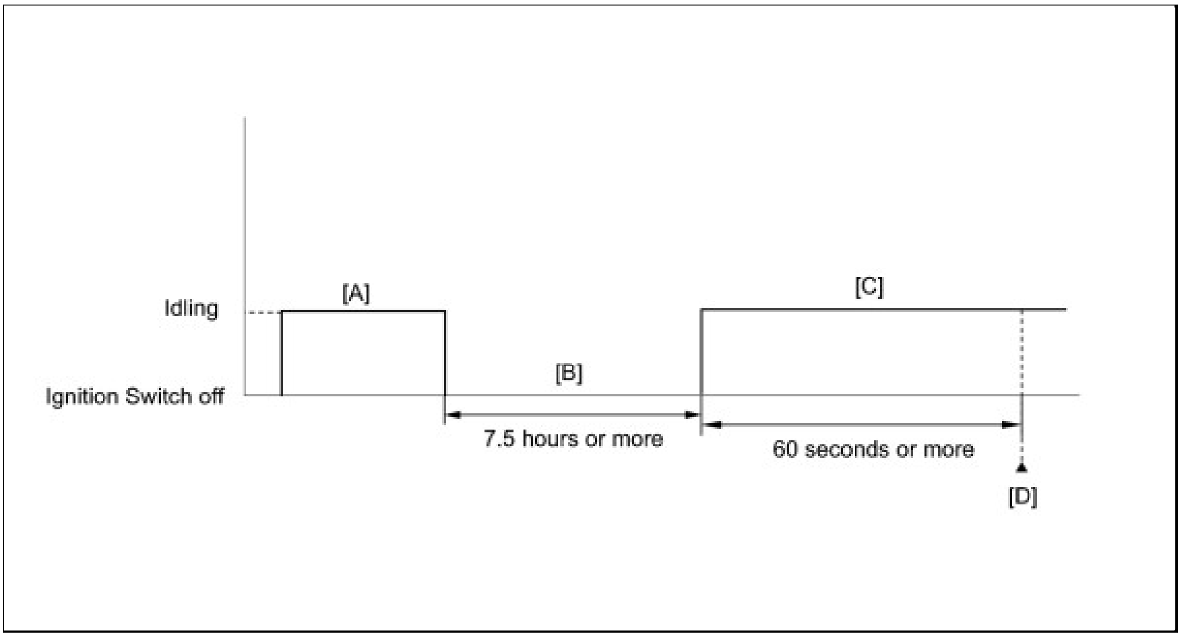
TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None
All of following conditions met	Conditions 1 and 2
1. All of following conditions met	Conditions (a), (b), (c) and (d)
(a) After ignition switch ON and engine not running time	Less than 20 seconds
(b) Soak Time	7 hours or more
(c) Battery voltage	10.5 V or more
(d) Time after engine start	35.2 seconds or more
2. Either of the following conditions are met	Condition (a) and (b)
(a) Minimum intake air temperature after engine start	-10°C (14°F) or more
(b) Engine coolant temperature before engine start	-10°C (14°F) or more

TYPICAL MALFUNCTION THRESHOLDS

Engine coolant temperature and intake air temperature deviate	Less than -20°C (-36°F) or more than 20°C (36°F)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO [A].
4. Turn the ignition switch off.
5. With the engine stopped, leave the vehicle as is for 7.5 hours or more [B].
6. Start the engine and wait 60 seconds or more [C].
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P011B.
9. Check the DTC judgment result [D].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] through [D] again.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P011B)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P011B	A
P011B and other DTCs	B

HINT:

If any DTCs other than P011B are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	**READ VALUE USING TECHSTREAM (INTAKE AIR TEMPERATURE)**

(a) Leave the vehicle for 7 hours or more.

HINT:

It is necessary leave the vehicle for 7 hours or more to allow conditions similar to the DTC detection conditions.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Intake Air.

(f) Read the value displayed on the Techstream.

OK:

Difference between the intake air temperature and the actual outside air temperature is within 10°C (50°F).

HINT:

Temperature readings on the vehicle's outside temperature gauge (if equipped) are not suitable for comparing to the intake air temperature reading. The outside temperature gauge has a significant delay built in to prevent temperature swings from being displayed on its display. Use an accurate thermometer to determine the outside air temperature.

NG ▶ **REPLACE MASS AIR FLOW METER**

OK

▼

3.	**READ VALUE USING TECHSTREAM (COOLANT TEMPERATURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / All Data / Coolant Temp.

(e) Read the value displayed on the Techstream.

OK:

The difference between the coolant temperature and the actual outside air temperature is within 10°C (50°F).

HINT:

If the result is not as specified, check if there are heat sources such as a block heater in the engine compartment.

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000XH30AGX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0300-P0304: Random / Multiple Cylinder Misfire Detected (2010 Corolla)		

DTC	**P0300**	**Random / Multiple Cylinder Misfire Detected**

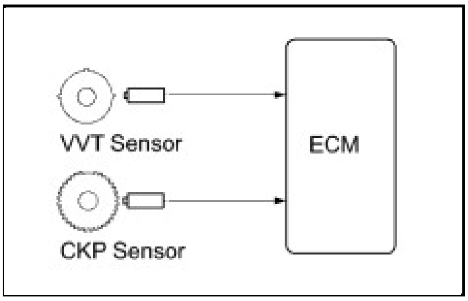
DTC	**P0301**	**Cylinder 1 Misfire Detected**

DTC	**P0302**	**Cylinder 2 Misfire Detected**

DTC	**P0303**	**Cylinder 3 Misfire Detected**

DTC	**P0304**	**Cylinder 4 Misfire Detected**

DESCRIPTION



When the engine misfires, high concentrations of hydrocarbons (HC) enter the exhaust gas. High HC concentration levels can cause an increase in exhaust emission levels. Extremely high concentrations of HC can also cause increases in the three-way catalytic converter temperature, which may cause damage to the three-way catalytic converter. To prevent this increase in emissions and to limit the possibility of thermal damage, the ECM monitors the misfire rate. When the temperature of the three-way catalytic converter reaches the point of thermal degradation, the ECM blinks the MIL. To monitor misfires, the ECM uses both the camshaft position sensor and the crankshaft position sensor. The camshaft position sensor is used to identify any misfiring cylinders and the crankshaft position sensor is used to measure variations in the crankshaft rotation speed. Misfires are counted when the crankshaft rotation speed variations exceed predetermined thresholds. If the misfire count exceeds the threshold levels, and could cause emission control system performance deterioration, the ECM illuminates the MIL and sets a DTC.

<table>
<tr><th>DTC NO.</th><th>DTC DETECTION CONDITION</th><th>TROUBLE AREA</th></tr>
<tr><td>P0300</td><td>When one of following conditions below is detected (2 trip detection logic):
• High temperature misfire occurs in three-way catalytic converter (MIL blinks)
• Emission deterioration misfire occurs (MIL illuminates)
• Simultaneous misfiring of several cylinders occurs</td><td rowspan="2">• Open or short in engine wire harness
• Connector connection
• Vacuum hose connections
• Ignition system
• Fuel injector
• Fuel pressure
• Mass air flow meter
• Engine coolant temperature sensor
• Compression pressure
• Valve clearance
• Valve timing
• PCV valve and hose
• PCV hose connections
• Intake system
• ECM</td></tr>
<tr><td>P0301
P0302
P0303
P0304</td><td>When one of following conditions below is detected (2 trip detection logic):
• High temperature misfire occurs in three-way catalytic converter (MIL blinks)
• Emission deterioration misfire occurs (MIL illuminates)
• Misfiring of specific cylinder occurs</td></tr>
</table>

When DTCs for misfiring cylinders are randomly set, but DTC P0300 is not set, it indicates that misfires have been detected in different cylinders at different times. DTC P0300 is only set when several misfiring cylinders are detected at the same time.

MONITOR DESCRIPTION

The ECM illuminates the MIL and sets a DTC when either one of the following conditions, which could cause emission control system performance deterioration, is detected (2 trip detection logic).

- Within the first 1000 crankshaft revolutions of the engine starting, an excessive misfiring rate (approximately 20 to 50 misfires per 1000 crankshaft revolutions) occurs once.
- An excessive misfiring rate (approximately 20 to 50 misfires per 1000 crankshaft revolutions) occurs a total of 4 times.

The ECM flashes the MIL and sets a DTC when either one of the following conditions, which could cause the three-way catalytic converter damage, is detected (2 trip detection logic).

HINT:

If a catalyst damage misfire occurs, the monitor informs the driver by blinking the MIL (1 trip).

Misfire Monitor for Mexico Models

The ECM illuminates the MIL and sets a DTC when either one of the following conditions, which could cause emission deterioration, is detected (2 trip detection logic).

- Within the first 1000 crankshaft revolutions of the engine starting, an excessive misfiring rate (approximately 1000 misfires per 1000 crankshaft revolutions) occurs once.

- An excessive misfiring rate (approximately 500 misfires per 1000 crankshaft revolutions) occurs a total of 4 times.

The ECM flashes the MIL and sets a DTC when the following condition, which could cause the Three-Way Catalytic Converter (TWC) damage, is detected (2 trip detection logic).

- A catalyst damage misfire, which is monitored every 200 crankshaft revolutions, occurs 3 times.

MONITOR STRATEGY

Related DTCs	P0300: Multiple cylinder misfire P0301: Cylinder 1 misfire P0302: Cylinder 2 misfire P0303: Cylinder 3 misfire P0304: Cylinder 4 misfire
Required Sensors/Components (Main)	Crankshaft position sensor Camshaft position sensor
Required Sensors/Components (Related)	Engine coolant temperature Intake air temperature sensor Mass air flow meter
Frequency of Operation	Continuous
Duration	1000 to 4000 crankshaft revolutions: Emission related misfire 200 to 600 crankshaft revolutions: Catalyst damaging misfire
MIL Operation	2 driving cycles: Emission related misfire MIL flashes immediately: Catalyst damaging misfire
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Misfire

Monitor runs whenever following DTCs are not present	P0016 (VVT System bank 1- Misalignment) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121 P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0327, P0328 (Knock Sensor) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor)

	P0351, P0352, P0353, P0354 (Igniter) P0500 (Vehicle Speed Sensor)
Battery voltage	8 V or more
VVT system	Not operated by scan tool
Engine RPM	400 to 6400 rpm
Either of following conditions (a) or (b) is met	-
(a) Engine coolant temperature at engine start	More than -7°C (19°F)
(b) Engine coolant temperature	More than 20°C (68°F)
Fuel cut	OFF

Monitor Period of Emission Related Misfire

First 1000 revolutions after engine start, or Check Mode	Crankshaft 1000 revolutions
Except above	Crankshaft 1000 revolutions x 4

Monitor Period of Catalyst Damaging Misfire (MIL blinks)

All of following conditions 1, 2 and 3 met	Crankshaft 200 revolutions
1. Driving cycles	1st
2. Check mode	OFF
3. Engine RPM	Less than 2450 rpm
Except above (MIL blinks immediately)	Crankshaft 200 revolutions x 3

FOR MEXICO MODELS:

Misfire: for Mexico models

The monitor will run whenever these DTCs are not present	P0016 (VVT System bank 1- Misalignment) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121 P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0327, P0328 (Knock Sensor) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor)

	P0351, P0352, P0353, P0354 (Igniter) P0500 (Vehicle Speed Sensor)
Battery voltage	8 V or more
VVT system	Not operated by scan tool
Engine RPM	400 to 6400 rpm
ECT	More than 65°C (149°F)
Fuel cut	OFF

Monitor period of emission-related-misfire: for Mexico models

First 1000 revolutions after engine start, or check mode	Crankshaft 1000 revolutions
Except above	Crankshaft 1000 revolutions x 4

Monitor period of catalyst-damaged-misfire (MIL blinks): for Mexico models

All of following conditions 1, 2 and 3 met	Crankshaft 200 revolutions
1. Driving cycles	1st
2. Check mode	OFF
Except above	Crankshaft 200 revolutions x 3

TYPICAL MALFUNCTION THRESHOLDS

Monitor Period of Emission Related Misfire

Misfire rate	1.266% or more (Automatic Transaxle) 1.493% or more (Manual Transaxle)

Monitor Period of Catalyst Damaged Misfire (MIL blinks)

Number of misfire per 200 revolutions	118 or more (varies with intake air amount and RPM)

FOR MEXICO MODELS:

Monitor period of emission-related-misfire: for Mexico models

Misfire rate	100% or more: for 1st 1000 revolutions 25% or more: after 1st 1000 revolutions

Monitor period of catalyst-damaged-misfire (MIL blinks): for Mexico models

Number of misfire per 200 revolutions	118 or more (varies with intake air amount and

	RPM)
Paired cylinder misfire (MIL blinks immediately)	Detected

MONITOR RESULT

Refer to Checking Monitor Status .

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Record the DTC(s) and freeze frame data.
5. Clear the DTCs (even if no DTCs are stored, perform the Clear DTC procedure) .
6. Using the Techstream, switch the ECM from normal mode to check mode .
7. Read the misfire counts of each cylinder, Cylinder #1 Misfire Count to Cylinder #4 Misfire Count, with the engine idling. If any misfire count is displayed, skip the following confirmation driving pattern.
8. Drive the vehicle so that the vehicle conditions displayed in Misfire RPM and Misfire Load of the Data List are the same as the freeze frame data. Perform this step several times.

   HINT:

   In order to store misfire DTCs, it is necessary to operate the vehicle for the period of time shown in the table below, confirm the Misfire RPM and Misfire Load in the Data List.

ENGINE SPEED	DURATION
Idling	8 minutes or more
1000	4.5 minutes or more
2000	2.5 minutes or more
3000	1.5 minutes or more

9. Check whether misfires have occurred by checking DTCs and freeze frame data.

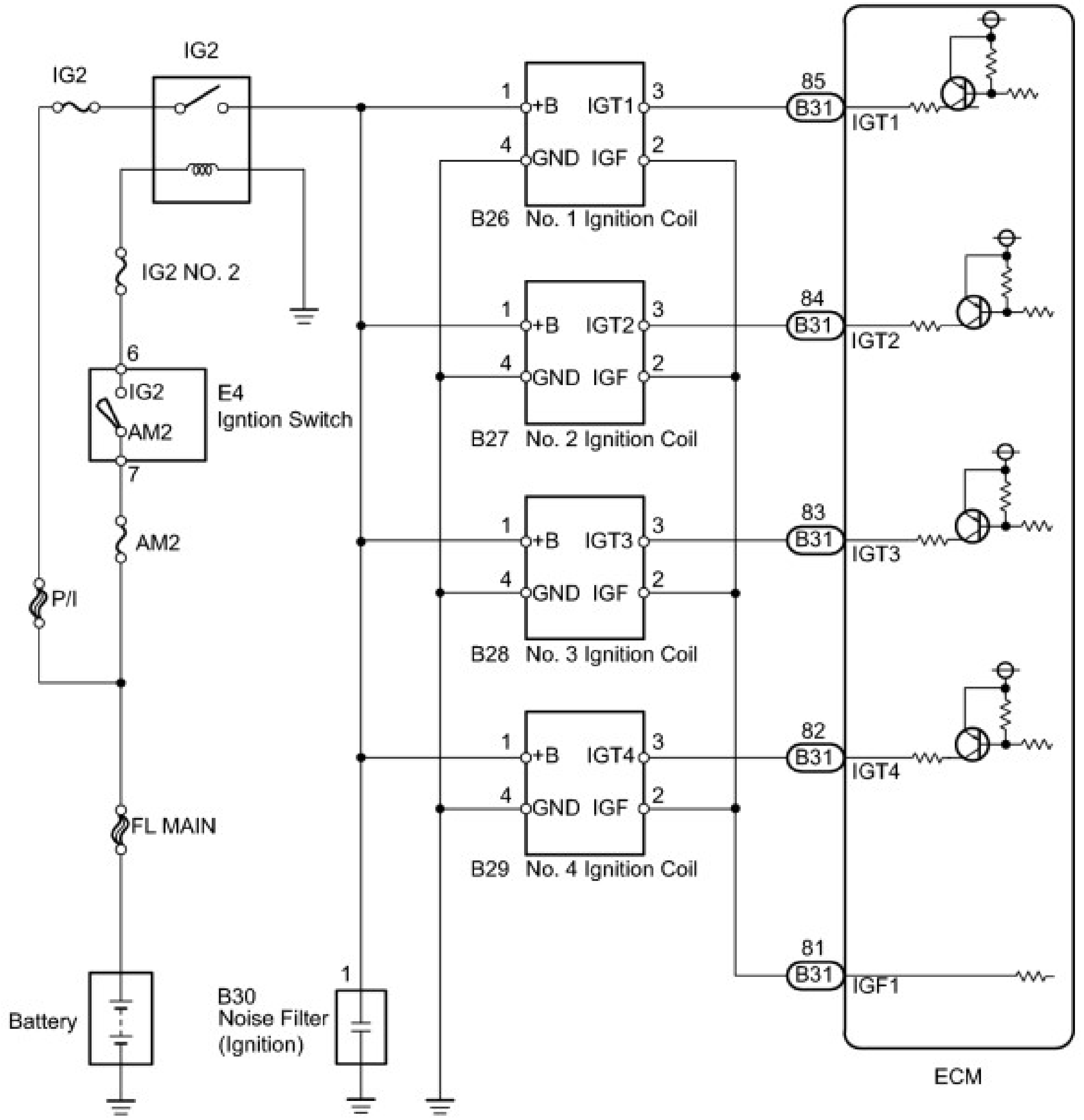
   HINT:

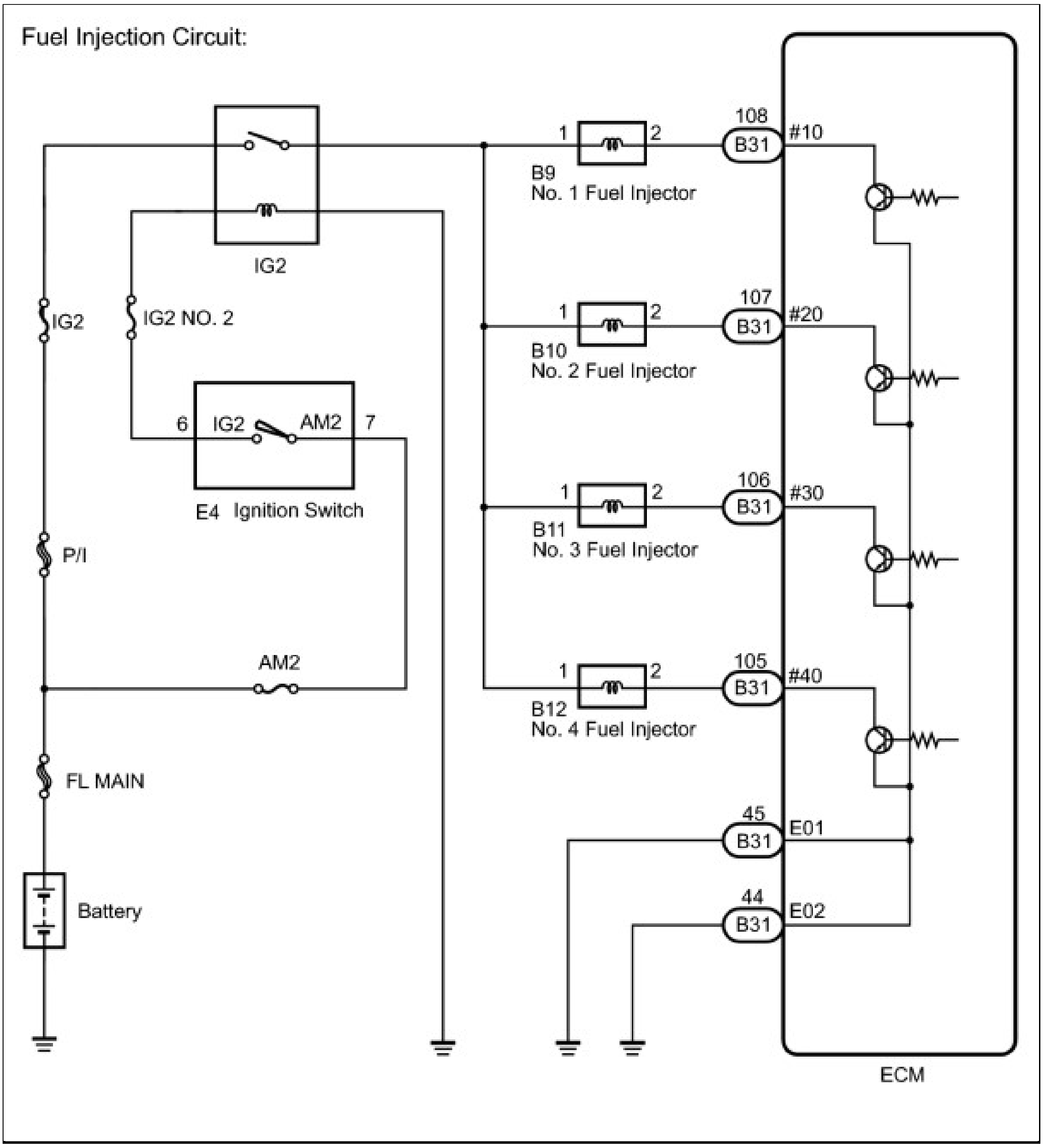
   Do not turn the ignition switch off until the output DTC(s) and freeze frame data have been recorded. When the ECM returns to normal mode (default), the stored DTC(s), freeze frame data and other data are cleared.

10. Record the DTC(s), freeze frame data and misfire counts.
11. Turn the ignition switch off and wait for at least 15 seconds.
12. Clear the DTCs (even if no DTCs are stored, perform the Clear DTC procedure) .

WIRING DIAGRAM

Ignition System Circuit:





INSPECTION PROCEDURE

HINT:

- If any DTCs other than misfire DTCs are output, troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- If the misfire does not recur when the vehicle is brought to the workshop, reproduce the conditions stored in the ECM as freeze frame data.
- If the misfire still cannot be reproduced even though the conditions stored in the ECM as freeze frame data have been reproduced, one of the following factors is considered to be a possible

cause of the problem:

a. There was insufficient fuel in the tank.
b. Improper fuel is used.
c. The spark plugs have been contaminated.
d. The problem requires further diagnosis.

- After finishing repairs, check the misfire counts of the cylinders (Cylinder #1 Misfire Count to Cylinder #4 Misfire Count).
- Be sure to confirm that no misfiring cylinder DTCs are set again by conducting the confirmation driving pattern after finishing repairs.
- When one of Short FT #1, Long FT #1, Short FT #2 or Long FT #2 in the freeze frame data is outside the range of +/- 20%, the air-fuel ratio may be Rich (-20% or less) or Lean (+20% or more).
- When the Coolant Temp in the freeze frame data is less than 75°C (167°F), the misfire occurred while warming up the engine.
- An extremely imbalanced drive wheel which causes body vibration may cause misfire DTCs to be detected.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO MISFIRE DTCS)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

HINT:

Write down indicated DTCs.

Result:

RESULT	PROCEED TO
P0300, P0301, P0302, P0303 and/or P0304	A
P0300, P0301, P0302, P0303 and/or P0304 and other DTCs	B

HINT:

If any DTCs other than P0300, P0301, P0302, P0303 and P0304 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	**READ VALUE USING TECHSTREAM (MISFIRE RPM AND MISFIRE LOAD)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Misfire / Misfire RPM and Misfire Load.

(e) Read and note the Misfire RPM and Misfire Load values.

HINT:

The Misfire RPM and Misfire Load values indicate the vehicle conditions under which the misfire occurs.

NEXT

▼

3.	**CHECK PCV HOSE CONNECTIONS**

(a) Check PCV hose.

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

NG ▶ **REPAIR OR REPLACE PCV HOSE**

OK

▼

4.	**READ VALUE USING TECHSTREAM (CATALYST OT MF F/C)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Catalyst OT MF F/C.

(e) Read the value displayed on the Techstream.

Result:

DATA LIST	TECHSTREAM DISPLAY	PROCEED TO
Catalyst OT MF F/C	Avail	A
	Not Avl	B

B ▶ **READ VALUE USING TECHSTREAM (CYLINDER #1, #2, #3 AND #4)**

A

▼

5.	**PERFORM ACTIVE TEST USING TECHSTREAM (PROHIBIT CATALYST OT MISFIRE PREVENT F/C)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Prohibit the Catalyst OT Misfire prevent F/C.

(e) Perform the Active Test.

NOTICE:

When performing the Active Test, make sure the vehicle is stopped and either idling or at 3000 rpm or less.

NEXT

▼

6.	**READ VALUE USING TECHSTREAM (CYLINDER #1, #2, #3 AND #4)**

(a) Enter the following menus: Powertrain / Engine and ECT / Data List / Misfire / Cylinder #1 Misfire Count, #2, #3 and #4.

(b) Start the engine and allow the engine to idle.
(c) Read each value for Cylinder #1 Misfire Count to #4 displayed on the Techstream. If no misfire counts occur in any cylinders, perform steps (d) and (e) and then check the misfire counts again.

(d) Drive the vehicle with the Misfire RPM and Misfire Load noted in the "READ VALUE USING TECHSTREAM (Misfire RPM and Misfire Load)" procedures above.
(e) Read the Cylinder #1 Misfire Count to #4 or DTCs displayed on the Techstream.

Result:

RESULT (MISFIRE COUNT)	PROCEED TO
Most misfires occur in only 1 or 2 cylinders	A
3 cylinders or more have equal misfire counts	B

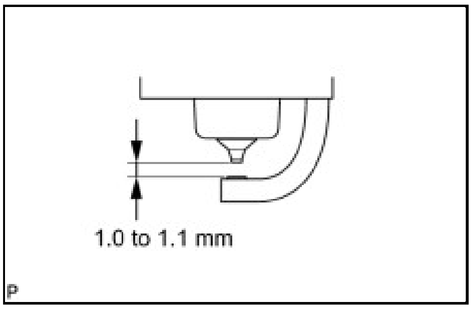
HINT:

- If it is difficult to reproduce misfires for each cylinder, check the Data List item called Misfire Margin. Try to find vehicle driving conditions that lower the Misfire Margin value. Values above 30% are considered normal.
- If the freeze frame data record of the engine coolant temperature is below 75°C (167°F), it may only be possible to detect the misfire when the engine is cold.
- If the freeze frame data record of the Engine Run Time is below 120 seconds, the misfire may be detected immediately after the engine is started.

B ▶ CHECK INTAKE SYSTEM

A ▼

7.	**INSPECT SPARK PLUG**



(a) Remove the ignition coil and the spark plug from the misfiring cylinder.

(b) Measure the spark plug electrode gap.

Standard Gap:
1.0 to 1.1 mm (0.0394 to 0.0433 in.)

(c) Check the electrode for carbon deposits.

Recommended Spark Plug:

MANUFACTURER	PRODUCT

MANUFACTURER	PRODUCT
DENSO	SK20R11
NGK	IFR6A11

NOTICE:

If the electrode gap is not as specified, replace the spark plug. Do not adjust the electrode gap.

(d) Reinstall the ignition coil.

NG ▶ **REPLACE SPARK PLUG**

OK ▼

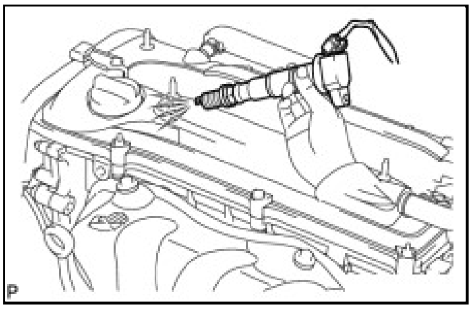
8.	CHECK FOR SPARK AND IGNITION

(a) Disconnect the injector connectors to prevent the engine from starting.

CAUTION:

Always disconnect all injector connectors.

(b) Remove the ignition coil from the cylinder head.



(c) Install the spark plug onto the ignition coil.

(d) Touch the spark plug assembly to the cylinder head.

(e) Crank the engine for less than 2 seconds and check for spark.

NOTICE:

Do not crank the engine for more than 2 seconds.

OK:
Sparks jump across electrode gap.

(f) Install the ignition coil.

(g) Reconnect the injector connectors.

NG ▶ **CHANGE TO**

KNOWN GOOD SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER

OK

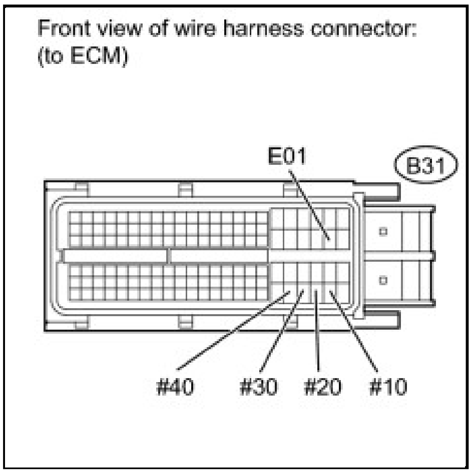
9.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the compression pressure of the misfiring cylinder INFO .

NG ▶ **CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION**

OK

10.	INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#10, #20, #30 AND /OR #40 VOLTAGE)



(a) Disconnect the ECM connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
B31-108 (#10) - B31-45 (E01)	Ignition switch ON	11 to 14 V

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
B31-107 (#20) - B31-45 (E01)	Ignition switch ON	11 to 14 V
B31-106 (#30) - B31-45 (E01)	Ignition switch ON	11 to 14 V
B31-105 (#40) - B31-45 (E01)	Ignition switch ON	11 to 14 V

(d) Reconnect the ECM connector.

NG ▶ **GO TO FUEL INJECTOR CIRCUIT**

OK
▼

11.	**CHECK FUEL INJECTOR OF MISFIRING CYLINDER**

(a) Check the injector injection (whether fuel volume is high or low, and whether injection pattern is poor) INFO .

NG ▶ **REPLACE FUEL INJECTOR**

OK
▼

12.	**CHECK VALVE CLEARANCE OF MISFIRING CYLINDER**

(a) Check the valve clearance INFO .

NG ▶ **ADJUST VALVE CLEARANCE**

OK

13.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:

No leaks in intake system.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK

14.	CHECK VALVE TIMING INFO

NG ▶ **ADJUST VALVE TIMING**

OK

15.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO .

NG ▶ **REPAIR OR REPLACE FUEL PUMP, PRESSURE REGULATOR, FUEL PIPE LINE OR FILTER**

OK

16.	READ VALUE USING TECHSTREAM (COOLANT TEMP) INFO

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK ▼

17.	INSPECT MASS AIR FLOW METER INFO

NG ▶ REPLACE MASS AIR FLOW METER

OK ▶ REPLACE ECM

18.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks in intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

19.	CHECK VALVE TIMING INFO

NG ▶ ADJUST VALVE TIMING

OK

20.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO .

NG REPAIR OR REPLACE FUEL PUMP, PRESSURE REGULATOR, FUEL PIPE LINE OR FILTER

OK

21.	READ VALUE USING TECHSTREAM (COOLANT TEMP) INFO

NG REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK

22.	INSPECT MASS AIR FLOW METER INFO

NG REPLACE MASS AIR FLOW METER

OK

23.	INSPECT SPARK PLUG

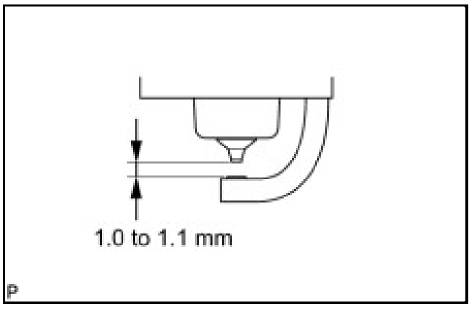
(a) Remove the ignition coil and the spark plug of the misfiring cylinder.

(b) Measure the spark plug electrode gap.

Standard Gap:
1.0 to 1.1 mm (0.0394 to 0.0433 in.)

(c) Check the electrode for carbon deposits.

Recommended Spark Plug:



MANUFACTURER	PRODUCT
DENSO	SK20R11
NGK	IFR6A11

NOTICE:
If the electrode gap is not as specified, replace the spark plug. Do not adjust the electrode gap.

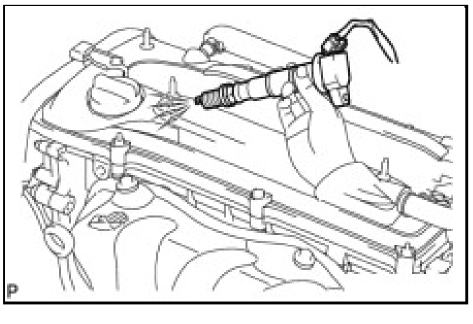
(d) Reinstall the ignition coil.

NG ▶ **REPLACE SPARK PLUG**

OK ▼

24.	CHECK FOR SPARK AND IGNITION

(a) Disconnect the injector connectors to prevent the engine from starting.



CAUTION:
Always disconnect all injector connectors.

(b) Remove the ignition coil from the cylinder head.

(c) Install the spark plug onto the ignition coil.

(d) Touch the spark plug tip to the cylinder head.

(e) Crank the engine for less than 2 seconds and check for spark.

NOTICE:

Do not crank the engine for more than 2 seconds.

OK:

Sparks jump across electrode gap.

(f) Install the ignition coil.

(g) Reconnect the injector connectors.

NG ▶ **CHANGE TO KNOWN GOOD SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER**

OK ▼

25.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the compression pressure of the misfiring cylinder INFO .

NG ▶ **CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION**

OK ▼

26.	INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#10, #20, #30 AND/OR #40 VOLTAGE)

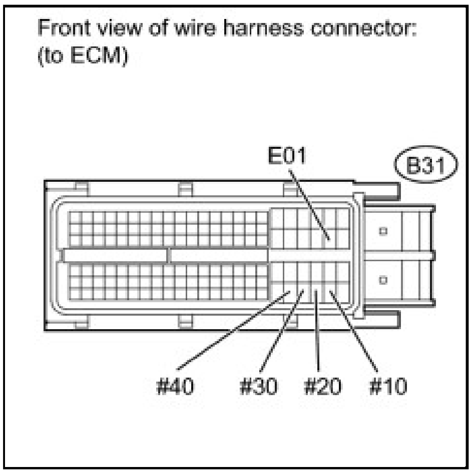
(a) Disconnect the ECM connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
B31-108 (#10) - B31-45 (E01)	Ignition switch ON	11 to 14 V
B31-107 (#20) - B31-45 (E01)	Ignition switch ON	11 to 14 V
B31-106 (#30) - B31-45 (E01)	Ignition switch ON	11 to 14 V
B31-105 (#40) - B31-45 (E01)	Ignition switch ON	11 to 14 V



(d) Reconnect the ECM connector.

NG ▶ **GO TO FUEL INJECTOR CIRCUIT**

OK ▼

27.	**CHECK FUEL INJECTOR OF MISFIRING CYLINDER**

(a) Check the injector injection (whether fuel volume is high or low, and whether injection pattern is poor) INFO .

NG ▶ **REPLACE FUEL INJECTOR**

OK ▼

28.	**CHECK VALVE CLEARANCE OF MISFIRING CYLINDER**

(a) Check the valve clearance INFO .

NG ▶ **ADJUST VALVE CLEARANCE**

OK ▶ **REPLACE ECM**

29.	**CHANGE TO KNOWN GOOD SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER**

(a) Change the installed spark plug to a known good spark plug.

(b) Perform a spark test.

CAUTION:

Always disconnect all injector connectors.

NOTICE:

Do not crank the engine for more than 2 seconds.

(1) Install the spark plug into the ignition coil and connect the ignition coil connector.

(2) Disconnect the injector connectors.

(3) Ground the spark plug.

(4) Check if spark occurs while the engine is being cranked.

OK:

Sparks jump across electrode gap.

NG ▶ **CHANGE TO KNOWN GOOD IGNITION COIL AND CHECK SPARK OF MISFIRING CYLINDER**

OK ▶ **REPLACE SPARK PLUG**

30.	**CHANGE TO KNOWN GOOD IGNITION COIL AND CHECK SPARK OF MISFIRING CYLINDER**

(a) Change the ignition coil to a known good ignition coil.

(b) Perform a spark test.

CAUTION:

Always disconnect all injector connectors.

NOTICE:

Do not crank the engine for more than 2 seconds.

(1) Install the spark plug into the ignition coil and connect the ignition coil connector.

(2) Disconnect the injector connector.

(3) Ground the spark plug.

(4) Check if sparks occur while the engine is being cranked.

OK:
Sparks jump across electrode gap.

NG ▶ **REPLACE ECM**

OK ▶ **REPLACE IGNITION COIL**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000T9P05JX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control (2010 Corolla)		

DTC	**P0125**	**Insufficient Coolant Temperature for Closed Loop Fuel Control**

DESCRIPTION

Refer to DTC P0115 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0125	Engine coolant temperature does not reach closed-loop enabling temperature for 20 minutes (this period varies with engine start engine coolant temperature) (2 trip detection logic)	• Cooling system • Engine coolant temperature sensor • Thermostat

MONITOR DESCRIPTION

The resistance of the engine coolant temperature sensor varies in proportion to the actual engine coolant temperature. The ECM supplies a constant voltage to the sensor and monitors the signal output voltage of the sensor. The signal output voltage varies according to the changing resistance of the sensor. After the engine is started, the engine coolant temperature is monitored through this signal. If the engine coolant temperature sensor indicates that the engine is not yet warm enough for closed-loop fuel control, despite a specified period of time having elapsed since the engine was started, the ECM interprets this as a malfunction in the sensor or cooling system and sets the DTC.

Example:

The engine coolant temperature is 5°C (41°F) at engine start. After about 1 minute running time, the engine coolant temperature sensor still indicates that the engine is not warm enough to begin closed-loop fuel (air-fuel ratio feedback) control. The ECM interprets this as a malfunction in the sensor or cooling system and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0125: Insufficient engine coolant temperature for closed-loop fuel control
Required Sensors/Components (Main)	Engine coolant temperature sensor Thermostat Cooling system

Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	52 seconds: Engine coolant temperature at engine start 1.67°C (35°F) or more 111 seconds: Engine coolant temperature at engine start 1.67 to -9.44°C (35 to 15°F) 1200 seconds: Engine coolant temperature at engine start less than -9.44°C (15°F)
MIL Operation	2 driving cycles
Sequence of Operation	None

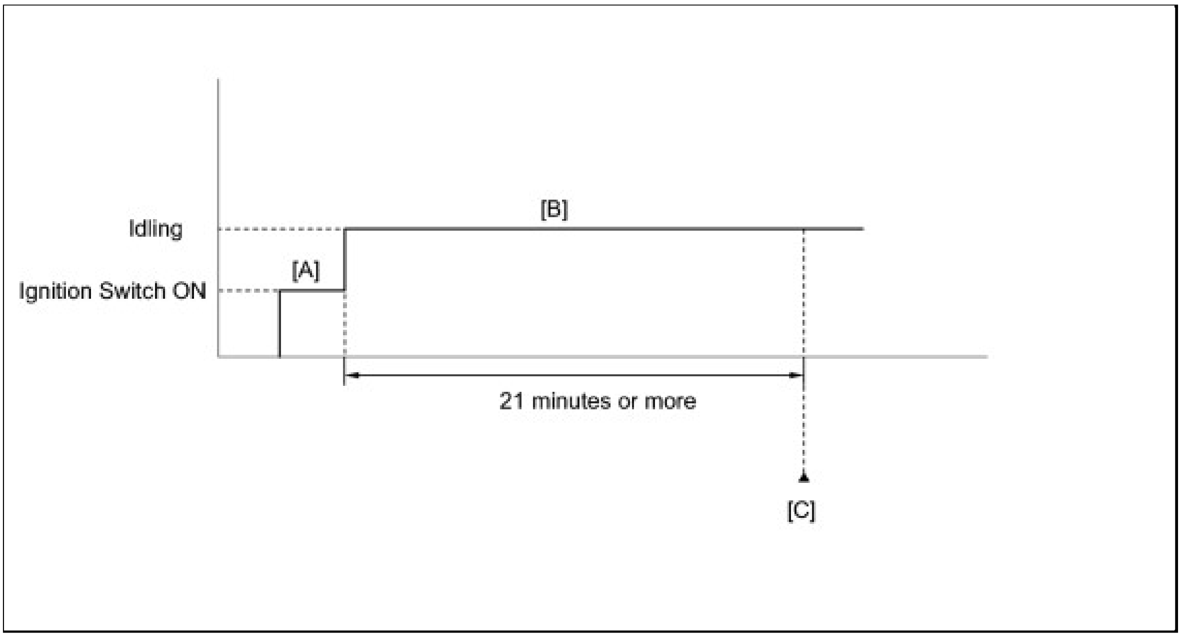
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Thermostat fail	Not detected

TYPICAL MALFUNCTION THRESHOLDS

Time until actual engine coolant temperature reaches closed-loop fuel control enabling temperature	52 seconds: Engine coolant temperature at engine start 1.67°C (35°F) or more 111 seconds: Engine coolant temperature at engine start 1.67 to -9.44°C (35 to 15°F) 1200 seconds: Engine coolant temperature at engine start less than -9.44°C (15°F)

CONFIRMATION DRIVING PATTERN



1. Leave the vehicle outside overnight.
2. Connect the Techstream to the DLC3.
3. Turn the ignition switch to ON and turn the Techstream on.
4. Enter the following menu items: Powertrain / Engine / Data List / Coolant Temp.
5. Check that the engine coolant temperature is 10°C (50°F) or less.
6. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
7. Turn the ignition switch off.
8. Turn the ignition switch to ON and turn the Techstream on [A].
9. Start the engine.
10. After starting the engine, wait 21 minutes or more [B].
11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0125.
13. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal
ABNORMAL	- DTC judgment completed - System abnormal
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

14. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Code / Pending.
15. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

16. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0115 INFO .

INSPECTION PROCEDURE

HINT:

- If any of DTCs P0115, P0116, P0117 or P0118 are set simultaneously with DTC P0125, the engine coolant temperature sensor may have an open or a short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0125)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0125	A

RESULT	PROCEED TO
P0125 and other DTCs	B

HINT:

If any DTCs other than P0125 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A
▼

2.	INSPECT THERMOSTAT

(a) Remove the thermostat INFO .

(b) Check the valve opening temperature of the thermostat.

Standard Value:
80 to 84°C (176 to 183°F)

HINT:

In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

(c) Reinstall the thermostat INFO .

NG ▶ **REPLACE THERMOSTAT**

OK
▼

3.	CHECK COOLING SYSTEM

(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal radiator fan operation or any modifications.

NG ▶ **REPAIR OR REPLACE COOLING SYSTEM**

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000WC3091X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0171,P0172: System Too Lean (Bank 1) (2010 Corolla)		

DTC	**P0171**	**System Too Lean (Bank 1)**

DTC	**P0172**	**System Too Rich (Bank 1)**

DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection duration. The fuel trim consists of both the short-term and long-term fuel trim.

The short-term fuel trim is fuel compensation that is used to constantly maintain the air fuel ratio at stoichiometric levels. The signal from the air fuel ratio sensor indicates whether the air fuel ratio is rich or lean compared to the stoichiometric ratio. This triggers a reduction in the fuel injection volume if the air fuel ratio is rich and an increase in the fuel injection volume if it is lean.

Factors such as individual engine differences, wear over time and changes in operating environment cause short-term fuel trim to vary from the central value. The long-term fuel trim, which controls overall fuel compensation, compensates for long-term deviations in the fuel trim from the central value caused by the short- term fuel trim compensation.

If both the short-term and long-term fuel trim are lean or rich beyond predetermined values, it is interpreted as a malfunction, and the ECM illuminates the MIL and sets a DTC.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0171	With warm engine and stable air fuel ratio feedback, fuel trim considerably in error to lean side (2 trip detection logic)	• Intake system • Injector blockage • Mass air flow meter • Engine coolant temperature sensor • Fuel pressure • Gas leak from exhaust system • Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • EFI No. 2 fuse • PCV valve and hose • PCV hose connections • ECM
P0172	With warm engine and stable air fuel ratio feedback, fuel trim considerably in error to rich side (2 trip detection logic)	• Injector leak or blockage • Mass air flow meter • Engine coolant temperature sensor • Ignition system • Fuel pressure • Gas leak from exhaust system • Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • EFI No. 2 fuse • ECM

HINT:

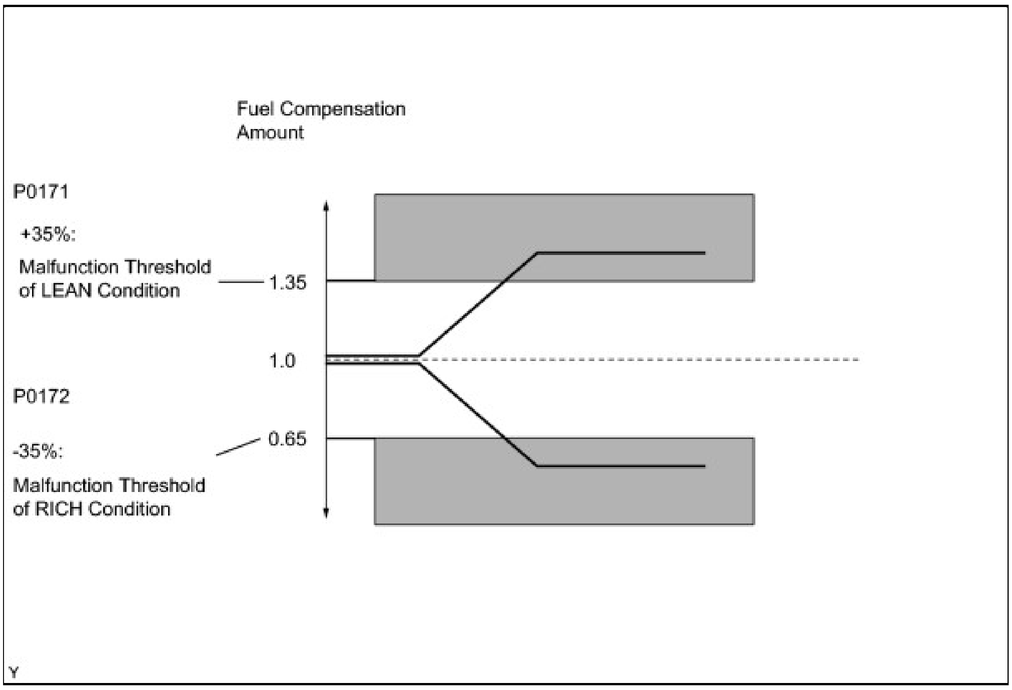
- When DTC P0171 is set, the actual air fuel ratio is on the lean side. When DTC P0172 is set, the actual air fuel ratio is on the rich side.
- If the vehicle runs out of fuel, the air fuel ratio is lean and DTC P0171 may be set. The MIL is then illuminated.
- When the total of the short-term and long-term fuel trim values is within the malfunction threshold (and the engine coolant temperature is more than 75°C [167°F]), the system is functioning normally.

MONITOR DESCRIPTION

Under closed-loop fuel control, a fuel injection volume that deviates from that estimated by the ECM causes changes in the long-term fuel trim compensation value. The long-term fuel trim is adjusted when there are persistent deviations in the short-term fuel trim value. Deviations from the ECM's estimated fuel injection volume also affects the average fuel trim learning value, which is a combination of the average short-term fuel trim (fuel feedback compensation value) and the average long-term fuel trim (learning value of the air- fuel ratio). If the average fuel trim learning value exceeds a malfunction threshold, the ECM interpret this a fault in the fuel system and sets a DTC.

Example:

If the average fuel trim learning value is more than +35% or less than -35%, the ECM interprets this as a fuel system malfunction.



MONITOR STRATEGY

Related DTCs	P0171: Fuel trim Lean (bank 1) P0172: Fuel trim Rich (bank 1)
Required Sensors/Components (Main)	Fuel system
Required Sensors/Components (Related)	Air fuel ratio sensor Mass air flow meter Crankshaft position sensor
Frequency of Operation	Continuous
Duration	Within 10 seconds

MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Fuel-trim

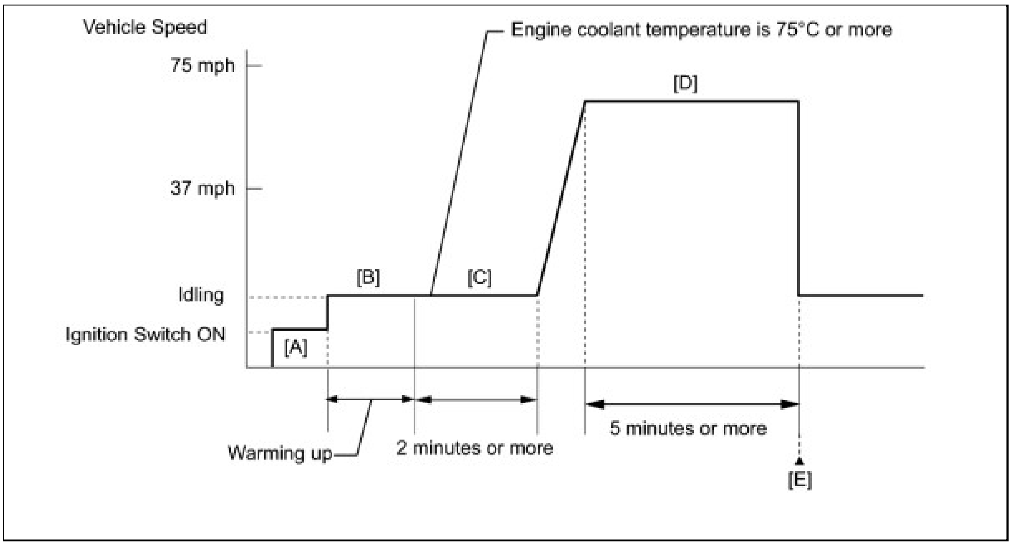
Monitor runs whenever following DTCs not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System bank 1- Advance) P0012 (VVT System bank 1- Retard) P0016 (VVT System bank 1- Misalignment) P0031, P0032 (Air Fuel Ratio Sensor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121 P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter) P0500 (Vehicle Speed Sensor)
Fuel system status	Closed-loop
Battery voltage	11 V or more
Either of following conditions 1 or 2 set	-
1. Engine RPM	Below 1100 rpm
2. Intake air amount per revolution	0.22 g/rev or more
Catalyst monitor	No executed

TYPICAL MALFUNCTION THRESHOLDS

Fuel-trim

Purge-cut	Executing
Either of following conditions 1 or 2 met	-
1. Average between short-term fuel trim and long-term fuel trim	35% or more (varies with engine coolant temperature)
2. Average between short-term fuel trim and long-term fuel trim	-35% or less (varies with engine coolant temperature)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or higher) with all the accessories switched off [B].
7. With the engine warmed up, idle the engine for 2 minutes or more [C].
8. Drive the vehicle at between 37 and 75 mph (60 and 120 km/h) and at an engine speed of between 1400 and 3200 rpm for 5 minutes or more [D].
9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0171 or P0172.
11. Check the DTC judgment result [E].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal
ABNORMAL	- DTC judgment completed - System abnormal
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [C] through [E] again.

12. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
13. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

14. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P2195 INFO .

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F sensor function provided in the Active Test. The Control the Injection Volume for A/F sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F sensor operation using the Techstream.

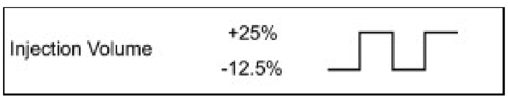
1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
5. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.
6. Perform the Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).
7. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1 S1 and O2S B1 S2) displayed on the Techstream.

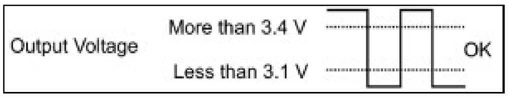
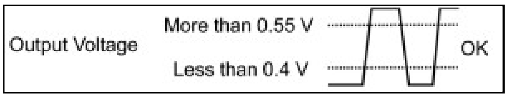
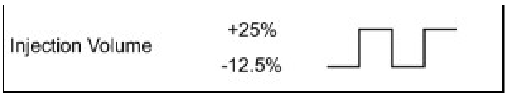
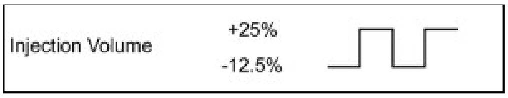
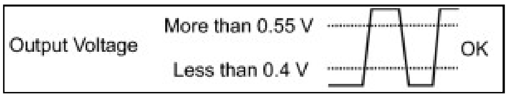
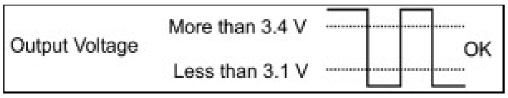
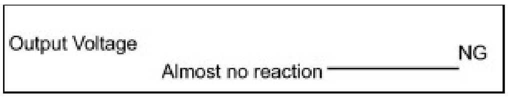
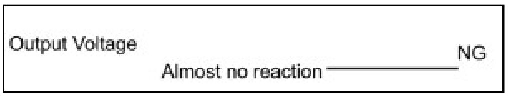
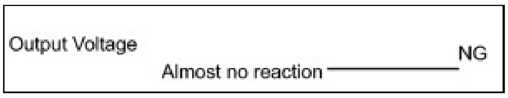
HINT:

- The Control the Injection Volume for A/F sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATE	VOLTAGE
AFS Voltage B1 S1 (Air fuel ratio sensor)	+25%	Rich	Less than 3.1 V
	-12.5%	Lean	More than 3.4 V
O2S B1 S2 (Heated oxygen sensor)	+25%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

NOTICE:
The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
1			-

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
			
2	 	 	• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3	 	 	• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit
4	 	 	• Injector • Fuel pressure • Gas leak from exhaust system (Air fuel ratio extremely rich or lean)

- Following the Control the Injection Volume for A/F sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1 S1 and O2S B1 S2; then press the graph button on the Data List view.

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.

- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0171 OR P0172)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0171 or P0172	A
P0171 or P0172 and other DTCs	B

HINT:

If any DTCs other than P0171 or P0172 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	CHECK PCV HOSE CONNECTIONS

(a) Check PCV hose.

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

NG ▶ **REPAIR OR REPLACE PCV HOSE**

OK ▼

3.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks in air induction system.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK
▼

4.	PERFORM ACTIVE TEST USING TECHSTREAM (AIR FUEL RATIO CONTROL)

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.

(f) Perform the Control the Injection Volume for A/F Sensor operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).

(g) Monitor the voltage outputs of the air fuel ratio sensor and the heated oxygen sensor (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard:

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATE	VOLTAGE
AFS Voltage B1S1 Air Fuel Ratio	+25%	Rich	Less than 3.1
	-12.5%	Lean	More than 3.4
O2S B1S2 Heated Oxygen	+25%	Rich	More than 0.55
	-12.5%	Lean	Less than 0.4

Result

STATE AFS VOLTAGE B1S1	STATE O2S B1S2	AIR FUEL RATIO CONDITION AND AIR FUEL RATIO SENSOR CONDITION	MISFIRE	SUSPECTED TROUBLE AREA	PROCEED TO
Lean/Rich	Lean/Rich	Normal	-	-	C
Lean	Lean	Actual air fuel ratio lean	May occur	• PCV valve and hose • PCV hose connections • Injector blockage • Gas leak from exhaust system	A

STATE AFS VOLTAGE B1S1	STATE O2S B1S2	AIR FUEL RATIO CONDITION AND AIR FUEL RATIO SENSOR CONDITION	MISFIRE	SUSPECTED TROUBLE AREA	PROCEED TO
				• Air induction system • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor	
Rich	Rich	Actual air fuel ratio rich	-	• Injector leak or blockage • Gas leak from exhaust system • Ignition system • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor	
Lean	Lean/Rich	Air fuel ratio sensor malfunction	-	• Air fuel ratio sensor	B
Rich	Lean/Rich	Air fuel ratio sensor malfunction	-	• Air fuel ratio sensor	

Lean: During Control the Injection Volume for A/F Sensor, the air fuel sensor output voltage (AFS Voltage) is consistently more than 3.4 V, and the heated oxygen sensor output voltage (O2S) is consistently less than 0.4 V.

Rich: During Control the Injection Volume for A/F Sensor, the AFS Voltage is consistently less than 3.1 V, and the O2S is consistently more than 0.55 V.

Lean/Rich: During Control the Injection Volume for A/F Sensor of the Active Test, the output voltage of the heated oxygen sensor alternates correctly.

C ▶ **PERFORM CONFIRMATION DRIVING PATTERN**

B ▶ **INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)**

A ▼

5.	**READ VALUE USING TECHSTREAM (COOLANT TEMP)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(e) Read the Data List twice, when the engine is both cold and warmed up.

Standard Value:
With cold engine: Same as ambient air temperature.

With warm engine: 80 to 100°C (176 to 212°F).

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

▼

6.	INSPECT MASS AIR FLOW METER

(a) Read the values using the Techstream (MAF).

NOTICE:

- Turn the ignition switch off.
- Perform the inspection with the vehicle indoors and on a level surface.
- Perform the inspection of the mass air flow meter while it is installed in the air cleaner case (installed on the vehicle).
- During the test, make sure that an exhaust air duct is not drawing air through the exhaust pipe.

(1) Connect the Techstream to the DLC3.

(2) Turn the ignition switch to ON (do not start the engine).

(3) Turn the Techstream on.

(4) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF.

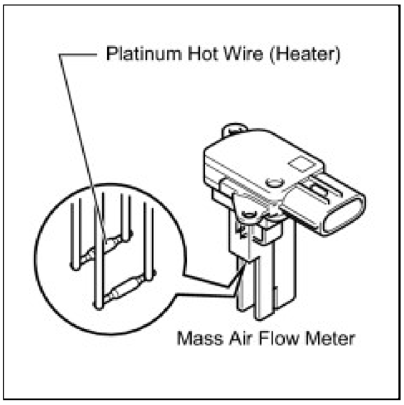
(5) Wait for 30 seconds, and read the values on the Techstream.

Standard Value:

Less than 0.48 g/sec

(b) Inspect the mass air flow meter.

(1) Remove the mass air flow meter INFO .



(2) Using a work light, check that the platinum filament (heater portion) in the mass air flow meter has no foreign matter attached.

OK:

No foreign matter attached.

(3) Reinstall the mass air flow meter INFO .

NG ▶ **REPLACE MASS AIR FLOW METER**

OK

7.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO .

NG ▶ **REPAIR OR REPLACE FUEL SYSTEM**

OK

8.	CHECK FOR EXHAUST GAS LEAK

OK:
No gas leaks.

NG ▶ **REPAIR OR REPLACE EXHAUST SYSTEM**

OK

9.	CHECK SPARK AND IGNITION

HINT:

- Refer to the ignition system inspection procedure INFO .
- If the spark plugs or ignition system malfunctions, engine misfires may occur. The misfire count can be read using the Techstream. Enter the following menus: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Rate (to Cylinder #4 Misfire Rate)

NG ▶ **REPAIR OR REPLACE IGNITION SYSTEM**

OK

10.	INSPECT FUEL INJECTOR ASSEMBLY (INJECTION AND VOLUME)

HINT:

- Refer to the fuel injector inspection procedure INFO .
- If the injectors malfunction, engine misfires may occur. The misfire count can be read using the Techstream. Enter the

following menus: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Count (to Cylinder #4 Misfire Count).

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY**

OK ▼

11.	**INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)** INFO

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK ▼

12.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF AIR FUEL RATIO SENSOR)** INFO

NG ▶ **INSPECT FUSE (EFI NO. 2 FUSE)**

OK ▼

13.	**CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)** INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)**

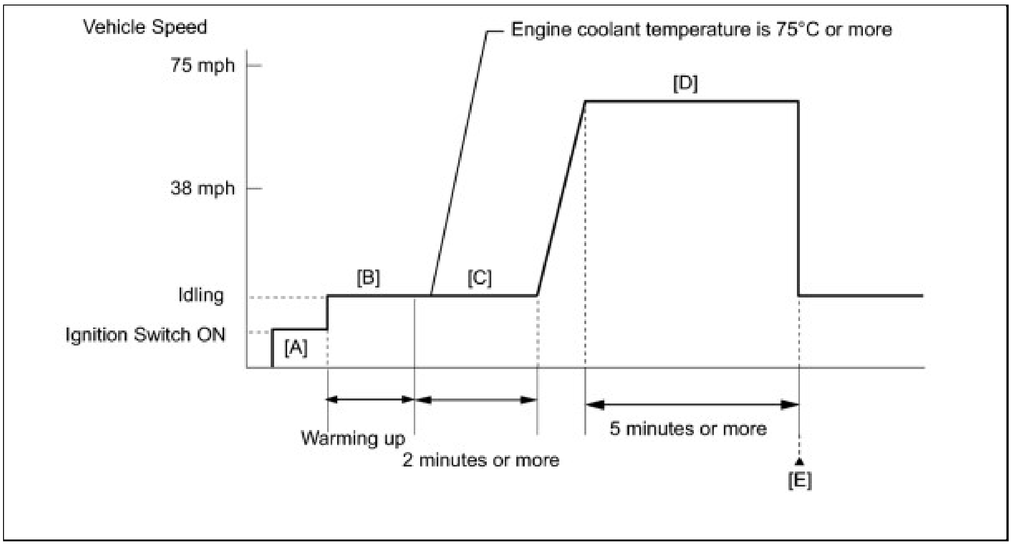
OK ▼

14.	**REPLACE AIR FUEL RATIO SENSOR**

(a) Replace the air fuel ratio sensor INFO .

NEXT ▼

15.	PERFORM CONFIRMATION DRIVING PATTERN



(a) Connect the Techstream to the DLC3.
(b) Turn the ignition switch to ON.
(c) Turn the Techstream on.
(d) Clear DTCs INFO .
(e) Switch the ECM from normal mode to check mode using the Techstream INFO .
(f) Start the engine and warm it up with all the accessories switched OFF.
(g) Drive the vehicle at between 40 mph and 75 mph (60 km/h and 120 km/h) and at an engine speed of between 1400 rpm and 3200 rpm for 3 to 5 minutes.

HINT:

If the system is still malfunctioning, the MIL will be illuminated during step (g).

NOTICE:
If the conditions in this test are not strictly followed, no malfunction will be detected.

NEXT

16.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0171 OR P0172)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P0171 or P0172	B

B ▶ **REPLACE ECM**

A ▶ **END**

17.	INSPECT FUSE (EFI NO. 2 FUSE) INFO

NG ▶ **REPLACE FUSE (EFI NO. 2 FUSE)**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ENGINE ROOM RELAY BLOCK)**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000TB304AX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0128: Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature) (2010 Corolla)		

DTC	**P0128**	**Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)**

DESCRIPTION

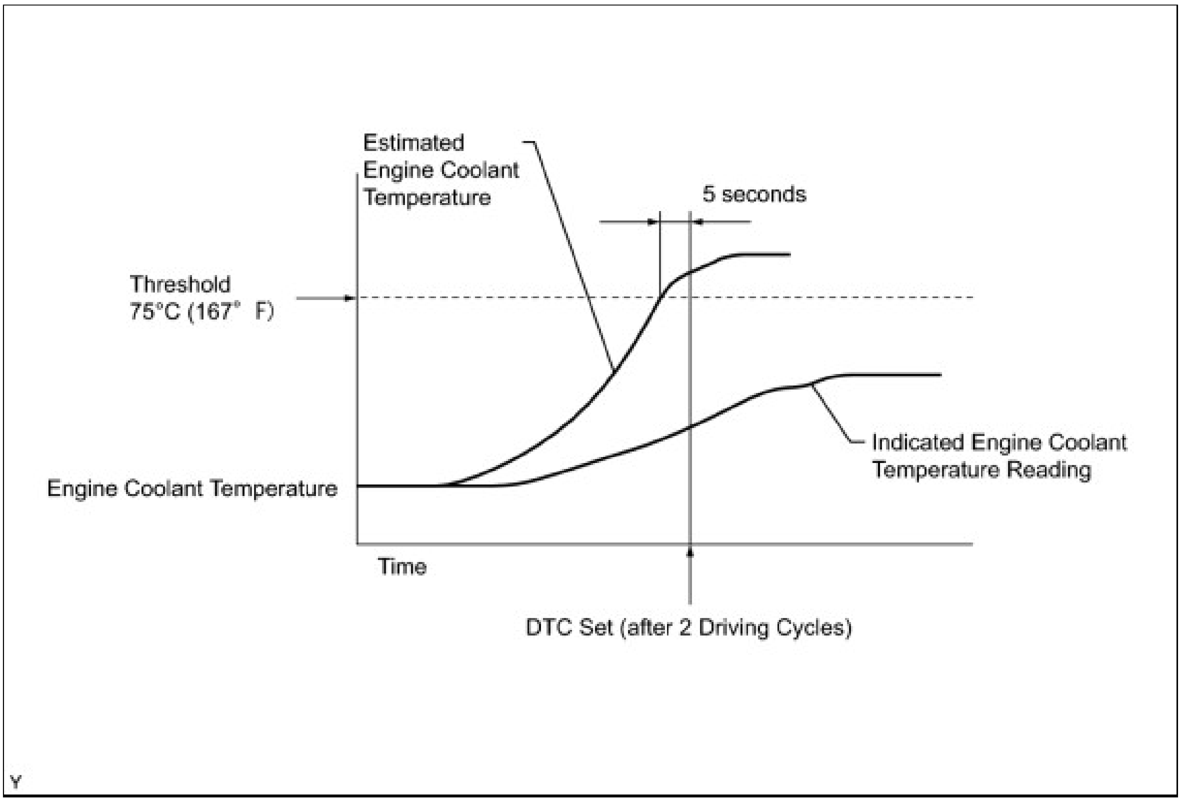
HINT:

This DTC relates to the thermostat.

This DTC is set when the engine coolant temperature does not reach 75°C (167°F) despite sufficient engine warm-up time having elapsed.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0128	• Conditions (a), (b) and (c) are met for 5 seconds (2 trip detection logic): • (a) Cold start • (b) Engine warmed up • (c) Engine coolant temperature less than 75°C (167°F)	• Thermostat • Cooling system • Engine coolant temperature sensor • ECM

MONITOR DESCRIPTION



The ECM estimates the engine coolant temperature based on the starting temperature, engine loads, and engine speeds. The ECM then compares the estimated temperature with the actual engine coolant temperature. When the estimated engine coolant temperature reaches 75°C (167°F), the ECM checks the actual engine coolant temperature. If the actual engine coolant temperature is less than 75°C (167°F), the ECM interprets this as a malfunction in the thermostat or the engine cooling system and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0128: Coolant Thermostat
Required Sensors/Components (Main)	Thermostat Engine coolant temperature sensor
Required Sensors/Components (Related)	Intake air temperature sensor Vehicle speed sensor
Frequency of Operation	Once per driving cycle
Duration	900 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

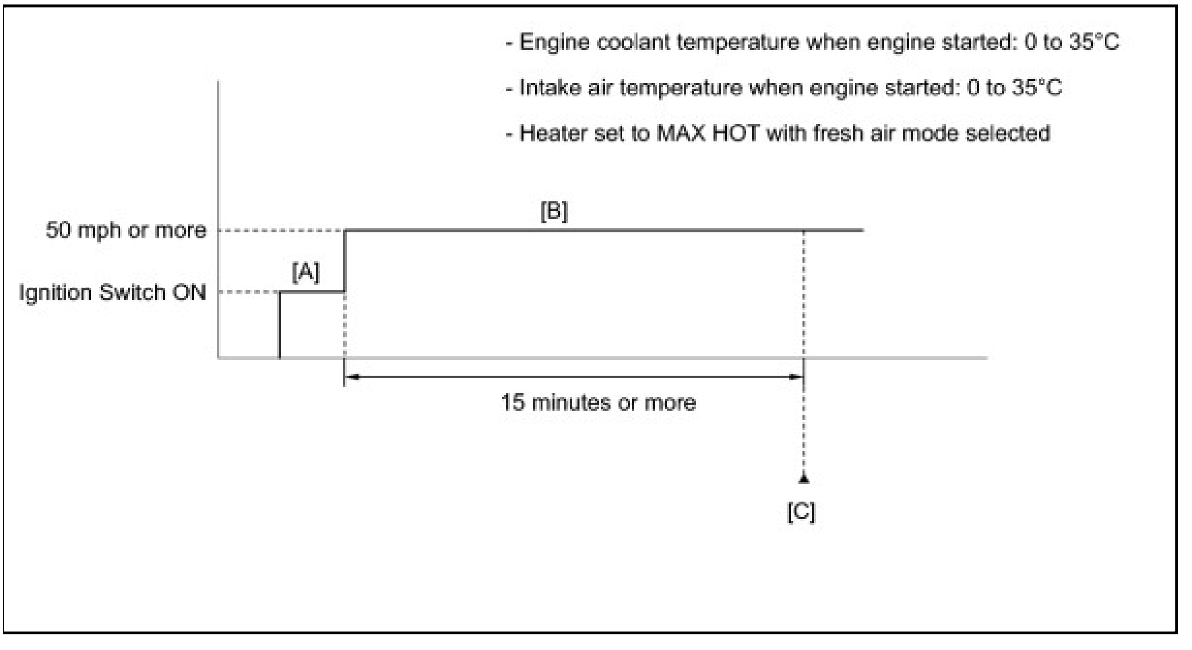
Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System bank 1- Advance) P0012 (VVT System bank 1- Retard) P0016 (VVT System bank 1- Misalignment) P0031, P0032 (Air Fuel Ratio Snesor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121 P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter) P0500 (Vehicle Speed Sensor) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)
Battery voltage	11 V or more
Either of following conditions 1 or 2 is met:	-
1. All of following conditions met:	-
• Engine coolant temperature at engine start - Intake air temperature at engine start	-15 to 7°C (5 to 45°F)
• Engine coolant temperature at engine start	-10 to 56°C (14 to 133°F)
• Intake air temperature at engine start	-10 to 56°C (14 to 133°F)
2. All of following conditions met:	-
• Engine coolant temperature at engine start - Intake air temperature at engine start	More than 7°C (45°F)
• Engine coolant temperature at engine start	56°C (133°F) or less
• Intake air temperature at engine start	-10°C (14°F) or more

Accumulated time at 80 mph (128 km/h) or more of vehicle speed	Less than 20 seconds

TYPICAL MALFUNCTION THRESHOLDS

Duration that both of following conditions (a) and (b) met	5 seconds or more
(a) Estimated engine coolant temperature	75°C (167°F) or more
(b) Engine coolant temperature sensor output	Below 75°C (167°F)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off for 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Enter the following menus: Powertrain / Engine / Data List / All Data / Coolant Temp and Intake Air.
7. Check that "Coolant Temp" and "Intake Air" in the Data List are within the range of 0 to 35°C (32 to 95°F).
8. Heater set to MAX HOT with fresh air mode selected.
9. Start the engine and wait 15 minutes or more [B].
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
11. Read Pending DTCs [C].

HINT:

If a pending DTC is output, the system is malfunctioning.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal
ABNORMAL	- DTC judgment completed - System abnormal
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C].

12. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
13. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

14. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0128)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0128	A
P0128 and other DTCs	B

HINT:

If any DTCs other than P0128 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A
▼

2.	CHECK COOLING SYSTEM

(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal radiator fan operation or any modifications.

NG ▶ **REPAIR OR REPLACE COOLING SYSTEM**

OK
▼

3.	INSPECT THERMOSTAT

(a) Remove the thermostat INFO .

(b) Measure the valve opening temperature of the thermostat.

Standard Value:

80 to 84°C (176 to 183°F)

HINT:

In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

(c) Reinstall the thermostat INFO .

NG ▶ **REPLACE THERMOSTAT**

OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	From: 200901
Model Year: 2010	Model: Corolla	Doc ID: RM000000SVT098X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0327,P0328: Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor) (2010 Corolla)		

DTC	P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)

DTC	P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)

DESCRIPTION

A flat type knock sensor is used. Flat type knock sensors (non-resonant type) have a structure that can detect vibrations over a wide band of frequencies: between approximately 6 kHz and 15 kHz.

Knock sensors are fitted onto the engine block to detect engine knocking.

The knock sensor contains a piezoelectric element which generates a voltage when it becomes deformed.

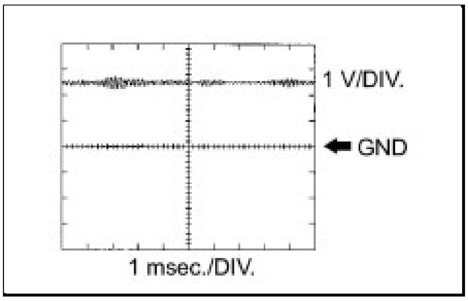
The voltage is generated when the engine block vibrates due to knocking. Occurrence of engine knocking can be suppressed by delaying the ignition timing.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0327	Output voltage of knock sensor less than 0.5 V for 1 second or more (1 trip detection logic)	• Short in knock sensor circuit • Knock sensor • ECM
P0328	Output voltage of knock sensor more than 4.5 V for 1 second or more (1 trip detection logic)	• Open in knock sensor circuit • Knock sensor • ECM

HINT:

When any of DTCs P0327 and P0328 are set, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is delayed to its maximum retardation. Fail-safe mode continues until the ignition switch is turned off.

Reference: Inspection using an oscilloscope



The correct waveform is as shown.

ECM Terminal Name	Between KNK1 and EKNK
Tester Range	1 V/DIV., 1 msec/DIV.
Condition	Engine speed maintained at 4000 rpm after warming up engine

MONITOR DESCRIPTION

If the output voltage transmitted by the knock sensor remains low or high for more than 1 second, the ECM interprets this as a malfunction in the sensor circuit, and sets a DTC.

The monitor for DTCs P0327 and P0328 begins to run when 5 seconds have elapsed since the engine was started.

If the malfunction is not repaired successfully, DTC P0327 or P0328 is set 5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0327: Knock sensor (bank 1) range check (Low voltage) P0328: Knock sensor (bank 1) range check (High voltage)
Required Sensors/Components (Main)	Knock sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Battery voltage	10.5 V or more

Time after engine start	5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

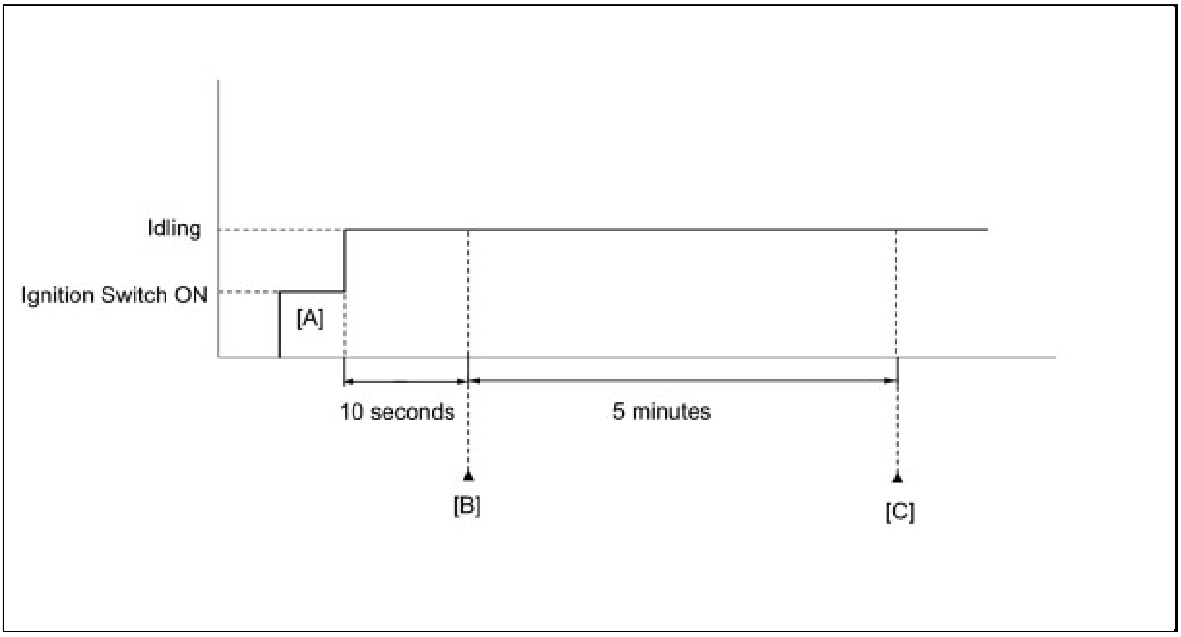
Knock Sensor Range Check (Low Voltage) P0327

Knock sensor voltage	Less than 0.5 V

Knock Sensor Range Check (High Voltage) P0328

Knock sensor voltage	More than 4.5 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and wait 10 seconds.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0327 or P0328.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, idle the engine for 5 minutes and check the DTC judgment result again [C].

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

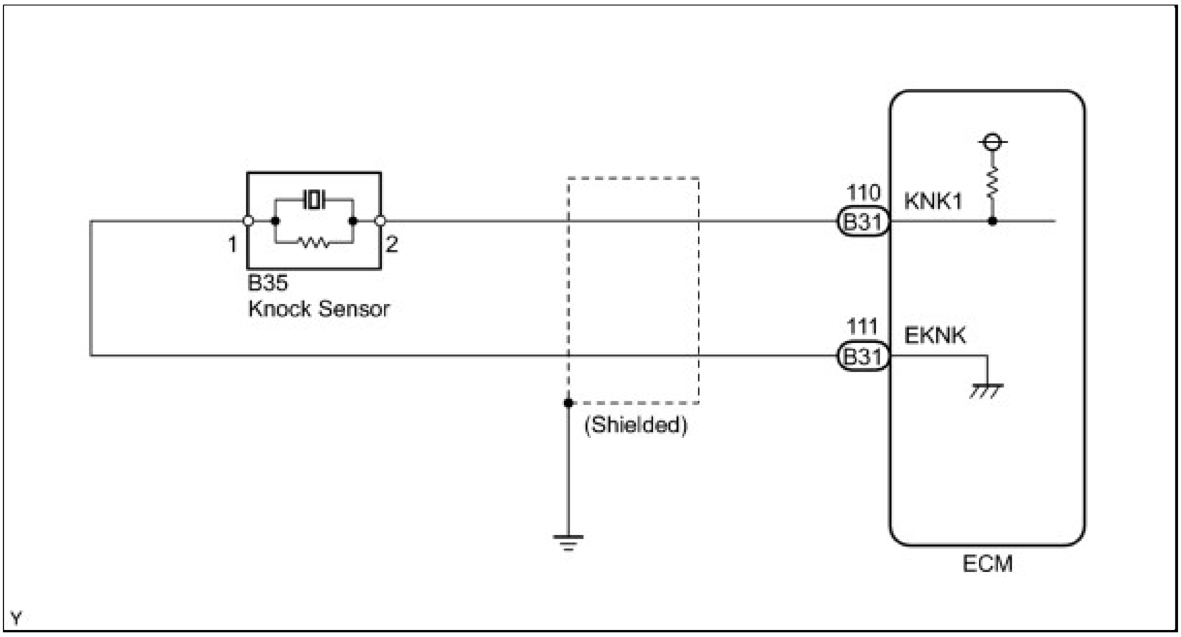
If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (KNOCK FEEDBACK VALUE)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / All Data / Knock Feedback Value.

(f) Read the value while driving the vehicle.

OK:

The value changes.

Malfunction does not occur	Knock Feedback Value changes

Malfunction occurs	Knock Feedback Value does not change

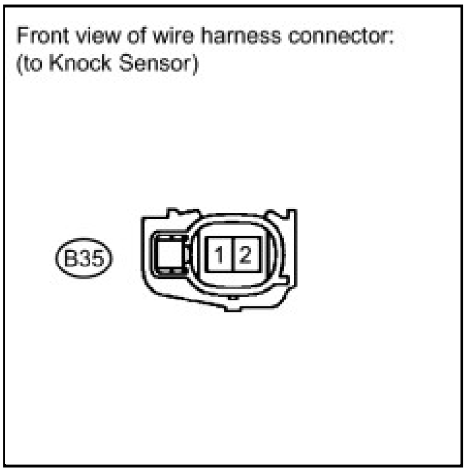
HINT:

The knock feedback value change can be confirmed by running the engine with a high load, for example, by activating the air conditioning system and racing the engine.

NG ▶ **INSPECT ECM (KNK1 VOLTAGE)**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	INSPECT ECM (KNK1 VOLTAGE)



(a) Disconnect the knock sensor connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

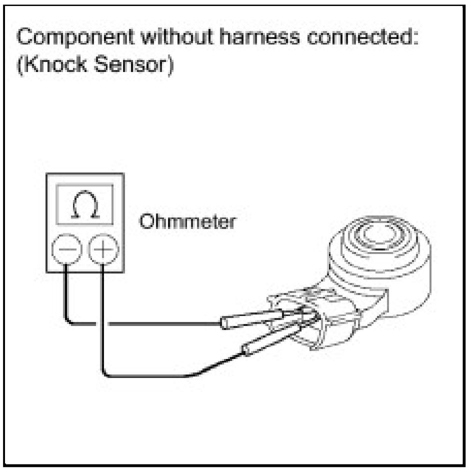
TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
B35-2 - B35-1	Ignition switch ON	4.5 to 5.5 V

(d) Reconnect the knock sensor connector.

NG ▶ **CHECK HARNESS AND CONNECTOR (ECM - KNOCK SENSOR)**

OK

3.	INSPECT KNOCK SENSOR



(a) Remove the knock sensor.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	120 to 280 kΩ

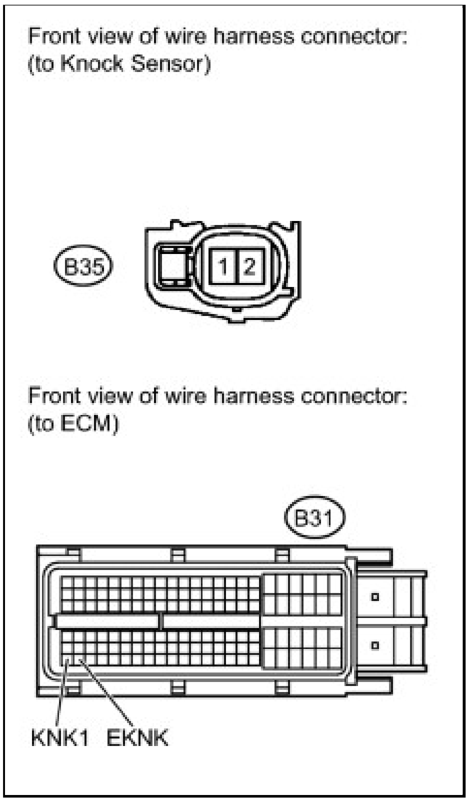
(c) Reinstall the knock sensor.

NG ▶ **REPLACE KNOCK SENSOR**

OK ▶ **REPLACE ECM**

4.	CHECK HARNESS AND CONNECTOR (ECM - KNOCK SENSOR)

(a) Disconnect the knock sensor connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B35-2 - B31-110 (KNK1)	Always	Below 1 Ω
B35-1 - B31-111 (EKNK)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B35-2 or B31-110 (KNK1) - Body ground	Always	10 kΩ or higher
B35-1 or B31-111 (EKNK) - Body ground	Always	10 kΩ or higher

(d) Reconnect the knock sensor connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - KNOCK SENSOR)**

OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000TCW0BFX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0335,P0339: Crankshaft Position Sensor "A" Circuit (2010 Corolla)		

DTC	**P0335**	**Crankshaft Position Sensor "A" Circuit**

DTC	**P0339**	**Crankshaft Position Sensor "A" Circuit Intermittent**

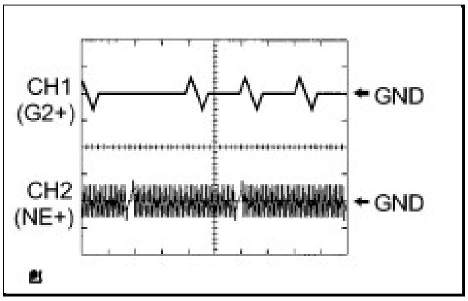
DESCRIPTION

The crankshaft position sensor system consists of a crankshaft position sensor plate and a pickup coil.

The sensor plate has 34 teeth and is installed on the crankshaft. The pickup coil is made of wound copper wire, an iron core and magnet. The sensor plate rotates and, as each tooth passes by the pickup coil, a pulse signal is created. The pickup coil generates 34 signals per engine revolution. Based on these signals, the ECM calculates the crankshaft position and engine RPM. Using these calculations, the fuel injection time and ignition timing are controlled.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0335	When either of following conditions is met: (1 trip detection logic) • Missing crankshaft position sensor signal despite camshaft position sensor signal inputs normal after engine cranked • No crankshaft position sensor signal to ECM at engine speed of 600 rpm or more	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Crankshaft position sensor plate • ECM
P0339	Following conditions (a), (b) and (c) are met: (1 trip detection logic) (a) Engine speed 1500 rpm or more (b) No crankshaft position sensor signal for 0.05 seconds or more (c) 3 seconds or more have elapsed since starter signal switched from ON to OFF	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Crankshaft position sensor plate • ECM

Reference: Inspection using an oscilloscope.



HINT:

- The correct waveform is as shown.
- G2+ stand for the camshaft position sensor signal, and NE+ stands for the crankshaft position sensor signal.
- A failure of the ground for the shielding of the wiring may result in noisy waveforms.

ECM Terminal Name	CH1: Between G2+ and G2- CH2: Between NE+ and NE-
Tester Range	5 V/DIV., 20 msec/DIV.
Condition	Idling

MONITOR DESCRIPTION

If there is no signal from the crankshaft position sensor despite the engine rotating, the ECM interprets this as a malfunction of the sensor.

If the malfunction is not repaired successfully, a DTC is set 10 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0335: Crankshaft position sensor range check or rationality
Required Sensors/Components (Main)	Crankshaft position sensor
Required Sensors/Components (Related)	Camshaft position sensor
Frequency of Operation	Continuous
Duration	3 times
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

Case 1

Time after starter OFF to ON	3 seconds or more
Number of camshaft position sensor signal pulse	6 times
Battery voltage	7 V or more
Ignition switch	ON

Case 2

Starter	OFF
Engine speed	600 rpm or more
Time after starter from ON to OFF	3 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

Case 1

Number of crankshaft position sensor signal pulse	132 or less, and 174 or more

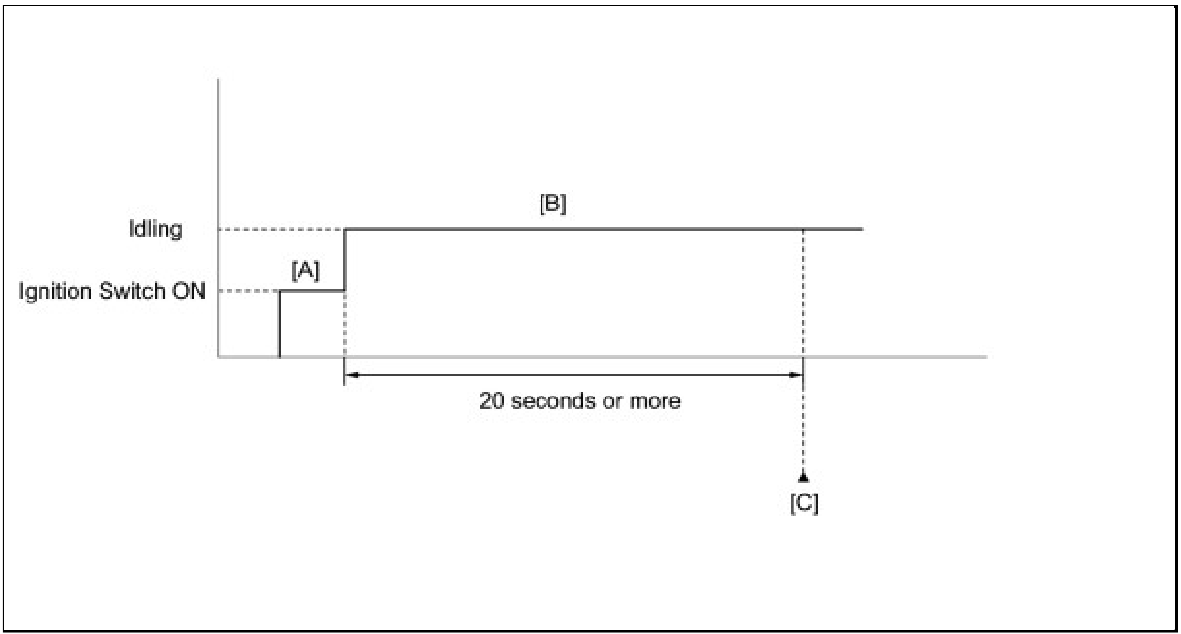
Case 2

Engine speed signal	No signal

COMPONENT OPERATING RANGE

Crankshaft position sensor	• Crankshaft position sensor output voltage fluctuates while crankshaft rotating • 34 crankshaft position sensor signals per crankshaft revolution

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Idle the engine for 20 seconds or more [B].
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P0335 or P0339.
10. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C] again.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

HINT:

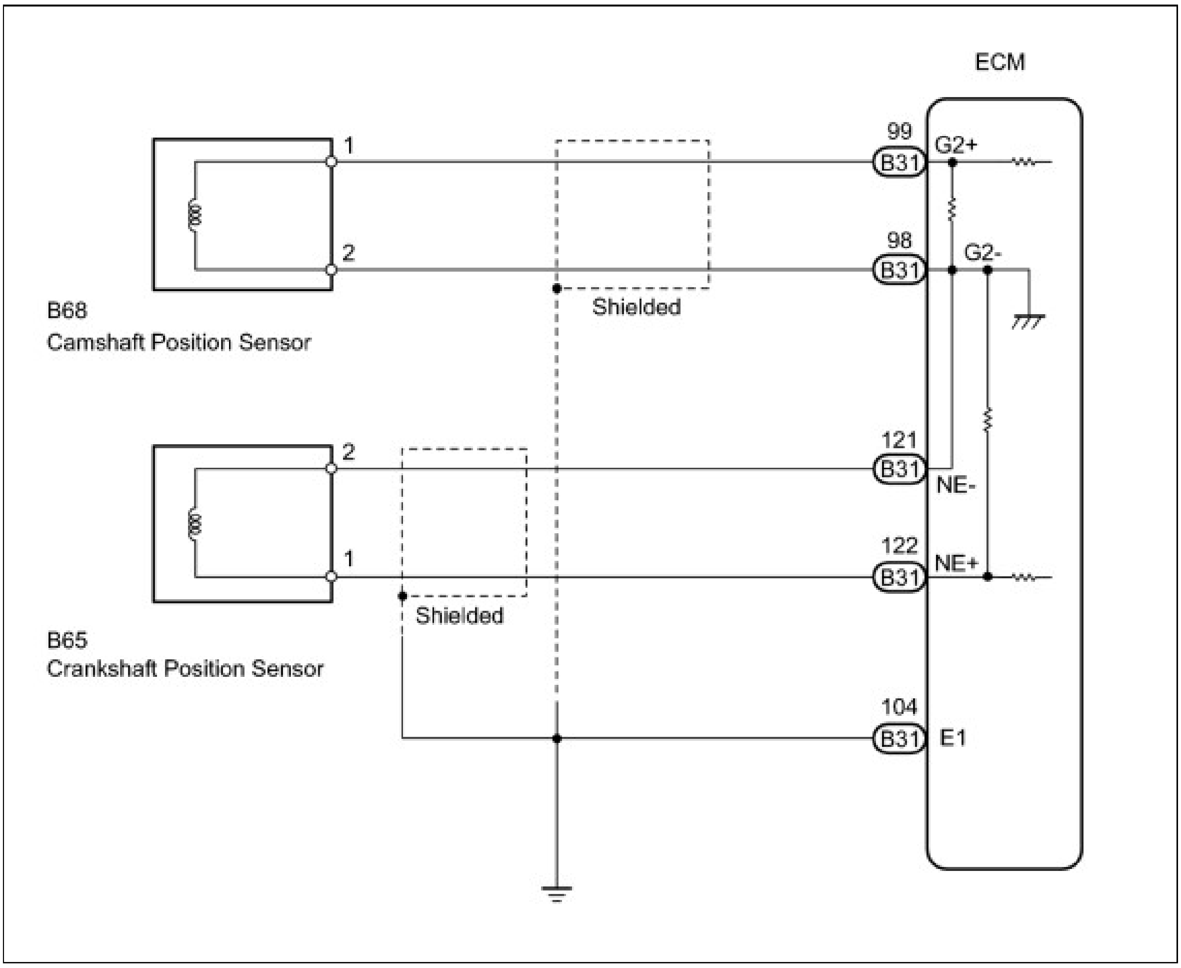
If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If no problem is found through this diagnostic troubleshooting procedure, troubleshoot the engine mechanical systems.
- Check the engine speed. The engine speed can be checked using the Techstream. To check, follow

the operation below:

a. Connect the Techstream to the DLC3.
b. Start the engine.
c. Turn the Techstream on.
d. Enter the following menus: Powertrain / Engine and ECT / Data List / Engine Speed.

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

PROCEDURE

1.	READ VALUE USING TECHSTREAM (ENGINE SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Engine Speed.

(e) Start the engine.

(f) Read the values displayed on the Techstream while the engine is running.

OK:
Correct values are displayed.

HINT:

- To check the engine speed change, display the graph on the Techstream.
- If the engine does not start, check the engine speed while cranking.
- If the engine speed indicated on the Techstream remains at zero (0), there may be an open or short in the crankshaft position sensor circuit.

NG ▶ **INSPECT CRANKSHAFT POSITION SENSOR (RESISTANCE)**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

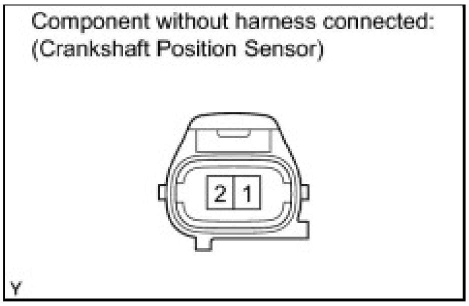
2.	INSPECT CRANKSHAFT POSITION SENSOR (RESISTANCE)

(a) Disconnect the crankshaft position sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	1150 to 1450 Ω



(c) Reconnect the crankshaft position sensor connector.

NG ▶ **REPLACE CRANKSHAFT POSITION SENSOR**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)**

(a) Disconnect the crankshaft position sensor connector.

(b) Disconnect the ECM connector.

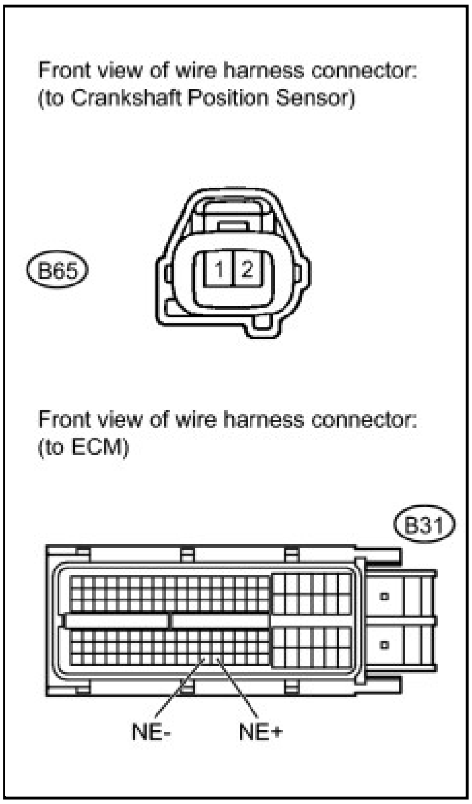
(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B65-1 - B31-122 (NE+)	Always	Below 1 Ω
B65-2 - B31-121 (NE-)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B65-1 or B31-122 (NE+) - Body ground	Always	10 kΩ or higher
B65-2 or B31-121 (NE-) - Body ground	Always	10 kΩ or higher

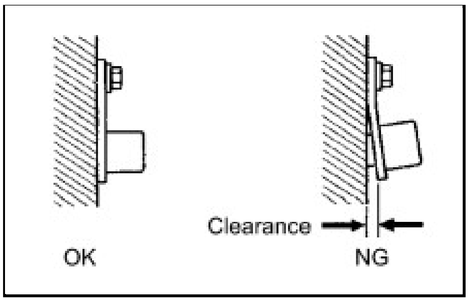
(d) Reconnect the crankshaft position sensor connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)**

OK ▼

4.	CHECK SENSOR INSTALLATION (CRANKSHAFT POSITION SENSOR)



(a) Check the crankshaft position sensor installation.

OK:
Sensor is installed correctly.

NG ▶ **SECURELY REINSTALL SENSOR**

OK ▼

5.	INSPECT CRANKSHAFT POSITION SENSOR PLATE (TEETH OF SENSOR PLATE)

(a) Check the teeth of the sensor plate.

OK:

Sensor plate does not have any cracks or deformation.

NG ▶ **REPLACE CRANKSHAFT POSITION SENSOR PLATE**

OK

▼

6.	REPLACE CRANKSHAFT POSITION SENSOR

(a) Replace crankshaft position sensor INFO .

NEXT

▼

7.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Start the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(g) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P0335 or P0339	B

HINT:

If the engine does not start, replace the ECM.

B ▶ REPLACE ECM

A ▶ END

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000XH40A8X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0351-P0354: Ignition Coil "A" Primary / Secondary Circuit (2010 Corolla)		

DTC	**P0351**	**Ignition Coil "A" Primary / Secondary Circuit**

DTC	**P0352**	**Ignition Coil "B" Primary / Secondary Circuit**

DTC	**P0353**	**Ignition Coil "C" Primary / Secondary Circuit**

DTC	**P0354**	**Ignition Coil "D" Primary / Secondary Circuit**

DESCRIPTION

HINT:

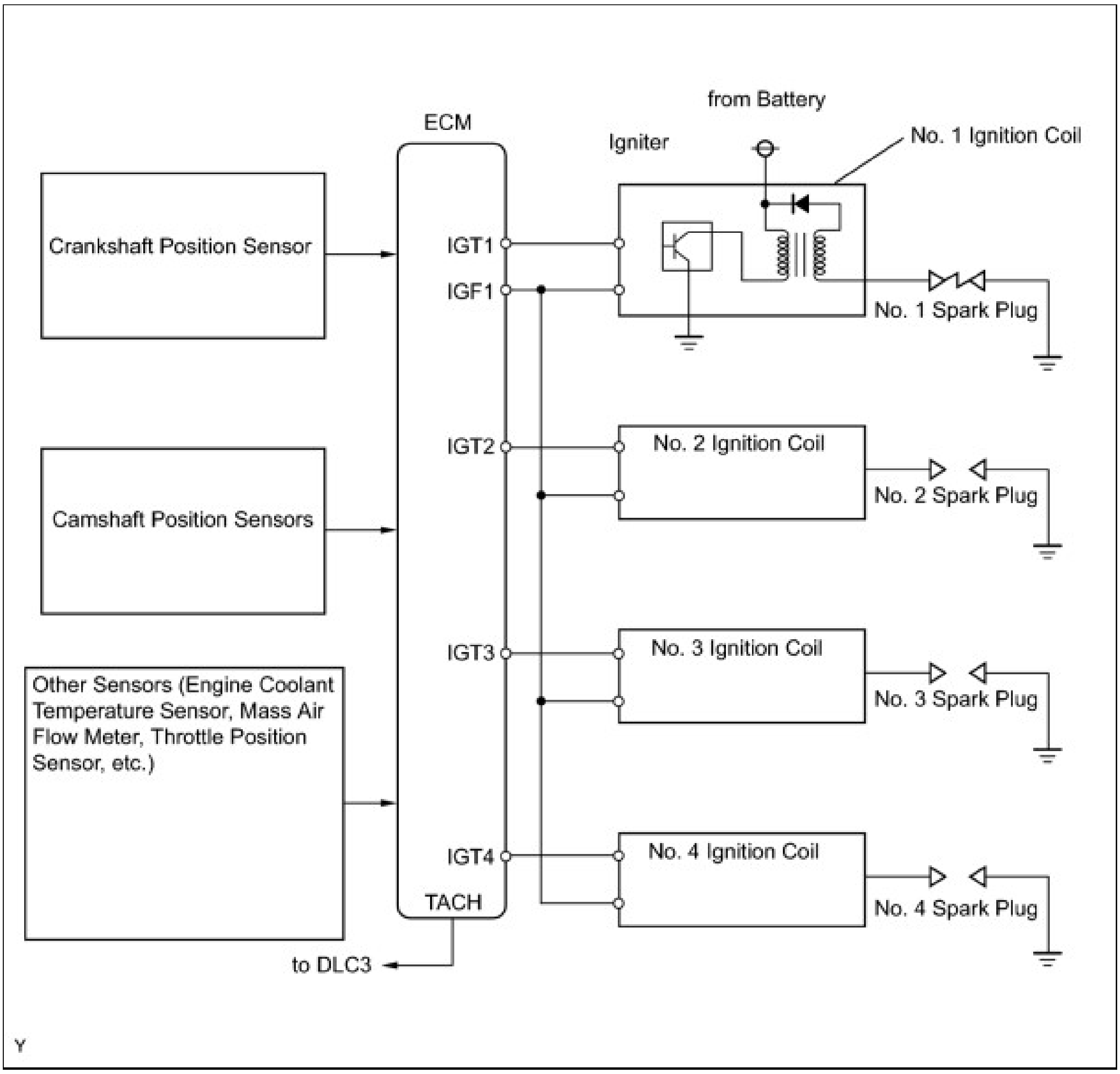
- These DTCs indicate malfunctions relating to the primary circuit.
- If DTC P0351 is set, check the No. 1 ignition coil circuit.
- If DTC P0352 is set, check the No. 2 ignition coil circuit.
- If DTC P0353 is set, check the No. 3 ignition coil circuit.
- If DTC P0354 is set, check the No. 4 ignition coil circuit.

A direct ignition system is used on this vehicle.

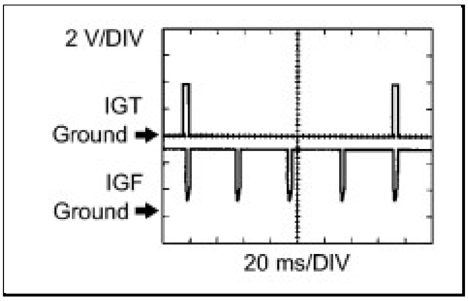
The direct ignition system is an ignition system in which each cylinder is ignited by its own ignition coil and spark plug. The secondary wiring of each ignition coil generates a powerful voltage which is applied directly to each spark plug. The spark passes from the center electrode of the spark plug to the ground electrode.

The ignition coils of this system each have a built-in igniter.

The ECM determines the ignition timing and transmits the ignition (IGT) signals to each cylinder. Using the IGT signal, the ECM turns the power transistor inside the igniter on and off. The power transistor, in turn, switches on and off the current to the primary coil. When the current to the primary coil is cut off, a powerful voltage is generated in the secondary coil. This voltage is applied to the spark plugs, causing them to spark inside the cylinders. As the ECM cuts the current to the primary coil, the igniter sends back an ignition confirmation (IGF) signal to the ECM, for each cylinder ignition.



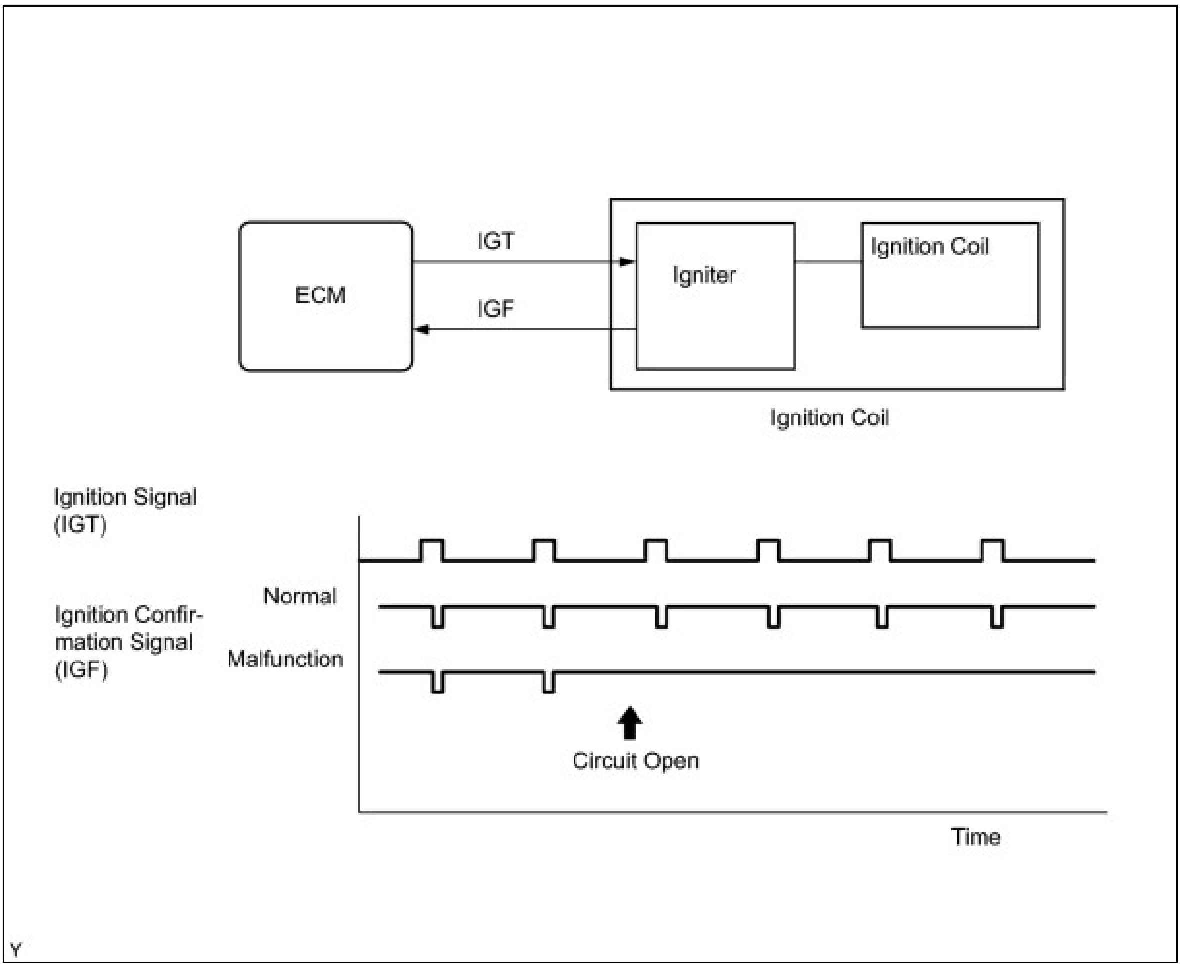
DTC NO.	DTC DETECTION CONDITIONS	TROUBLE AREAS
P0351 P0352 P0353 P0354	No IGF signal to ECM while engine running (1 trip detection logic)	• Ignition system • Open or short in IGF1 or IGT circuit (1 to 4) between ignition coil and ECM • No. 1 to No. 4 ignition coils • ECM



Reference: Inspection using an oscilloscope.
While cranking or idling the engine, check the waveform between terminals IGT (1 to 4) and E1, and IGF1 and E1 of the ECM connector.

ECM Terminal Name	Between IGT (1 to 4) and E1 Between IGF1 and E1
Tester Range	2 V/DIV, 20 ms/DIV
Condition	Idling

MONITOR DESCRIPTION



If the ECM does not receive any IGF signals despite transmitting the IGT signal, it interprets this as a fault in the igniter and sets a DTC.

If the malfunction is not repaired successfully, a DTC is set 1 second after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0351: Igniter (cylinder 1) malfunction P0352: Igniter (cylinder 2) malfunction P0353: Igniter (cylinder 3) malfunction P0354: Igniter (cylinder 4) malfunction
Required Sensors/Components (Main)	Igniter
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	0.512 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Either of following conditions A or B is met	-
A. Engine RPM	1500 rpm or less
B. Starter	OFF
Either of following conditions C or D met	-
C. Both of following conditions (a) and (b) are met	-
(a) Engine speed	500 rpm or less
(b) Battery voltage	6 V or more
D. All of following conditions (a), (b) and (c) are met	-
(a) Engine speed	More than 500 rpm
(b) Battery voltage	10 V or more
(c) Number of sparks after CPU reset	5 sparks or more

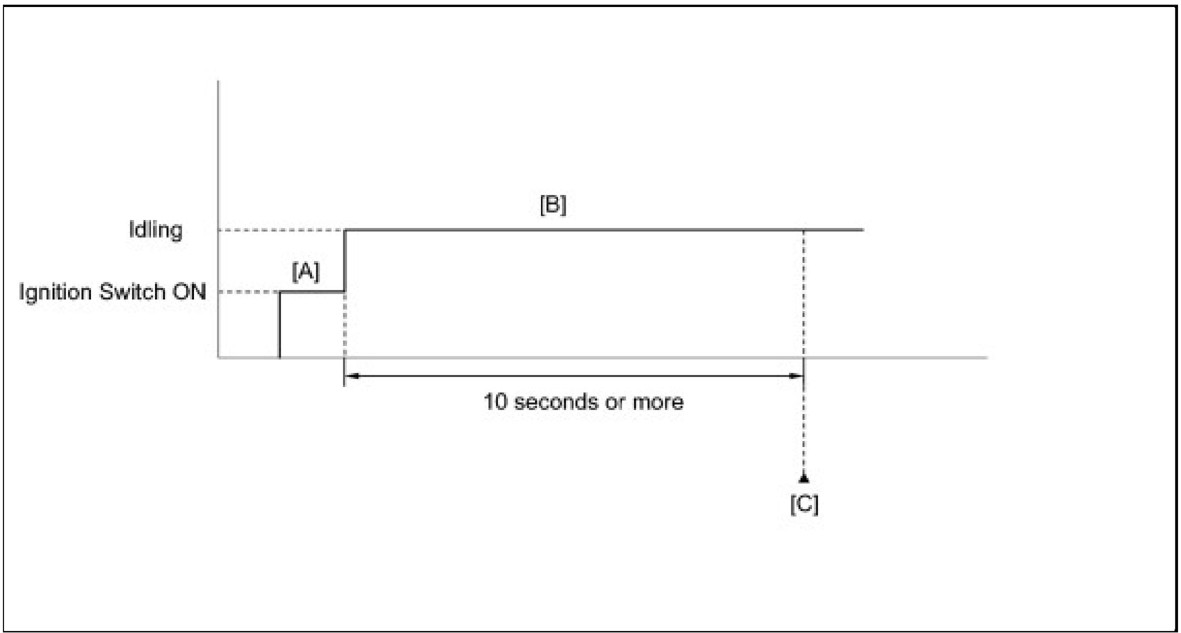
TYPICAL MALFUNCTION THRESHOLDS

IGF signal	ECM does not receive any IGF signal despite ECM sending IGT signal to igniter

COMPONENT OPERATING RANGE

IGF signal	Igniter transmits IGF signal when it receives IGT signal from ECM

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Idle the engine for 10 seconds or more [B].
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P0351, P0352, P0353 or P0354.
10. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal

TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C] again.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

HINT:

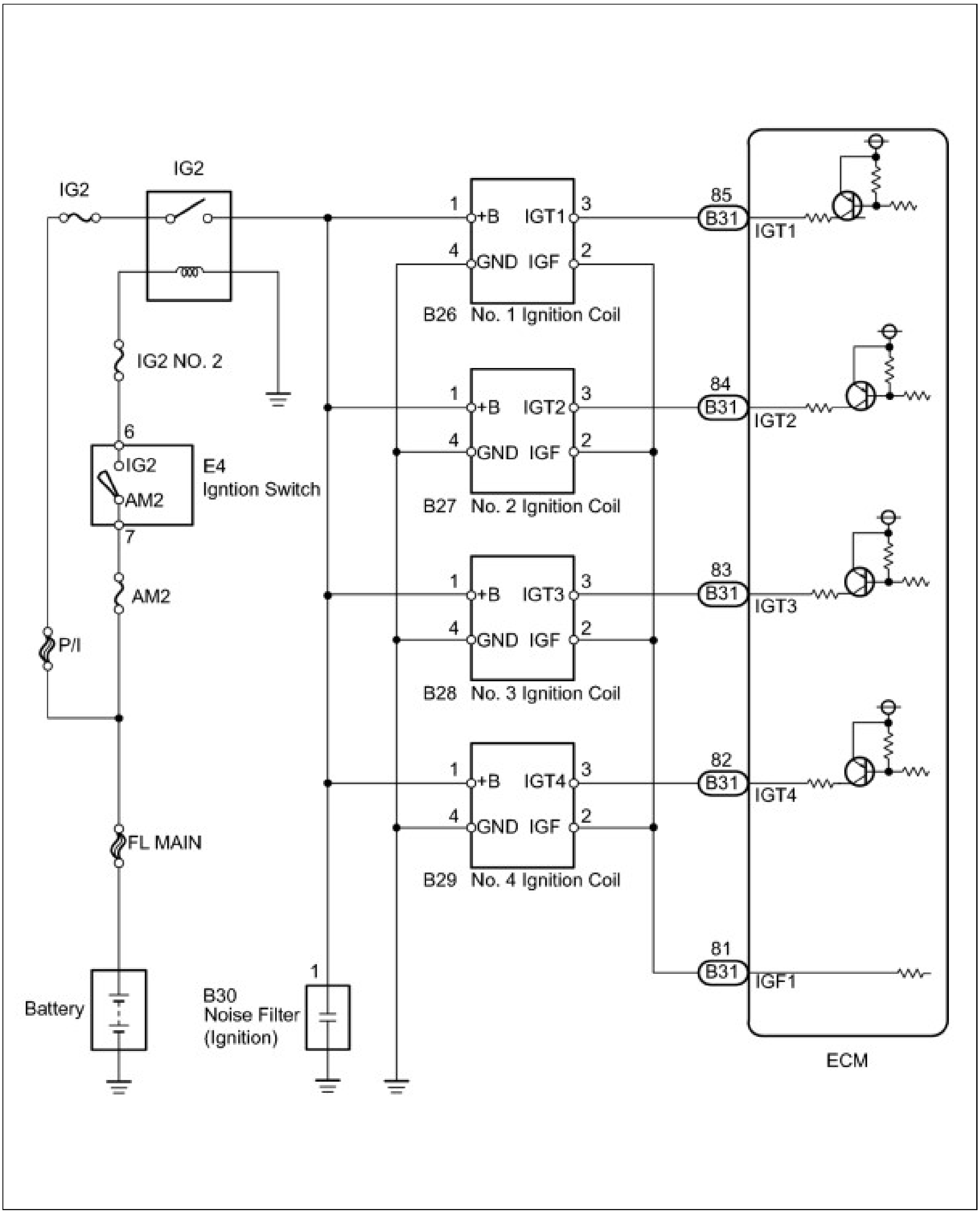
If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



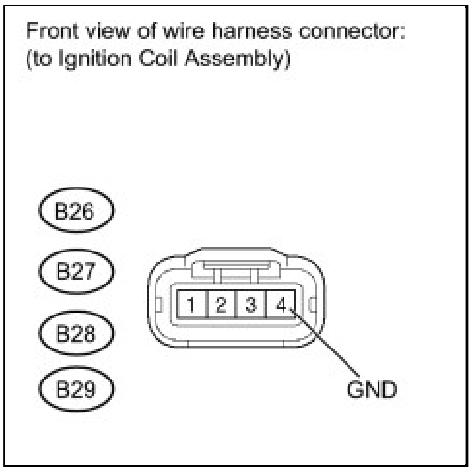
INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	INSPECT IGNITION COIL ASSEMBLY (GROUND CIRCUIT)



(a) Disconnect the ignition coil assembly connectors.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B26-4 (GND) - Body ground	Always	Below 1 Ω
B27-4 (GND) - Body ground	Always	Below 1 Ω
B28-4 (GND) - Body ground	Always	Below 1 Ω
B29-4 (GND) - Body ground	Always	Below 1 Ω

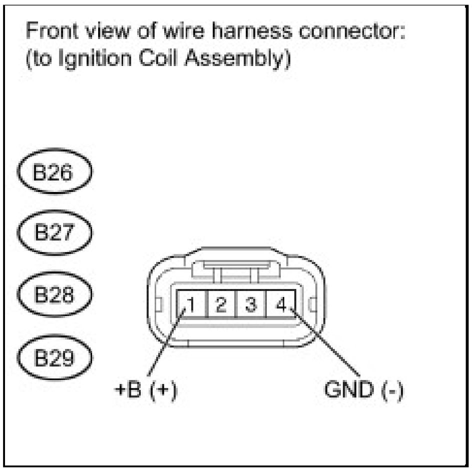
(c) Reconnect the ignition switch assembly connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (GROUND CIRCUIT)**

OK ▼

2.	INSPECT IGNITION COIL ASSEMBLY (POWER SOURCE)

(a) Disconnect the ignition coil assembly connectors.



(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B26-1 (+B) - B26-4 (GND)	Ignition switch ON	11 to 14 V
B27-1 (+B) - B27-4 (GND)	Ignition switch ON	11 to 14 V
B28-1 (+B) - B28-4 (GND)	Ignition switch ON	11 to 14 V
B29-1 (+B) - B29-4 (GND)	Ignition switch ON	11 to 14 V

(d) Reconnect the ignition coil assembly connectors.

NG ▶ **CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - INTEGRATION RELAY)**

OK
▼

3.	**CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - ECM)**

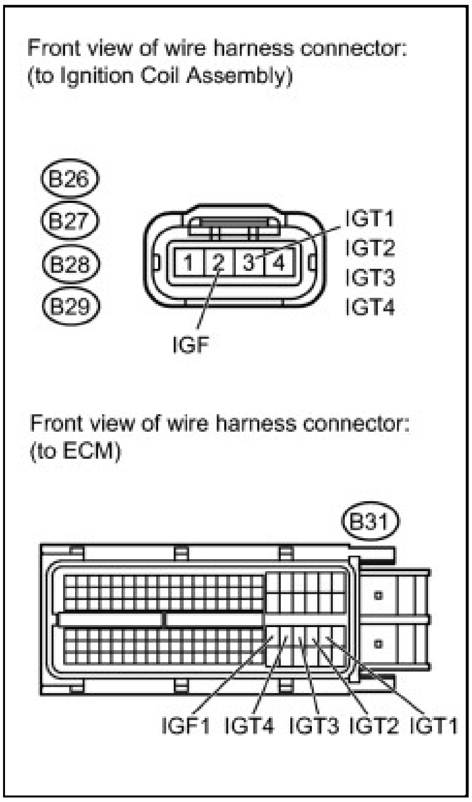
(a) Disconnect the ignition coil assembly connectors.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B26-2 (IGF) - B31-81 (IGF1)	Always	Below 1 Ω
B27-2 (IGF) - B31-81 (IGF1)	Always	Below 1 Ω
B28-2 (IGF) - B31-81 (IGF1)	Always	Below 1 Ω
B29-2 (IGF) - B31-81 (IGF1)	Always	Below 1 Ω



Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B26-3 (IGT1) - B31-85 (IGT1)	Always	Below 1 Ω
B27-3 (IGT2) - B31-84 (IGT2)	Always	Below 1 Ω
B28-3 (IGT3) - B31-83 (IGT3)	Always	Below 1 Ω
B29-3 (IGT4) - B31-82 (IGT4)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B26-2 (IGF) or B31-81 (IGF1) - Body ground	Always	10 kΩ or higher
B27-2 (IGF) or B31-81 (IGF1) - Body ground	Always	10 kΩ or higher
B28-2 (IGF) or B31-81 (IGF1) - Body ground	Always	10 kΩ or higher
B29-2 (IGF) or B31-81 (IGF1) - Body ground	Always	10 kΩ or higher

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED

		CONDITION
B26-3 (IGT1) or B31-85 (IGT1) - Body ground	Always	10 kΩ or higher
B27-3 (IGT2) or B31-84 (IGT2) - Body ground	Always	10 kΩ or higher
B28-3 (IGT3) or B31-83 (IGT3) - Body ground	Always	10 kΩ or higher
B29-3 (IGT4) or B31-82 (IGT4) - Body ground	Always	10 kΩ or higher

(d) Reconnect the ECM connector.

(e) Reconnect the ignition coil assembly connectors.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION COIL ASSEMBLY - ECM)**

OK ▼

4.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0351, P0352, P0353 OR P0354)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Shuffle arrangement of the ignition coil with igniters (among No. 1 to No. 4 cylinders).

NOTICE:

Do not shuffle the connectors.

(f) Perform a simulation test.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

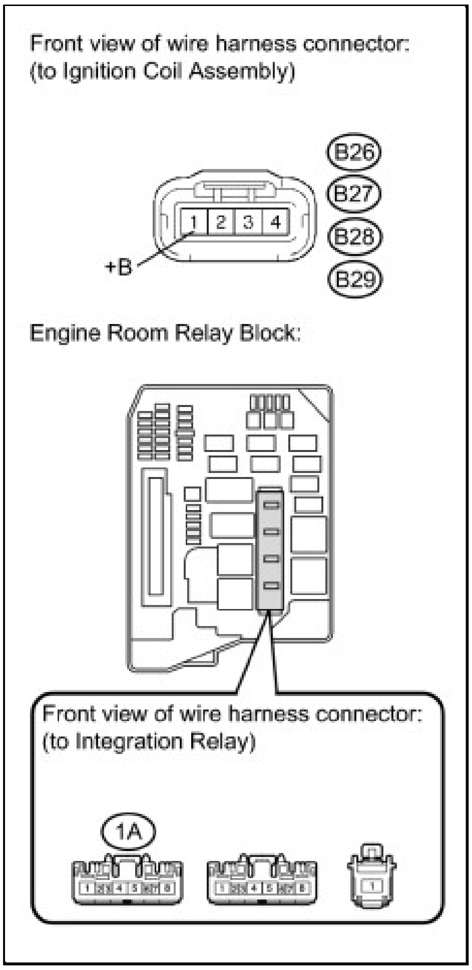
Result:

RESULT	PROCEED TO
Same DTC is output	A
Different ignition coil DTC is output	B

B ▶ **REPLACE IGNITION COIL ASSEMBLY**

A ▶ **REPLACE ECM**

5.	CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - INTEGRATION RELAY)



(a) Disconnect the ignition coil assembly connectors.

(b) Remove the integration relay from the engine room relay block.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B26-1 (+B) - 1A-4	Always	Below 1 Ω
B27-1 (+B) - 1A-4	Always	Below 1 Ω
B28-1 (+B) - 1A-4	Always	Below 1 Ω
B29-1 (+B) - 1A-4	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B26-1 (+B) or 1A-4 - Body ground	Always	10 kΩ or higher
B27-1 (+B) or 1A-4 - Body ground	Always	10 kΩ or higher
B28-1 (+B) or 1A-4 - Body ground	Always	10 kΩ or higher
B29-1 (+B) or 1A-4 - Body ground	Always	10 kΩ or higher

(d) Reinstall the integration relay.

(e) Reconnect the ignition coil assembly connectors.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION COIL ASSEMBLY - INTEGRATION RELAY)**

OK ▶ **REPAIR OR REPLACE ECM POWER SOURCE CIRCUIT**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM0000012JE03TX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0340: Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor) (2010 Corolla)		

DTC	**P0340**	**Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)**

DESCRIPTION

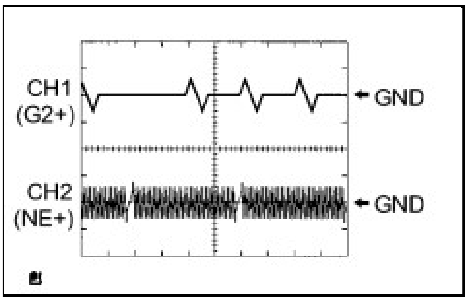
The camshaft position sensor consists of a magnet and an iron core which is wrapped with copper wire, and is installed onto the cylinder head. When the camshaft rotates, each of 3 teeth on the camshaft passes through the camshaft position sensor. This activates the internal magnet in the sensor, generating a voltage in the copper wire. The camshaft rotation is synchronized with the crankshaft rotation. When the crankshaft turns twice, the voltage is generated 3 times in the camshaft position sensor. The generated voltage in the sensor acts as a signal, allowing the ECM to locate the camshaft position. This signal is then used to control ignition timing, fuel injection timing, and the VVT system.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0340	When either of following conditions is met: • No camshaft position sensor signal to ECM while cranking (2 trip detection logic) • Missing camshaft position sensor signal despite crankshaft position sensor signal inputs normal at engine speed of 600 rpm or more (1 trip detection logic)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft • Timing chain jumped a tooth • ECM

HINT:

DTC P0340 indicates a malfunction relating to the camshaft position sensor circuit (the wire harness between the ECM and camshaft position sensor, and the camshaft position sensor itself).

Reference: Inspection using an oscilloscope



HINT:

- The correct waveform is as shown in the illustration.
- G2+ stands for the camshaft position sensor signal, and NE+ stands for the crankshaft position sensor signal.
- A failure of the ground for the shielding of the wiring may result in noisy waveforms.

ECM Terminal Name	CH1: Between G2+ and G2- CH2: Between NE+ and NE-
Tester Range	5 V/DIV., 20 msec/DIV.
Condition	Idling

MONITOR DESCRIPTION

If no signal is transmitted by the camshaft position sensor despite the engine revolving, or the rotation of the camshaft and the crankshaft is not synchronized, the ECM interprets this as a malfunction of the sensor.

If the malfunction is not repaired successfully, the DTC is set 10 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0340: Camshaft position sensor range check P0340: Camshaft position/crankshaft position misalignment
Required Sensors/Components (Main)	Camshaft position sensor
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	4 seconds: Camshaft position sensor range check 5 seconds: Camshaft position/crankshaft position misalignment
MIL Operation	2 driving cycles: Camshaft position sensor range check Immediate: Camshaft position/crankshaft position misalignment
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

Camshaft Position Sensor Range Check

Starter	ON
Minimum battery voltage while starter ON	Less than 11 V

Camshaft Position/Crankshaft Position Misalignment

Engine speed	600 rpm or more
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

Camshaft Position Sensor Range Check

Camshaft position sensor signal	No signal

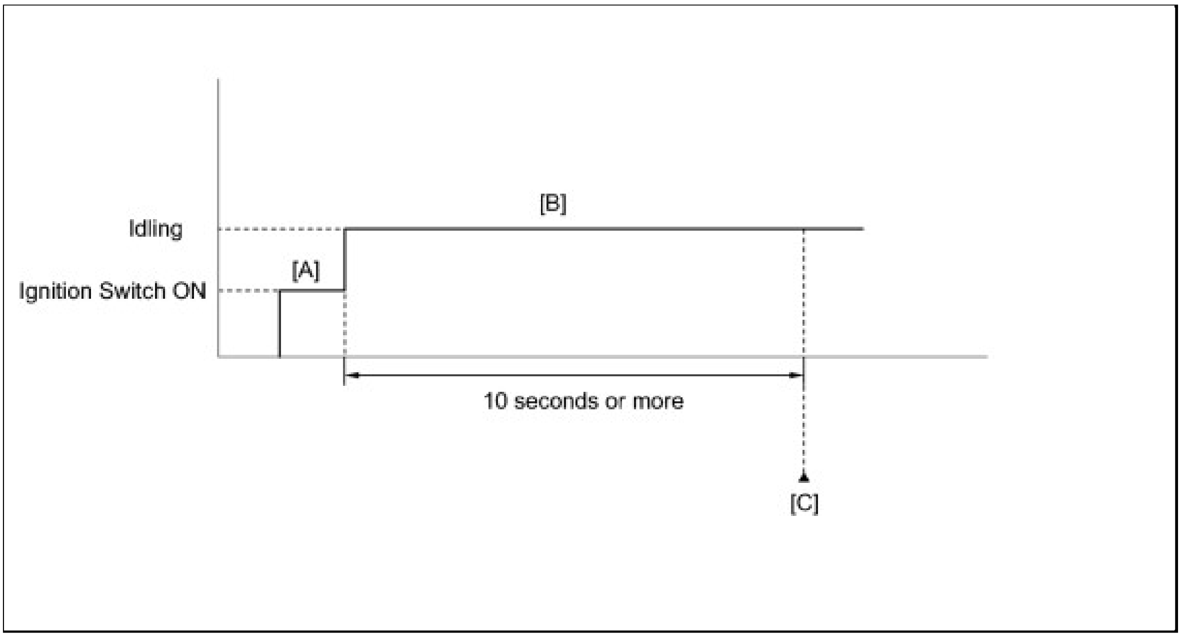
Camshaft Position/Crankshaft Position Misalignment

Camshaft position and crankshaft position phase	Misaligned

COMPONENT OPERATING RANGE

Camshaft position sensor	• Camshaft position sensor output voltage fluctuates while camshaft rotating • 3 camshaft position sensor signals per 2 crankshaft revolutions

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Idle the engine for 10 seconds or more [B].
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P0340, P0342 or P0343.
10. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C] again.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0335 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	INSPECT CAMSHAFT POSITION SENSOR (RESISTANCE)

(a) Disconnect the camshaft position sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	950 to 1250 Ω

Component without harness connected:
(Camshaft Position Sensor)

(c) Reconnect the camshaft position sensor connector.

NG ▶ **REPLACE CAMSHAFT POSITION**

SENSOR

OK

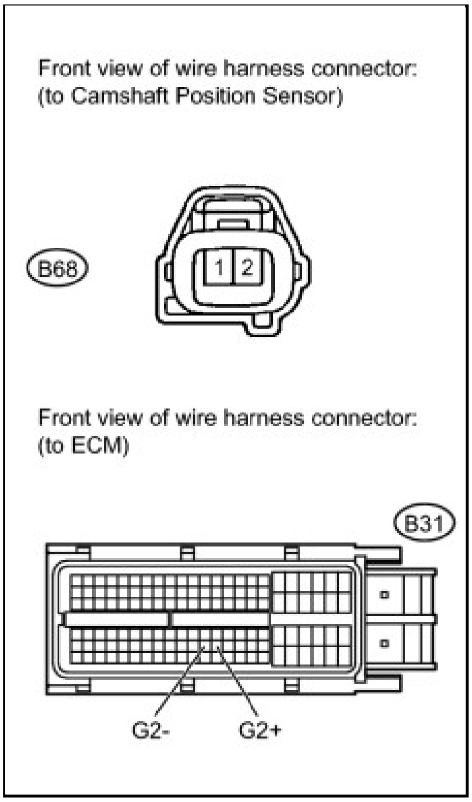
2.	CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)

(a) Disconnect the camshaft position sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B68-1 - B31-99 (G2+)	Always	Below 1 Ω
B68-2 - B31-98 (G2-)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B68-1 or B31-99 (G2+) - Body ground	Always	10 kΩ or higher
B68-2 or B31-98 (G2-) - Body ground	Always	10 kΩ or higher

(d) Reconnect the ECM connector.

(e) Reconnect the camshaft position sensor connector.

NG **REPAIR OR REPLACE HARNESS OR CONNECTOR (CAMSHAFT**

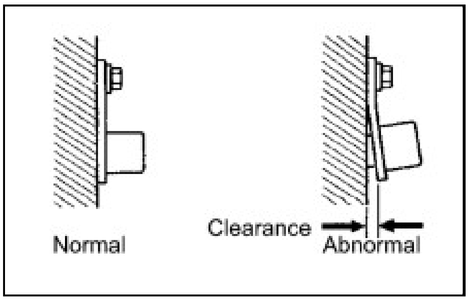
POSITION
SENSOR -
ECM)

OK

3.	**CHECK SENSOR INSTALLATION (CAMSHAFT POSITION SENSOR)**

(a) Check the camshaft position sensor installation.

OK:
Sensor is installed correctly.



NG ▶ **SECURELY REINSTALL SENSOR**

OK

4.	**CHECK VALVE TIMING** INFO

NG ▶ **ADJUST VALVE TIMING**

OK

5.	**INSPECT CAMSHAFT**

(a) Check the teeth of the camshaft.

OK:
Camshaft teeth do not have any cracks or deformation.

NG ▶ **REPLACE CAMSHAFT**

OK

6.	REPLACE CAMSHAFT POSITION SENSOR

(a) Replace camshaft position sensor INFO .

NEXT

7.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Start the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(g) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P0340	B

HINT:

If the engine does not start, replace the ECM.

B ▶ **REPLACE ECM**

A ▶ **END**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000WC0058X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0420: Catalyst System Efficiency Below Threshold (Bank 1) (2010 Corolla)		

DTC	**P0420**	**Catalyst System Efficiency Below Threshold (Bank 1)**

MONITOR DESCRIPTION

The ECM uses sensors mounted in front of and behind the three-way catalytic converter to monitor its efficiency.

The first sensor, the air fuel ratio sensor, sends pre-catalyst information to the ECM. The second sensor, the heated oxygen sensor, sends post-catalyst information to the ECM.

In order to detect any deterioration in the three-way catalytic converter, the ECM calculates the oxygen storage capacity of the three-way catalytic converter. This calculation is based on the voltage output of the heated oxygen sensor while performing active air-fuel ratio control.

The oxygen storage capacity value is an indication of the oxygen storage capacity of the three-way catalytic converter. When the vehicle is being driven with a warm engine, active air-fuel ratio control is performed for approximately 15 to 20 seconds. When it is performed, the ECM deliberately sets the air-fuel ratio to lean or rich. If the cycle of the waveform for the heated oxygen sensor is long, the oxygen storage capacity is great. There is a direct correlation between the heated oxygen sensor and the oxygen storage capacity of the three-way catalytic converter.

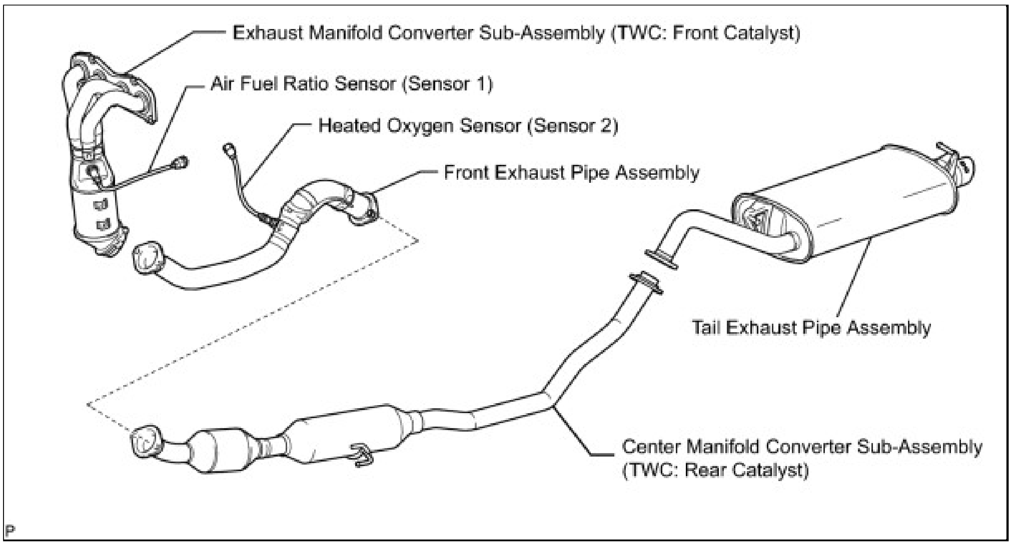
The ECM uses the oxygen storage capacity value to determine the state of the three-way catalytic converter. If any deterioration has occurred, it illuminates the MIL and sets the DTC.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0420	Oxygen Storage Capacity value smaller than standard value under active air fuel ratio control (2 trip detection logic)	• Gas leak from exhaust system • Air fuel ratio sensor (sensor 1) • Heated oxygen sensor (sensor 2) • Exhaust manifold converter sub-assembly (TWC: Front catalyst) • Center manifold converter sub-assembly (TWC: Rear catalyst)

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

CATALYST LOCATION



MONITOR STRATEGY

Related DTCs	P0420: Catalyst Deterioration
Required Sensors/Components (Main)	Air fuel ratio sensor Heated oxygen sensor
Required Sensors/Components (Related)	Intake air temperature sensor Mass air flow meter Crankshaft position sensor Engine coolant temperature sensor
Frequency of Operation	Once per driving cycle
Duration	About 30 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System bank 1- Advance) P0012 (VVT System bank 1- Retard) P0016 (VVT System bank 1- Misalignment) P0031, P0032 (Air Fuel Ratio Sensor Heater - Sensor 1) P0037, P0038 (Heated Oxygen Sensor Heater - Sensor 2) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121 P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0136, P0137, P0138, P0139 (Rear Oxygen sensor - Sensor 2) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor)

	P0351, P0352, P0353, P0354 (Igniter) P0500 (Vehicle Speed Sensor) P0606, P0607 (Heated Oxygen Sensor - Sensor 2) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)
Battery voltage	11 V or more
Intake air temperature	-10°C (14°F) or more
Engine coolant temperature	75°C (167°F) or more
Atmospheric pressure coefficient	0.75 or more
Idling	OFF
Engine RPM	Less than 4000 rpm
Air fuel ratio sensor status	Activated
Fuel system status	Closed loop
Engine load	10 to 80%
All of the following conditions are met	Condition 1, 2 and 3
1. Mass air flow rate	2.5 to 50 g/sec
2. Front catalyst temperature (estimated)	620 to 840°C (1148 to 1544°F)
3. Rear catalyst temperature (estimated)	400 to 770°C (752 to 1418°F)
Shift position	A/T models: 4th or higher M/T models: 3rd or higher

TYPICAL MALFUNCTION THRESHOLDS

Oxygen storage capacity of three-way catalytic converter	Less than 0.07 g

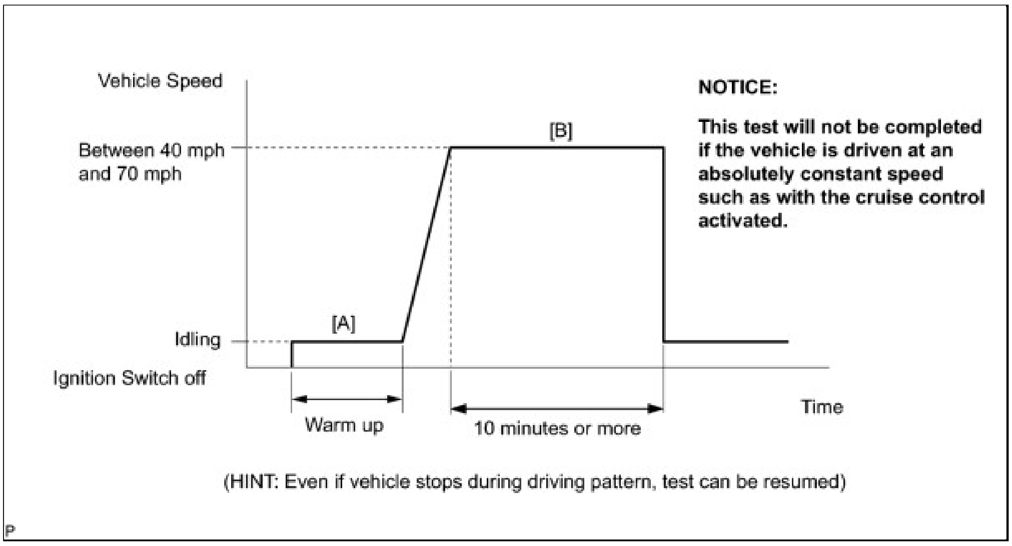
MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

HINT:

Performing this confirmation pattern will activate the catalyst monitor. This is very useful for verifying the completion of a repair.



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
5. Turn the ignition switch off.
6. Turn the ignition switch to ON and turn the Techstream on [A].
7. Enter the following menus: Powertrain / Engine / Monitor.
8. Check that Catalyst / Status2 is Incomplete.
9. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or higher) [A].
10. Drive the vehicle at between 40 and 70 mph (64 and 113 km/h) for at least 10 minutes or more [B].
11. The monitor items will change to Complete as Catalyst monitor operates.
12. Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
13. Check if any DTCs (pending DTCs) are set.

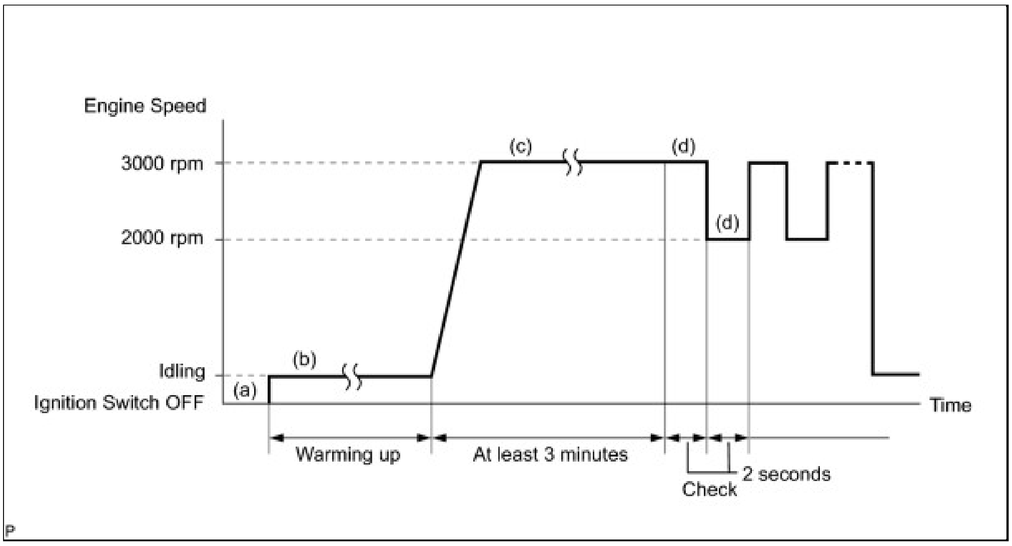
HINT:

If Catalyst does not change to Complete, and no pending DTCs are stored, extend the driving time.

CONDITIONING FOR SENSOR TESTING

HINT:

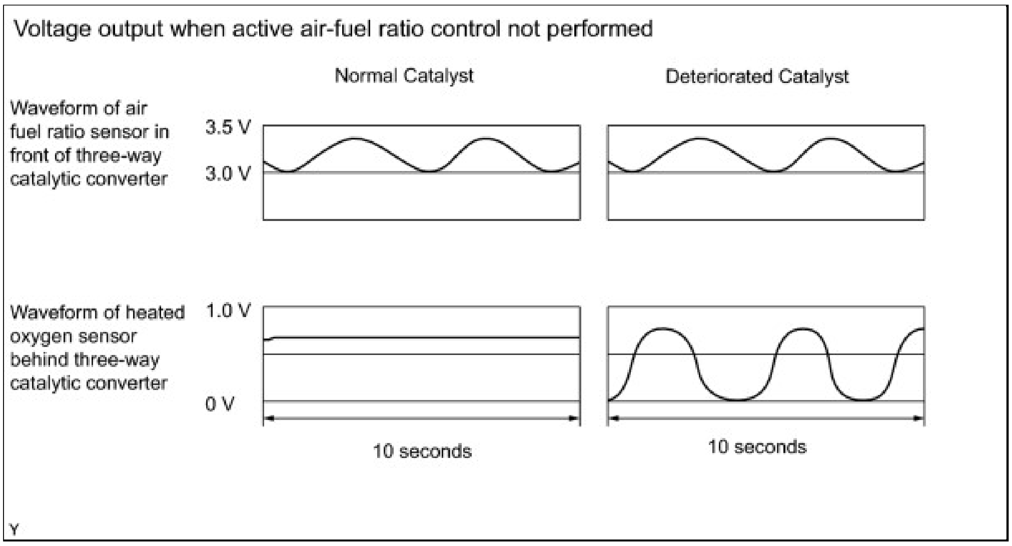
Perform the operation with the engine speeds and time durations described below prior to checking the waveforms of the air fuel ratio sensor and heated oxygen sensor. This is in order to activate the sensors sufficiently to obtain the appropriate inspection results.



(a) Connect the Techstream to the DLC3.
(b) Start the engine and warm it up with all the accessories switched OFF until the engine coolant temperature stabilizes.
(c) Run the engine at an engine speed of between 2500 rpm and 3000 rpm for at least 3 minutes.
(d) While running the engine at 3000 rpm for 2 seconds and 2000 rpm for 2 seconds, check the waveforms of the air fuel ratio and heated oxygen sensors using the Techstream.

HINT:

- If either of the voltage outputs of the air fuel ratio or heated oxygen sensor does not fluctuate, or there is noise in the waveform of either sensor, the sensor may be malfunctioning.
- If the voltage outputs of both the sensors remain lean or rich, the air fuel ratio may be extremely lean or rich. In such cases, perform the following active test: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.
- If the three-way catalytic converter has deteriorated, the heated oxygen sensor (located behind the three-way catalytic converter) voltage output fluctuates up and down frequently, even under normal driving conditions (active air-fuel ratio control is not performed).



INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F sensor Active Test. The Control the Injection Volume for A/F sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other

potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F sensor operation using Techstream.

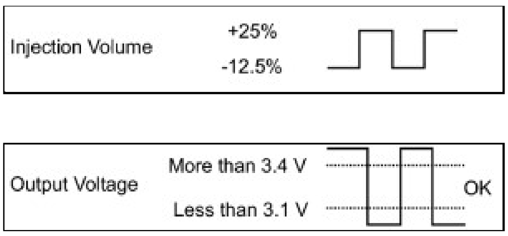
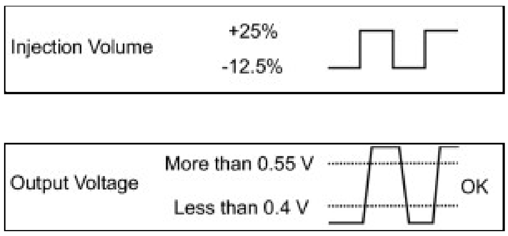
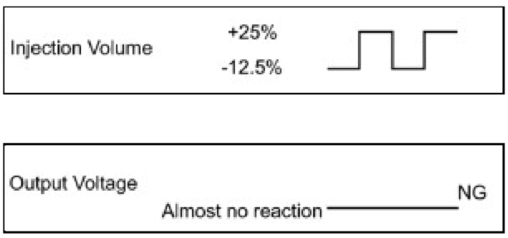
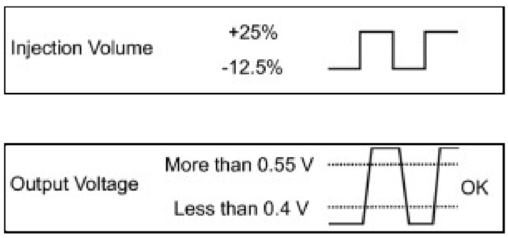
1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
5. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.
6. Perform the Active Test operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume.)
7. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1 S1 and O2S B1 S2) displayed on the Techstream.

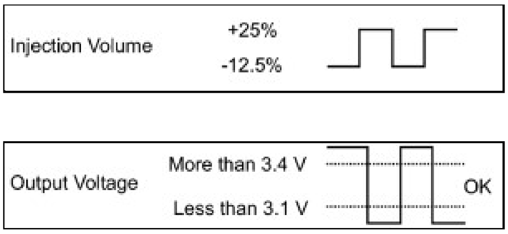
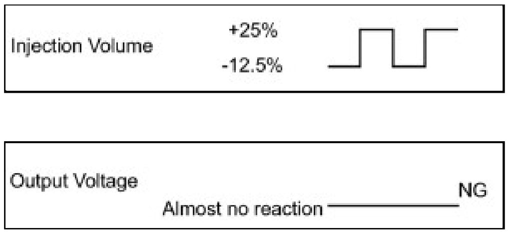
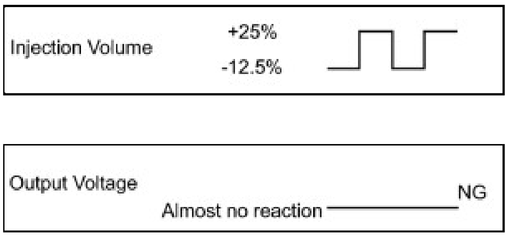
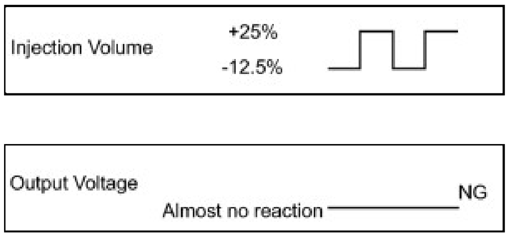
HINT:

- The Control the Injection Volume for A/F sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1 S1 (Air fuel ratio sensor)	+25%	Rich	Less than 3.1 V
	-12.5%	Lean	More than 3.4 V
O2S B1 S2 (Heated oxygen sensor)	+25%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

NOTICE:
The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
1			-
2			• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3			• Heated oxygen

<table>
<tr><th>CASE</th><th>AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE</th><th>HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE</th><th>MAIN SUSPECTED TROUBLE AREA</th></tr>
<tr><td></td><td>
</td><td>
</td><td>sensor
• Heated oxygen sensor heater
• Heated oxygen sensor circuit</td></tr>
<tr><td>4</td><td>
</td><td>
</td><td>• Injector
• Fuel pressure
• Gas leak from exhaust system (Air fuel ratio extremely rich or lean)</td></tr>
</table>

- Following the Control the Injection Volume for A/F sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / AFS Voltage B1 S1 and O2S B1 S2; then press the graph button on the Data List view.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0420)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0420	A

RESULT	PROCEED TO
P0420 and other DTCs	B

HINT:

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

B ▶ **GO TO DTC CHART**

A
▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL INJECTION VOLUME FOR A/F SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up.

(c) Turn the Techstream on.

(d) Run the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.

(f) Perform the Active Test operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).

(g) Monitor the voltage outputs of the air fuel ratio sensor and heated oxygen sensor (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard:

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air Fuel Ratio)	+25%	Rich	Less than 3.1
	-12.5%	Lean	More than 3.4
O2S B1S2 (Heated Oxygen)	+25%	Rich	More than 0.55
	-12.5%	Lean	Less than 0.4

Result:

STATUS AFS VOLTAGE B1S1	STATUS O2S B1S2	AIR FUEL RATIO CONDITION AND AIR FUEL RATIO AND HEATED OXYGEN SENSORS CONDITION	MISFIRE	MAIN SUSPECTED TROUBLE AREA	PROCEED TO
Lean/Rich	Lean/Rich	Normal	-	Three-way catalytic converter Gas leakage from exhaust system	A
		Air fuel ratio sensor		r fuel ratio sensor	

Lean: During Control the Injection Volume for A/F sensor, the air fuel ratio sensor output voltage (AFS Voltage) is consistently more than 3.4 V, and the heated oxygen sensor output voltage (O2S) is consistently less than 0.4 V.

Rich: During Control the Injection Volume for A/F sensor, the AFS Voltage is consistently less than 3.1 V, and the O2S is consistently more than 0.55 V.

Lean/Rich: During Control the Injection Volume for A/F sensor of the Active Test, the output voltage of the heated oxygen sensor alternates correctly.

C ▶ **CHECK FOR EXHAUST GAS LEAK**

B ▶ **REPLACE AIR FUEL RATIO SENSOR (SENSOR 1)**

A ▼

3.	CHECK FOR EXHAUST GAS LEAK

(a) Check exhaust system.

OK:
No gas leaks.

NG ▶ **REPAIR OR REPLACE EXHAUST GAS LEAK POINT**

OK ▼

4.	REPLACE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY (TWC: FRONT CATALYST)

(a) Replace exhaust manifold converter sub-assembly INFO .

NEXT ▶ **REPLACE CENTER EXHAUST PIPE ASSEMBLY (TWC: REAR CATALYST)**

5.	CHECK FOR EXHAUST GAS LEAK

(a) Check exhaust system.

OK:
No gas leaks.

NG ▶ **REPAIR OR REPLACE EXHAUST GAS LEAK POINT**

OK ▶ **REPLACE HEATED OXYGEN SENSOR (SENSOR 2)**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000002BHB01YX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P043E,P043F,P2401,P2402,P2419: Evaporative Emission System Reference Orifice Clog Up (2010 Corolla)		

DTC	**P043E**	**Evaporative Emission System Reference Orifice Clog Up**

DTC	**P043F**	**Evaporative Emission System Reference Orifice High Flow**

DTC	**P2401**	**Evaporative Emission Leak Detection Pump Stuck OFF**

DTC	**P2402**	**Evaporative Emission Leak Detection Pump Stuck ON**

DTC	**P2419**	**Evaporative Emission System Switching Valve Control Circuit Low**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P043E	Reference orifice clogged	P043E, P043F, P2401, P2402 and P2419 present when one of following conditions met during key-off EVAP monitor: • Reference orifice clogged • Reference orifice high-flow • Leak	• Canister pump module (Reference orifice, leak detection pump, vent valve) • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe	While ignition switch OFF	2 trip
P043F	Reference orifice high-flow				
P2401	Leak detection pump stuck OFF				

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
		detection pump OFF malfunction • Leak detection pump ON malfunction • Vent valve ON (close) malfunction	from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM		
P2402	Leak detection pump stuck ON				
P2419	Vent valve stuck closed				

HINT:

The reference orifice is located inside the canister pump module.

DESCRIPTION

The description can be found in the EVAP (Evaporative Emission) System .

HINT:

Unit expressions

- [kPa-a (mmHg-a)] denotes absolute pressure.
- [kPa-g (mmHg-g)] denotes gauge pressure (relative pressure).
- On the Techstream, choose the unit of measurement according to the inspection procedure.

INSPECTION PROCEDURE

Refer to the EVAP System .

MONITOR DESCRIPTION

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

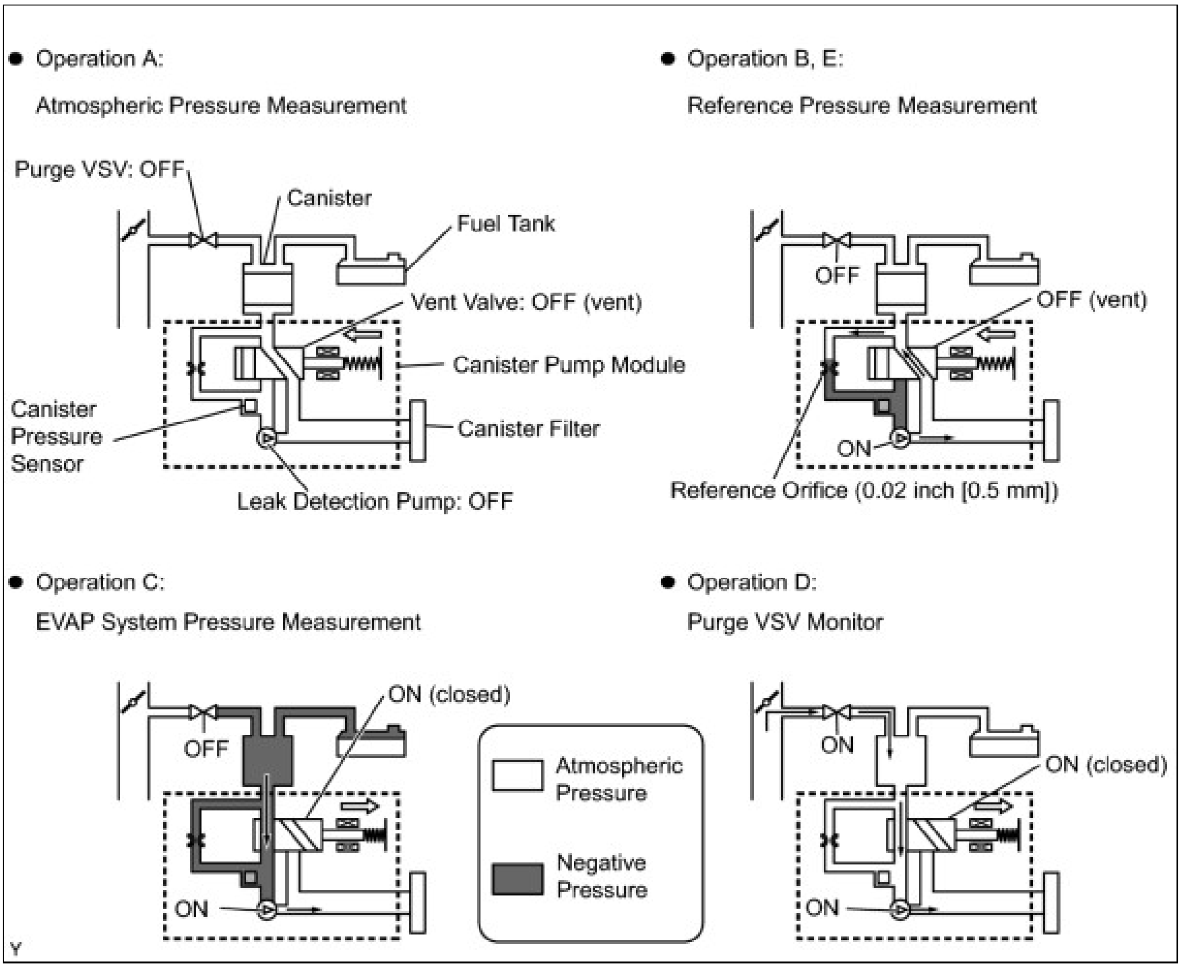
HINT:

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

SEQUENCE	OPERATION	DESCRIPTION	DURATION
-	ECM activation	The key-off monitor is activated by soak timer 5, 7 or 9.5 hours after ignition switch turned off.	-

SEQUENCE	OPERATION	DESCRIPTION	DURATION
A	Atmospheric pressure measurement	Vent valve is turned OFF (vent) and the EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa-a and 110 kPa-a (525 mmHg-a and 825 mmHg-a), the ECM cancels EVAP system monitor.	60 seconds
B	First reference pressure measurement	In order to determine reference pressure, the leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if the leak detection pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut the EVAP system. Negative pressure (vacuum) created in the EVAP system, and EVAP system pressure then measured. The measured value is memorized as it will be used in the leak check. If the EVAP pressure does not stabilize within 15 minutes, the ECM cancels EVAP system monitor.	15 minutes*
D	Purge VSV monitor	Purge VSV is opened and then the EVAP system pressure is measured by the ECM. A large increase indicates normality.	10 seconds
E	Second reference pressure measurement	After a second reference pressure measurement, the leak check is performed by comparing the first and second reference pressure. If stabilized system pressure is higher than second the reference pressure, the ECM determines that the EVAP system is leaking.	60 seconds
-	Final check	Atmospheric pressure is measured and then the monitor result is recorded by the ECM.	-

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

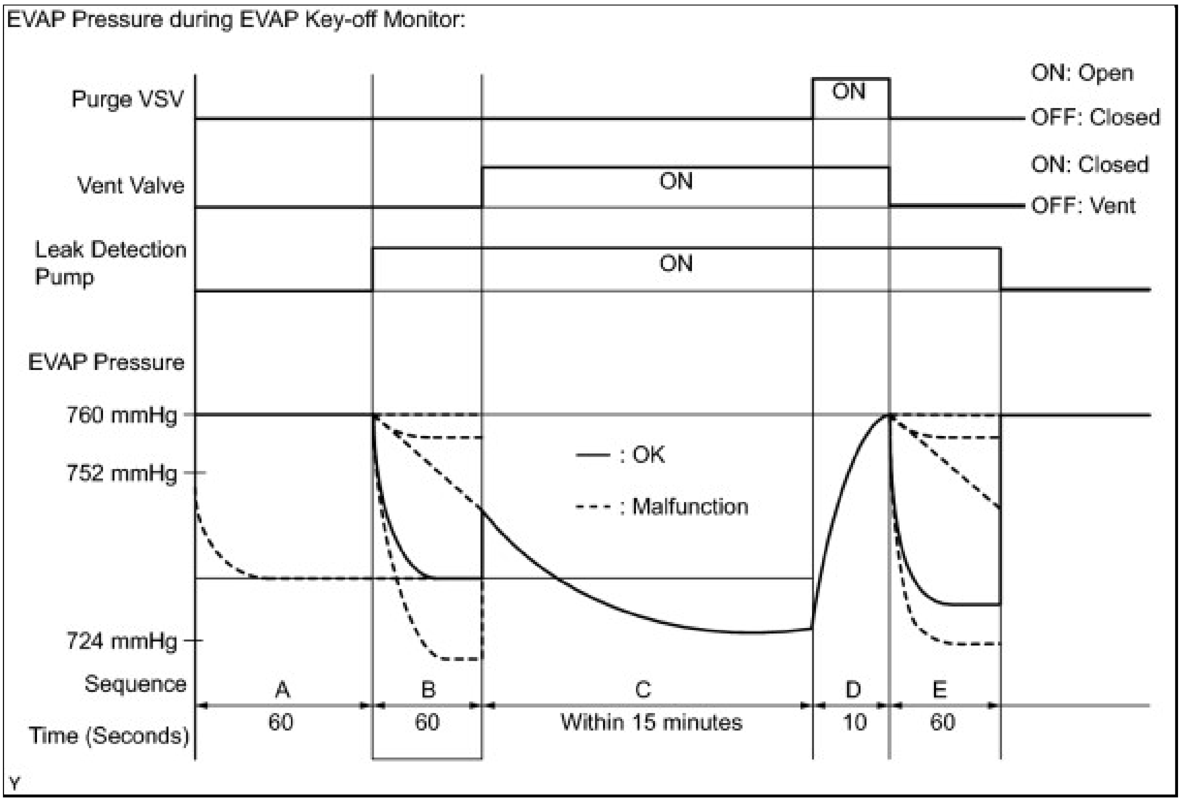


The leak detection pump creates negative pressure through the reference orifice (in operation B and E). When the system is normal, the EVAP pressure is between 724 to 752 mmHg* and saturated within a minute. If not, the ECM interprets this as a malfunction. The ECM will illuminate the MIL and set DTC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

*: Typical value.

HINT:

"Saturated" indicates that the EVAP pressure change is less than 0.286 kPa-g (2.14 mmHg) in 60 seconds.



MONITOR STRATEGY

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

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Atmospheric pressure	70 to 110 kPa-a (525 to 825 mmHg-a)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Ignition switch	OFF
Time after key off	5, 7 or 9.5 hours
Canister pressure sensor malfunction (P0451, P0452 and P0453)	Not detected

Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of following conditions are met before key off	Conditions 1 and 2
1. Duration that vehicle driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4 to 35°C (40 to 95°F)
Intake air temperature	4.4 to 35°C (40 to 95°F)

TYPICAL MALFUNCTION THRESHOLDS

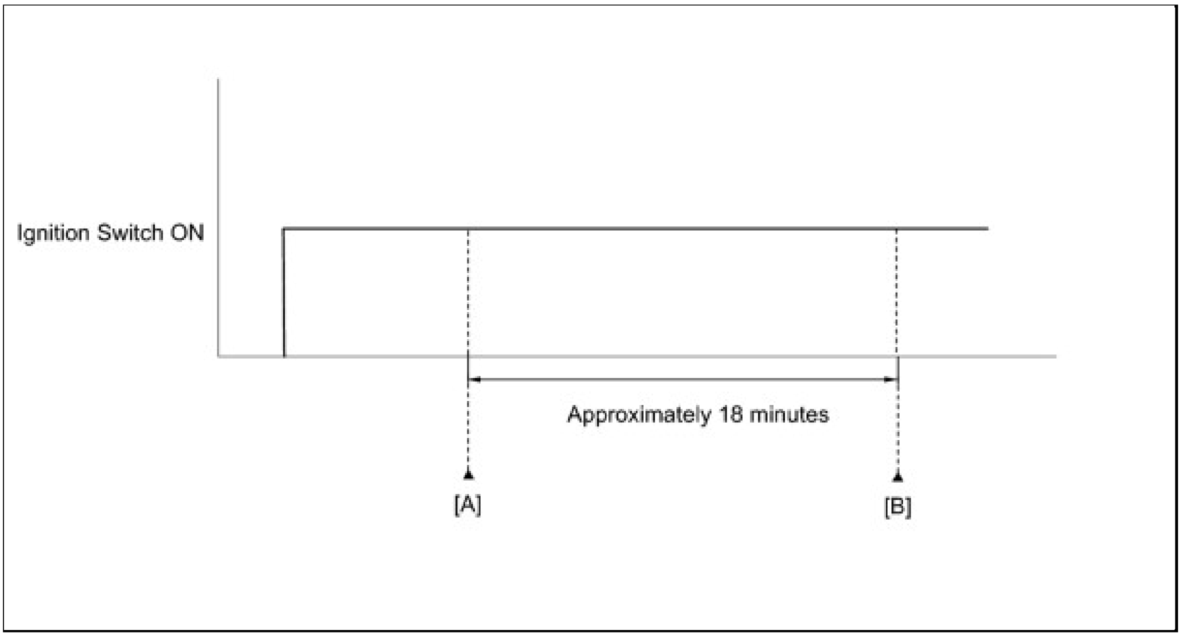
"Saturated" indicates that the EVAP pressure change is less than 0.286 kPa-g (2.14 mmHg-g) in 60 seconds.

One of following conditions is met	-
EVAP pressure just after reference pressure measurement started	More than -1 kPa-g (-7.5 mmHg-g)
Reference pressure	Less than -4.85 kPa-g (-36.4 mmHg-g)
Reference pressure	-1.057 kPa-g (-7.93 mmHg-g) or more
Reference pressure	Not saturated within 60 seconds
Reference pressure difference between first and second	0.7 kPa-g (5.25 mmHg-g) or more

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode [A].
7. After the "Evaporative System Check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine / Utility / All readiness.
8. Input the DTC: P043E, P043F, P2401, P2402 or P2419.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000SWF05FX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0441: Evaporative Emission Control System Incorrect Purge Flow (2010 Corolla)		

DTC	**P0441**	**Evaporative Emission Control System Incorrect Purge Flow**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0441	Purge VSV (Vacuum Switching Valve) stuck open	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. Reference pressure measured at start and at end of leak check. If stabilized pressure higher than [second reference pressure x 0.35], ECM determines that purge VSV stuck open.	• Purge VSV • Connector/wire harness (Purge VSV - ECM) • ECM • Canister pump module • Leak from EVAP system	While ignition switch off	2 trip
	Purge VSV stuck closed	After EVAP leak check performed, purge VSV turned ON (open), and atmospheric air introduced into EVAP system. Reference pressure measured at start and at end of check. If pressure does not return to near atmospheric pressure, ECM determines that purge VSV stuck closed.	• Purge VSV • Connector/wire harness (Purge VSV - ECM) • ECM • Canister pump module • Leak from EVAP system	While ignition switch off	2 trip
	Purge flow	While engine running, following conditions successively met: • Negative pressure not created in EVAP system when purge VSV	• Purge VSV • Connector/wire harness (Purge VSV - ECM) • Leak from EVAP line (Purge VSV - Intake	While engine running	2 trip

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
		turned ON (open) • EVAP system pressure change less than 0.4 kPa-g (3.0 mmHg-g) when vent valve turned ON (closed) • Atmospheric pressure change before and after purge flow monitor less than 0.1 kPa-g (0.75 mmHg-g)	manifold) • ECM		

DESCRIPTION

The description can be found in the EVAP (Evaporative Emission) System .

INSPECTION PROCEDURE

Refer to the EVAP System .

HINT:

Unit expressions

- [kPa-a (mmHg-a)] denotes absolute pressure.
- [kPa-g (mmHg-g)] denotes gauge pressure (relative pressure).
- On the Techstream, choose the unit of measurement according to the inspection procedure.

MONITOR DESCRIPTION

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

1. KEY-OFF MONITOR

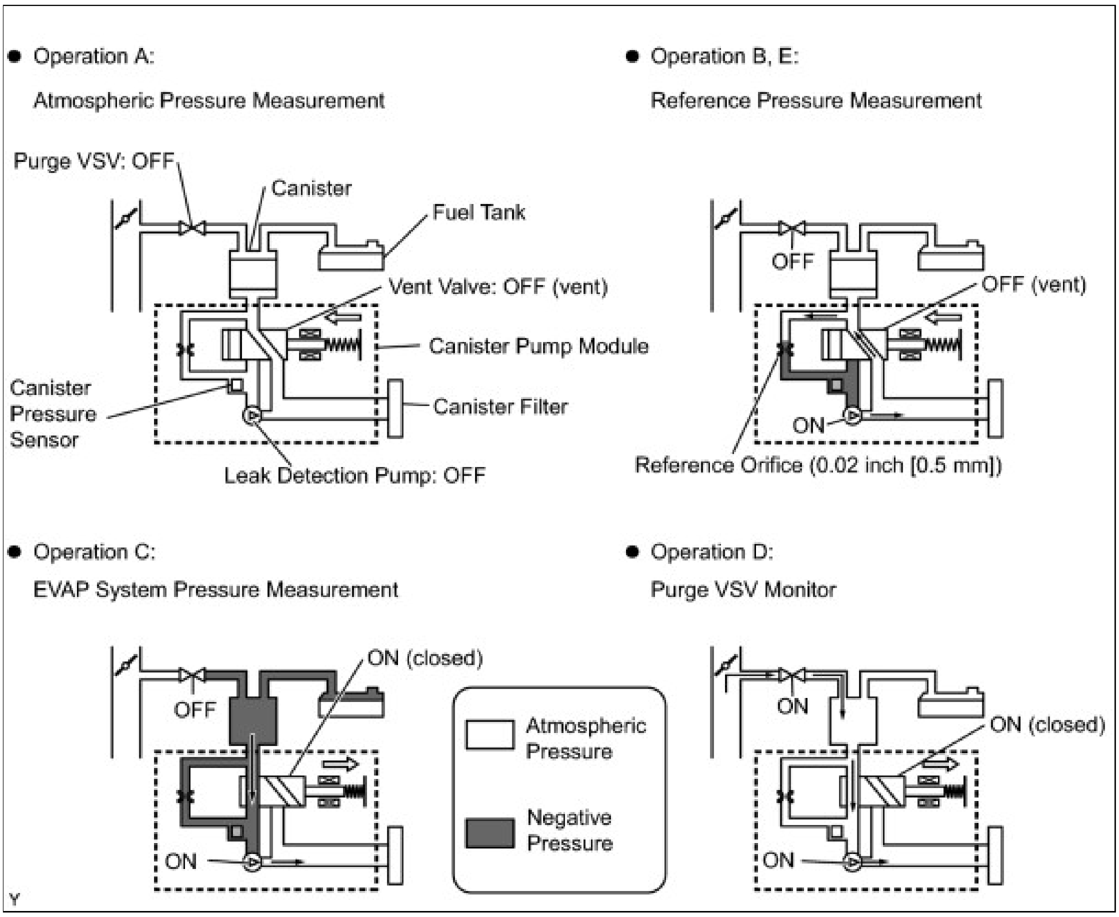
   5 hours* after the ignition switch is turned to off, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

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

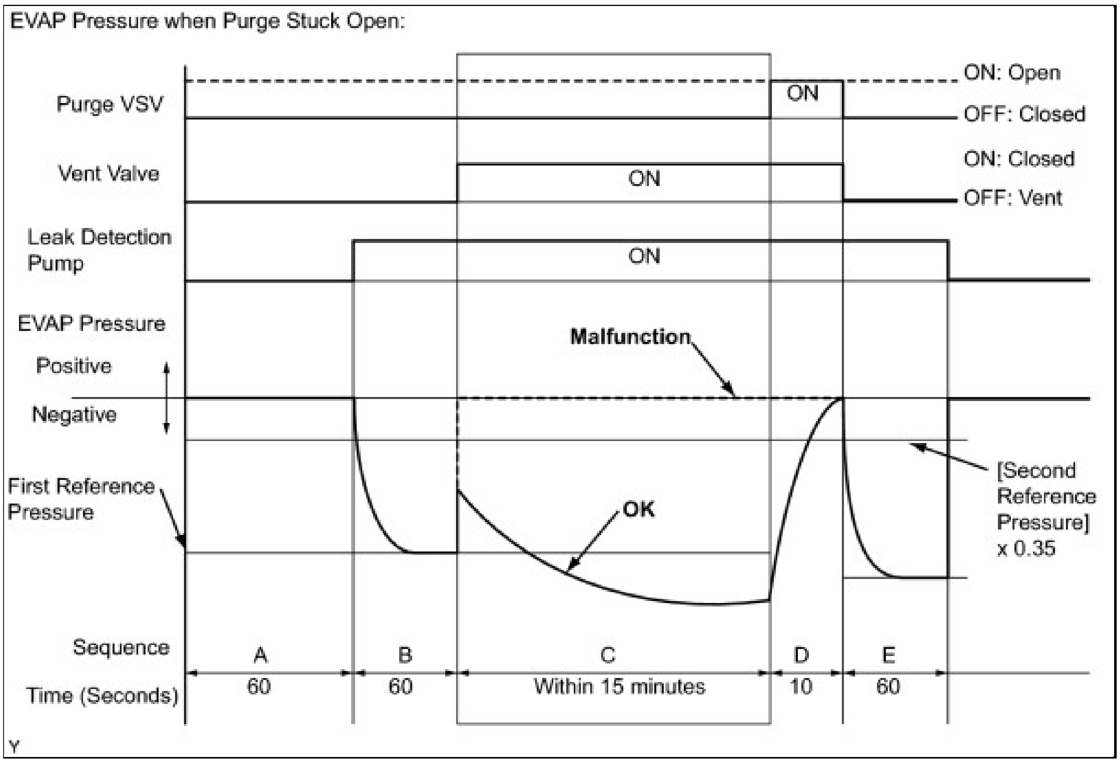
SEQUENCE	OPERATION	DESCRIPTION	DURATION
-	ECM activation	The key-off monitor is activated by soak timer 5, 7 or 9.5 hours after ignition switch turned OFF.	-
A	Atmospheric pressure measurement	Vent valve is turned OFF (vent) and the EVAP system pressure is measured by the ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa-a and 110 kPa-a (525 mmHg-a and 825 mmHg-a), the ECM cancels EVAP system monitor.	60 seconds
B	First reference pressure measurement	In order to determine the reference pressure, the leak detection pump creates negative pressure (vacuum) through the reference orifice and then the ECM checks if the leak detection pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut the EVAP system. Negative pressure (vacuum) created in the EVAP system, and the EVAP system pressure then measured. The measured value is memorized as it will be used in the leak check. If the EVAP pressure does not stabilize within 15 minutes, the ECM cancels the EVAP system monitor.	15 minutes*
D	Purge VSV monitor	Purge VSV is opened and then the EVAP system pressure is measured by the ECM. A large increase indicates normality.	10 seconds
E	Second reference pressure measurement	After a second reference pressure measurement, the leak check is performed by comparing the first and second reference pressure. If stabilized system pressure is higher than the second reference pressure, the ECM determines that the EVAP system is leaking.	60 seconds
-	Final check	Atmospheric pressure is measured and then the monitor result is recorded by the ECM.	-

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



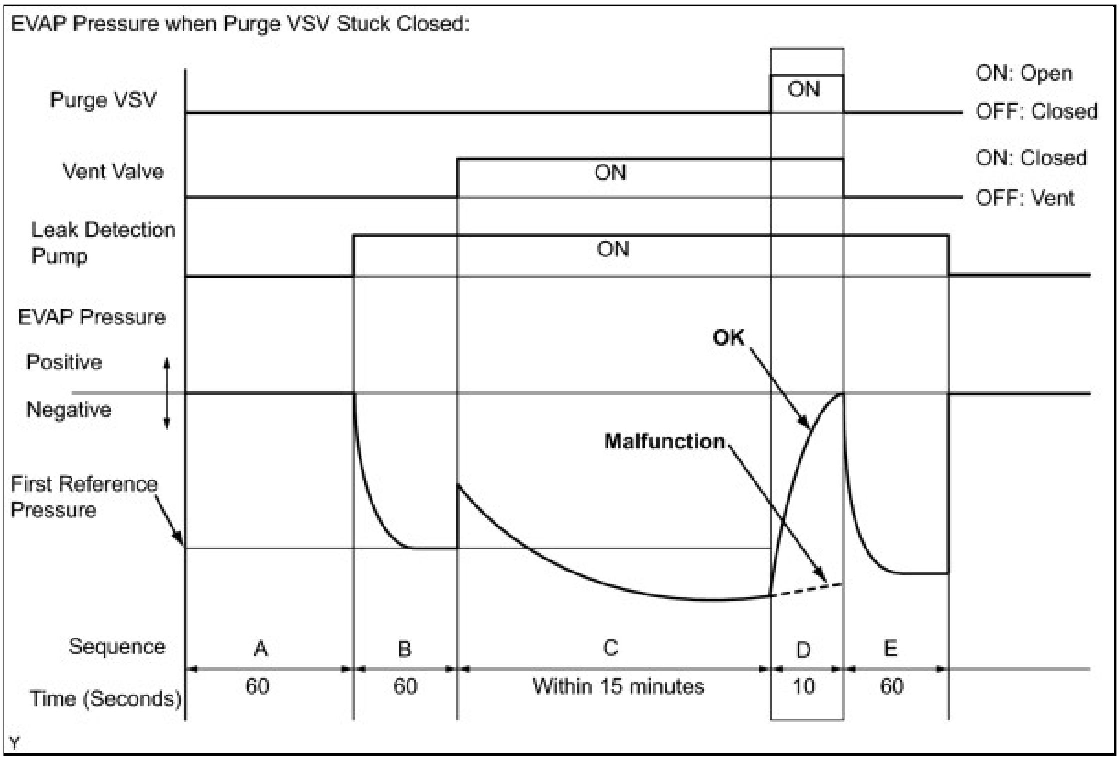
a. Purge VSV stuck open

In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The EVAP system pressure is then measured by the ECM using the canister pressure sensor. If the stabilized system pressure is higher than [second reference pressure x 0.35], the ECM interprets this as the purge VSV (Vacuum Switching Valve) being stuck open. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).

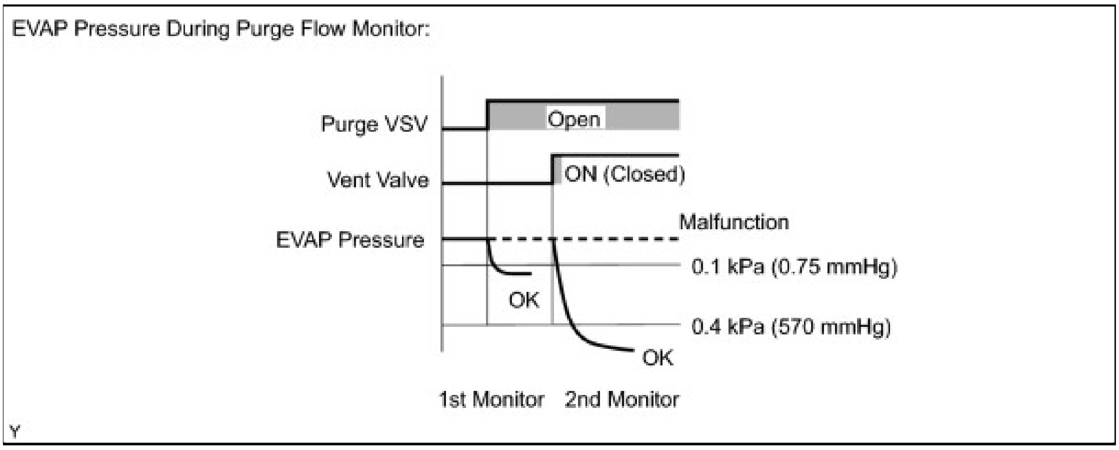


b. Purge VSV stuck closed

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



2. PURGE FLOW MONITOR



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

- The 1st monitor

While the engine is running and the purge VSV is ON (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.

- The 2nd monitor

The vent valve is turned ON (closed) and the EVAP pressure is then measured. If the variation in the pressure is less than 0.4 kPa-g (3.0 mmHg-g), the ECM interprets this as the purge VSV being stuck closed, and illuminates the MIL and sets DTC P0441 (2 trip detection logic).

Atmospheric pressure check:

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

OBD II MONITOR SPECIFICATIONS

1. Key-off Monitor

Monitor Strategy

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

Typical Enabling Conditions

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

Typical Malfunction Thresholds

Purge VSV stuck open:	-
EVAP pressure when vacuum introduction complete	Higher than reference pressure x 0.35

Purge VSV stuck closed:	-
EVAP pressure change after purge VSV ON (open)	Less than 0.3 kPa-g (2.25 mmHg-g)

OBD II MONITOR SPECIFICATIONS

1. Purge Flow Monitor

Monitor Strategy

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

Typical Enabling Conditions

Monitor runs whenever following DTCs are not present	None
Engine	Running
Engine coolant temperature	4.4°C (40°F) or more
Intake air temperature	4.4°C (40°F) or more
Canister pressure sensor malfunction	Not detected
Purge VSV	Not operated by scan tool
EVAP system check	Not operated by scan tool
Battery voltage	10 V or more
Purge duty cycle	8% or more

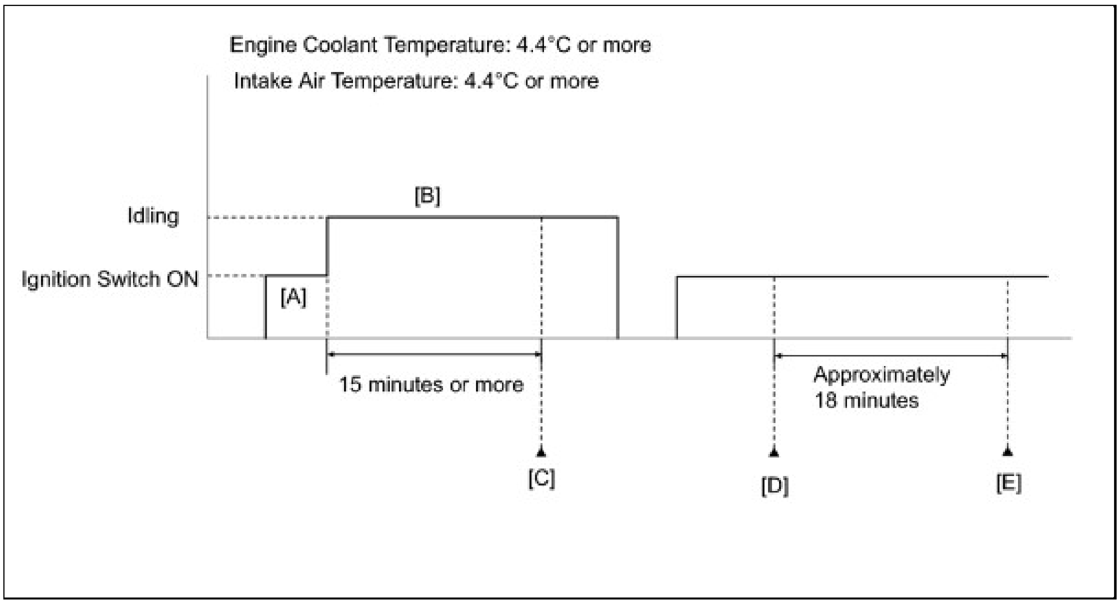
Typical Malfunction Thresholds

Both of following conditions are met	Conditions 1 and 2
1. EVAP pressure change when purge operation started	Less than 0.1 kPa-g (0.75 mmHg-g)
2. EVAP pressure change during purge operation when vent valve closed	Less than 0.4 kPa-g (3.0 mmHg-g)

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and wait 15 minutes or more [B].
7. Enter the following menus: Powertrain / Engine / Utility / All readiness.
8. Input the DTC: P0441.
9. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ You should perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.

- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

10. Turn the ignition switch to ON and turn the Techstream on.
11. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
12. Turn the ignition switch off.
13. Turn the ignition switch to ON and turn the Techstream on.
14. Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode [D].
15. After the "Evaporative System Check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine / Utility / All Readiness.
16. Input the DTC: P0441.
17. Check the DTC judgment result [E].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal
ABNORMAL	- DTC judgment completed - System abnormal
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

18. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
19. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

20. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

Last Modified: 3-10-2010	6.4 C	From: 200901
Model Year: 2010	Model: Corolla	Doc ID: RM0000012MC02HX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0451-P0453: Evaporative Emission Control System Pressure Sensor Range / Performance (2010 Corolla)		

DTC	P0451	Evaporative Emission Control System Pressure Sensor Range / Performance

DTC	P0452	Evaporative Emission Control System Pressure Sensor / Switch Low Input

DTC	P0453	Evaporative Emission Control System Pressure Sensor / Switch High Input

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0451	Canister pressure sensor noise	Sensor output voltage fluctuates frequently within certain time period.	• Canister pump module • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• EVAP monitoring (ignition switch off) • Engine running	2 trip
	Canister pressure sensor signal becomes fixed/flat	Sensor output voltage does not vary within certain time period.	• Canister pump module • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• EVAP monitoring (ignition switch off)	2 trip
P0452	Canister pressure sensor low input	EVAP pressure less than 42.1 kPa for 0.5 seconds.	• Canister pump module • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• Ignition switch ON • EVAP monitoring (ignition switch off)	1 trip

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0453	Canister pressure sensor high input	EVAP pressure more than 123.8 kPa for 0.5 seconds.	• Canister pump module • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• Ignition switch ON • EVAP monitoring (ignition switch off)	1 trip

HINT:

The canister pressure sensor is built into the canister pump module.

DESCRIPTION

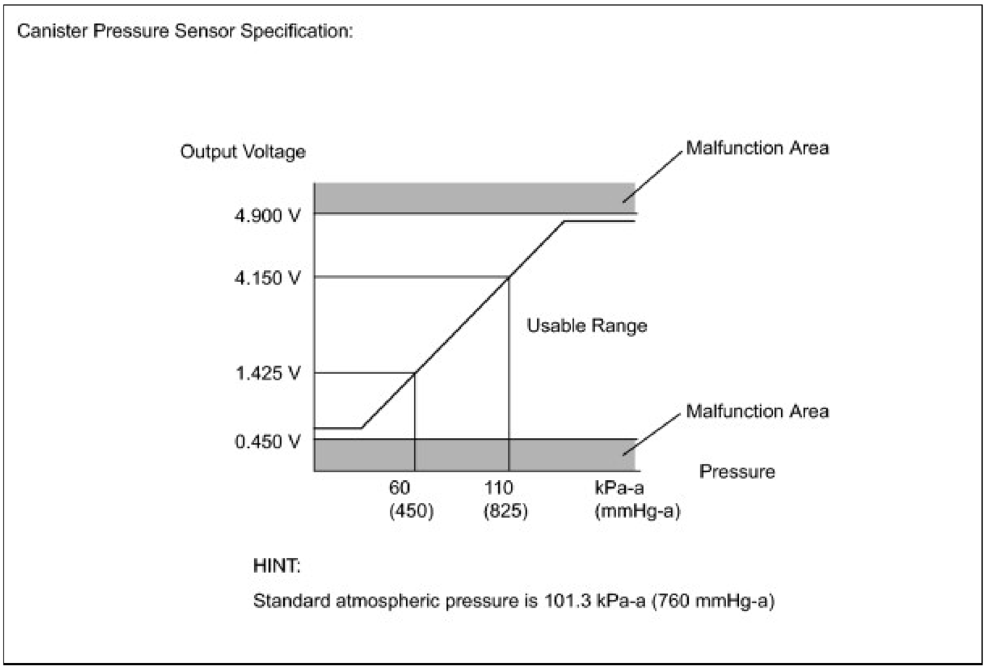
The description can be found in the EVAP (Evaporative Emission) System INFO .

HINT:

Unit expressions

- [kPa-a (mmHg-a)] denotes absolute pressure.
- [kPa-g (mmHg-g)] denotes gauge pressure (relative pressure).
- On the Techstream, choose the unit of measurement according to the inspection procedure.

MONITOR DESCRIPTION



1. DTC P0451: Canister pressure sensor noise or fixed/flat

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

Alternatively, if the sensor voltage output does not change for 10 seconds, the ECM interprets this as the sensor being fixed/flat, and stops the monitor. The ECM then illuminates the MIL and sets the DTC.

(Both malfunctions are detected by 2 trip detection logic.)

2. DTC P0452: Canister pressure sensor voltage low

   If the canister pressure sensor voltage output [pressure] is below 0.45 V [42.1 kPa-a (315.7 mmHg-a)], the ECM interprets this as an open or short circuit malfunction in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).

3. DTC P0453: Canister pressure sensor voltage high

   If the canister pressure sensor voltage output [pressure] is 4.9 V [123.8 kPa-a (928.5 mmHg-a)] or more, the ECM interprets this as an open or short circuit malfunction in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).

MONITOR STRATEGY

Required Sensors/Components	Canister pump module
Frequency of Operation	Once per driving cycle: P0451 sensor fixed/flat Continuous: P0451 sensor noise, P0452 and P0453
Duration	0.5 seconds: P0452 and P0453 Less than 15 seconds: P0451 (Noise Monitor) Less than 2 minutes: P0451 (Fixed/flat monitor)
MIL Operation	Immediate: P0452 and P0453 2 driving cycles: P0451
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0451 (Noise monitor)

Monitor runs whenever following DTCs not present	None
Atmospheric pressure (absolute pressure)	70 to 110 kPa-a (525 to 825 mmHg-a)
Battery voltage	10.5 V or more
Intake air temperature	4.4 to 35°C (40 to 95°F)
Canister pressure sensor malfunction (P0452, 0453)	Not detected
Either of following conditions met	A or B
A. Engine condition	Running
B. Time after key off	5 or 7 or 9.5 hours

P0451 (Fixed/flat monitor)

Monitor runs whenever following DTCs are not present	None
Battery voltage	10.5 V or more
Intake air temperature	4.4 to 35°C (40 to 95°F)
Canister pressure sensor malfunction (P0452, 0453)	Not detected
Atmospheric pressure (absolute pressure)	70 to 110 kPa-a (525 to 825 mmHg-a)
Time after key off	5 or 7 or 9.5 hours

P0452 and P0453

Monitor runs whenever following DTCs are not present	None
Either of following conditions is met	(a) or (b)
(a) Ignition switch	ON
(b) Soak timer	ON

TYPICAL MALFUNCTION THRESHOLDS

P0451: Canister Pressure Sensor Noise

Frequency that EVAP pressure change 0.3 kPa-g (2.25 mmHg-g) or more	10 times or more in 10 seconds

P0451: Canister Pressure Sensor Fixed/Flat

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

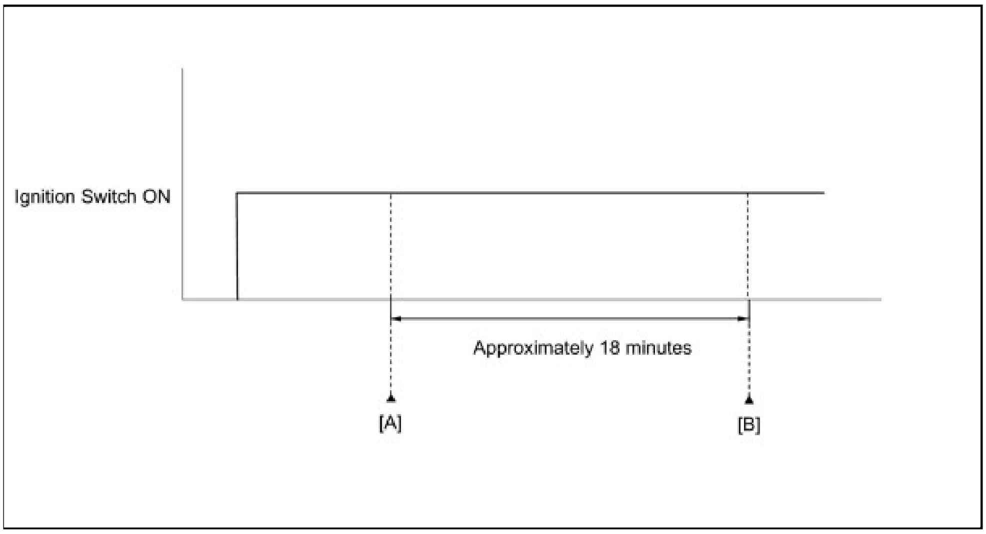
P0452: Canister Pressure Sensor Low Voltage

EVAP pressure	Less than 42.1 kPa-a (315.7 mmHg-a)

P0453: Canister Pressure Sensor High Voltage

EVAP pressure	More than 123.8 kPa-a (928.5 mmHg-a)

CONFIRMATION DRIVING PATTERN



NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Enter the following menus: Powertrain / Engine / Data List / Intake Air.

4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) .
5. Turn the ignition switch off.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode [A].
8. After the "Evaporative System Check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine / Utility / All readiness.
9. Input the DTC: P0451, P0452 or P0453.
10. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

HINT:

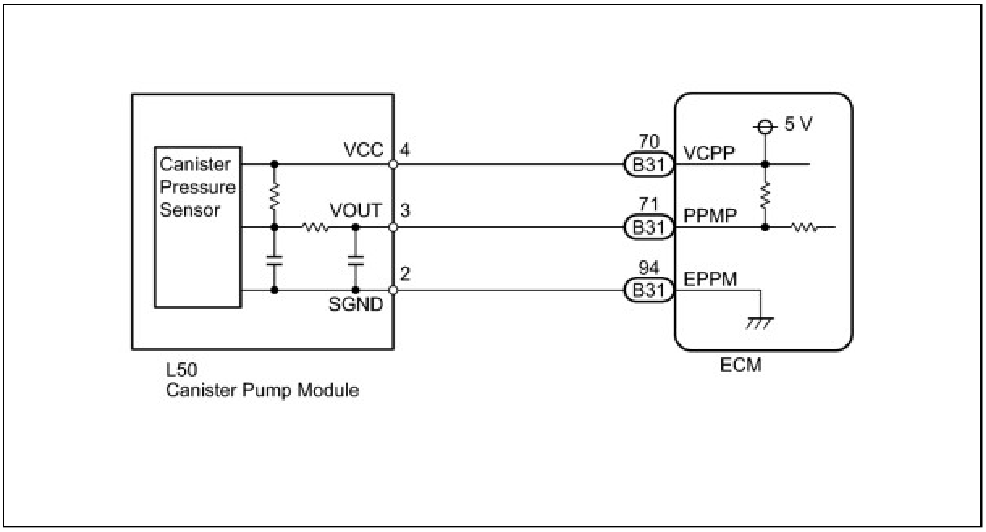
If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

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

PROCEDURE

1.	CONFIRM DTC AND EVAP PRESSURE

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON (do not start the engine).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

(f) Enter the following menus: Powertrain / Engine and ECT / Data List / EVAP / Vapor Pressure Pump.

(g) Read the EVAP (Evaporative Emission) pressure displayed on the Techstream.

Result:

DISPLAY (DTC OUTPUT)	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
P0451	-	Canister pressure sensor	C
P0452	Less than 45 kPa-a (430 mmHg-a)	• Wire harness/connector (ECM - Canister pressure sensor) • Canister pressure sensor • ECM	A
P0453	More than 120 kPa-a (900 mmHg-a)	• Wire harness/connector (ECM - Canister pressure sensor) • Canister pressure sensor	B

DISPLAY (DTC OUTPUT)	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
		• ECM	

C ▶ **GO TO EVAP SYSTEM**

B ▶ **CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)**

A ▼

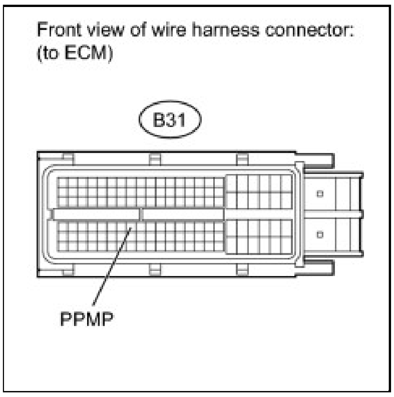
2.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Turn the ignition switch to off.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Result:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
B31-71 (PPMP) - Body ground	Always	10 Ω or less	• Wire harness/connector (ECM - Canister pressure sensor) • Short in canister pressure sensor circuit	A
		10 kΩ or more	• Wire harness/connector (ECM - Canister pressure sensor) • Short in ECM circuit	B

(d) Reconnect the ECM connector.

B ▶ **REPLACE ECM**

A ▼

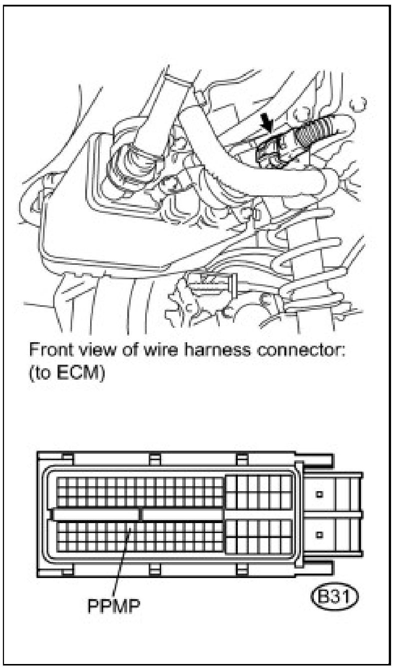
3.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the canister pump module connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Result:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
B31-71 (PPMP) - Body ground	Always	10 kΩ or more	Short in canister pressure sensor circuit	A
		10 Ω or less	Short in wire harness/connector (ECM - Canister pressure sensor)	B

(d) Reconnect the canister pump module connector.

(e) Reconnect the ECM connector.

B **REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER - ECM)**

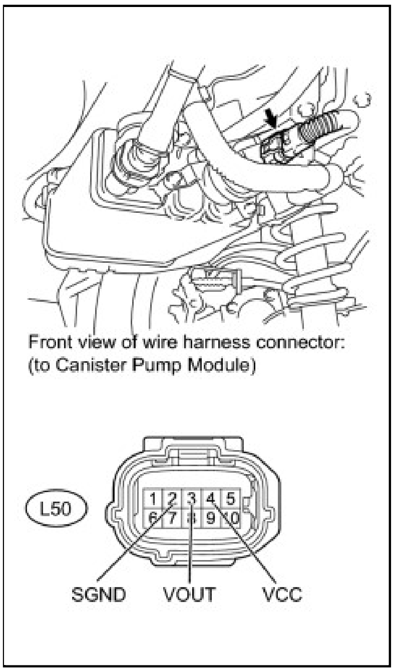
A **REPLACE CANISTER**

4.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the canister pump module connector.

(b) Measure the voltage and resistance according to the value(s) in the table below.

Standard Voltage:



TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
L50-4 (VCC) - Body ground	Ignition switch ON	4.5 to 5.5 V
L50-3 (VOUT) - Body ground	Ignition switch ON	4.5 to 5.5 V

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
L50-2 (SGND) - Body ground	Always	100 Ω or less

Result:

TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Voltage and resistance within standard ranges	Open in canister pressure sensor circuit	A

Voltage and resistance outside standard ranges	Open in wire harness/connector (ECM - Canister pressure sensor)	B

(c) Reconnect the canister pump module connector.

B **REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER - ECM)**

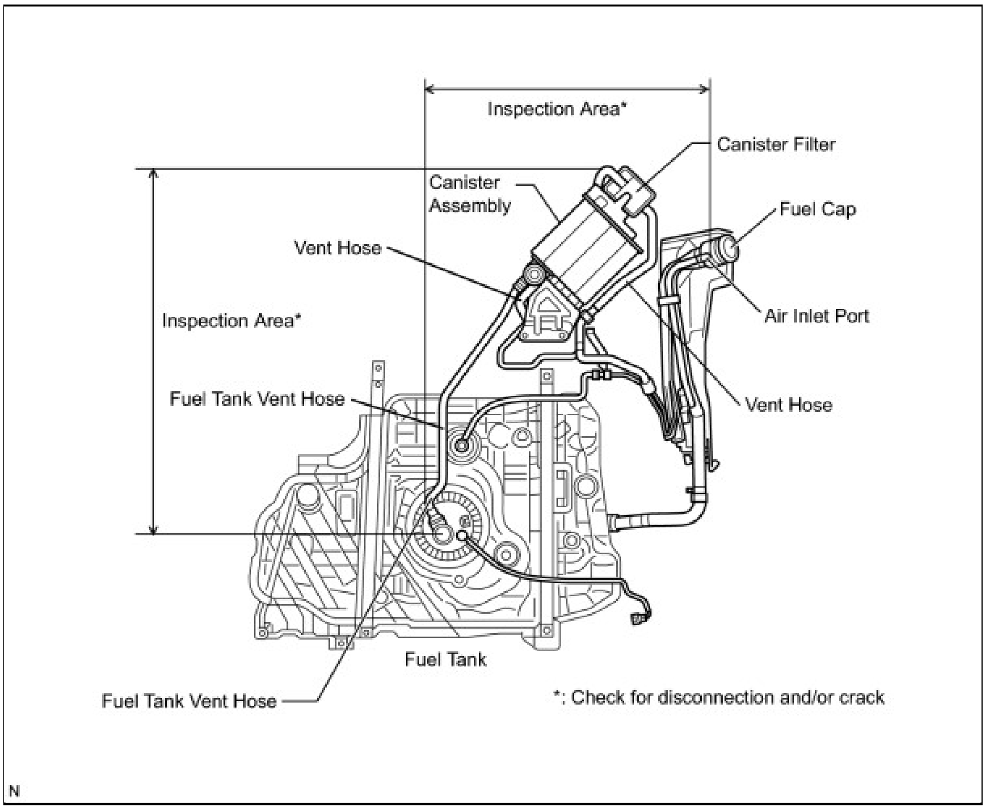
A

5.	**REPLACE CANISTER**

(a) Replace the canister INFO .

NOTICE:

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



NEXT **CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)**

6.	**REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER - ECM)**

HINT:

If the exhaust tailpipe has been removed, go to the next step before reinstalling it.

NEXT ▶ CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

7.	**REPLACE ECM**

(a) Replace the ECM INFO .

NEXT ▶ CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

8.	**CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Wait for at least 60 seconds.

(e) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

HINT:

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

NEXT ▶ **END**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000VSO04VX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0443: Evaporative Emission Control System Purge Control Valve Circuit (2010 Corolla)		

DTC	**P0443**	**Evaporative Emission Control System Purge Control Valve Circuit**

DESCRIPTION

HINT:

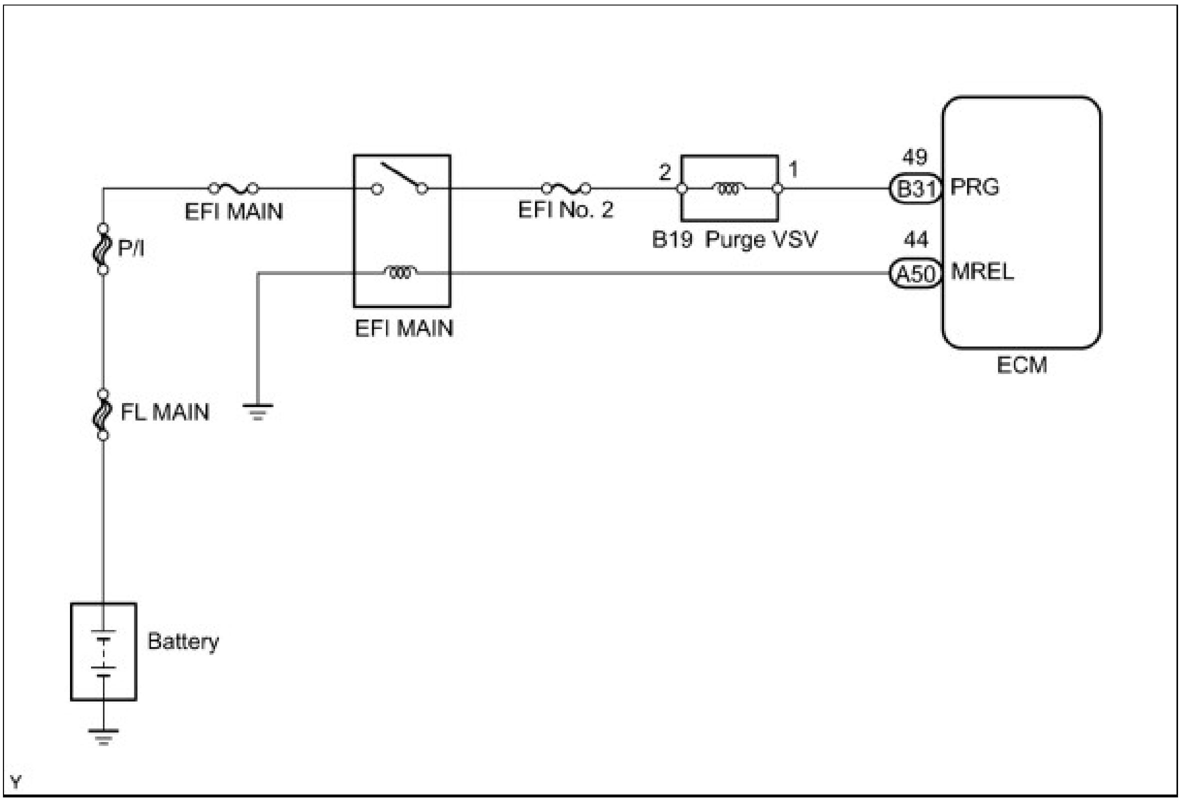
This DTC P0443 is applicable to Mexico models only.

To reduce hydrocarbon emissions, evaporated fuel from the fuel tank is routed through a charcoal canister to the intake manifold for combustion in the cylinders.

The ECM changes the duty signals to the purge VSV so that the intake amount of hydrocarbon emissions is appropriate for the driving conditions (engine load, engine speed, vehicle speed, etc.) after the engine is warmed up.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0443	Terminal voltage of ECM output circuit does not correspond with drive signals from ECM to purge VSV (1-trip detection logic)	• Open or short in purge VSV circuit • Purge VSV • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

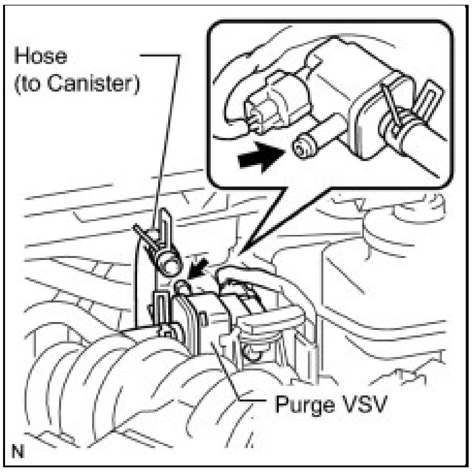
HINT:

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

PROCEDURE

1.	**PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE PURGE VSV CONTROL)**

(a) Connect the Techstream to the DLC3.



(b) Disconnect the vacuum hose from the purge VSV.

(c) Start the engine.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Activate the VSV for Evap Control.

(f) When the purge VSV is operated using the Techstream, check whether the VSV applies suction to your finger.

OK:

TESTER OPERATION	SPECIFIED CONDITION
VSV is ON	VSV applies suction to finger
VSV is OFF	VSV applies no suction to finger

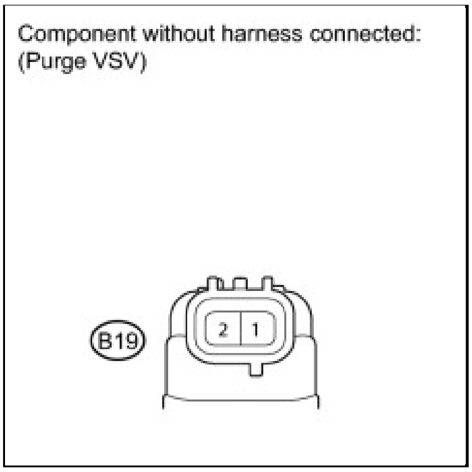
(g) Reconnect the vacuum hose to the purge VSV.

NG ▶ **INSPECT PURGE VSV**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	INSPECT PURGE VSV

(a) Disconnect the purge VSV connector.



(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

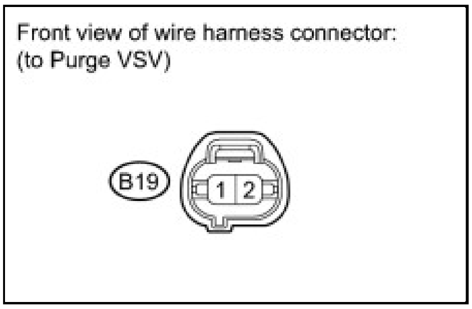
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B19-1 - B19-2	20°C (68°F)	23 to 26 Ω

(c) Reconnect the purge VSV connector.

NG ▶ **REPLACE PURGE VSV**

OK
▼

3.	**INSPECT PURGE VSV (POWER SOURCE VOLTAGE)**



(a) Disconnect the purge VSV connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

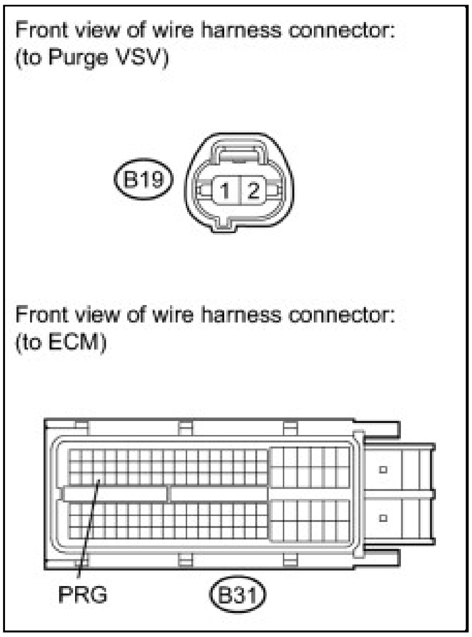
TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
B19-2 - Body ground	Ignition switch to ON	9 to 14 V

(d) Reconnect the purge VSV connector.

NG ▶ **INSPECT FUSE (EFI NO. 2 FUSE)**

OK ▼

4.	CHECK HARNESS AND CONNECTOR (PURGE VSV - ECM)



(a) Disconnect the purge VSV connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B19-1 - B31-49 (PRG)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B19-1 or B31-49 (PRG) - Body ground	Always	10 kΩ or higher

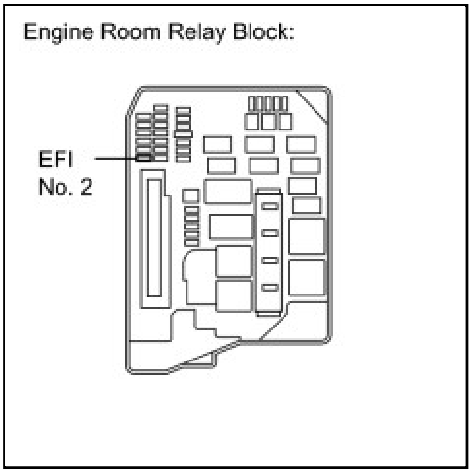
(d) Reconnect the purge VSV connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (PURGE VSV - ECM)**

OK ▶ **REPLACE ECM**

5.	INSPECT FUSE (EFI NO. 2 FUSE)



(a) Remove the EFI No. 2 fuse from the engine room relay block.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI No. 2 fuse	Always	Below 1 Ω

(c) Reinstall the EFI No. 2 fuse.

NG ▶ **REPLACE FUSE (EFI NO. 2 FUSE)**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (PURGE VSV - ENGINE ROOM JUNCTION BLOCK (EFI MAIN RELAY))**

Last Modified: 3-10-2010	6.4 C	From: 200901
Model Year: 2010	Model: Corolla	Doc ID: RM000000SWH04QX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0455,P0456: Evaporative Emission Control System Leak Detected (Gross Leak) (2010 Corolla)		

DTC	P0455	Evaporative Emission Control System Leak Detected (Gross Leak)

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

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0455	EVAP gross leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. Reference pressure measured at start and at end of leak check. If stabilized pressure higher than [second reference pressure x 0.35], ECM determines that EVAP system has large leak.	• Fuel tank cap (loose) • Leak from EVAP line (Canister - Fuel tank) • Leak from EVAP line (Purge VSV - Canister) • Canister pump module • Leak from fuel tank • Leak from canister	While ignition switch OFF	2 trip
P0456	EVAP small leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. Reference pressure measured at start and at end of leak	• Fuel tank cap (loose) • Leak from EVAP line (Canister - Fuel	While ignition switch OFF	2 trip

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
		check. If stabilized pressure higher than second reference pressure, ECM determines that EVAP system has small leak.	tank) • Leak from EVAP line (Purge VSV - Canister) • Canister pump module • Leak from fuel tank • Leak from canister		

DESCRIPTION

The description can be found in the EVAP (Evaporative Emission) System .

INSPECTION PROCEDURE

Refer to the EVAP System .

HINT:

Unit expressions

- [kPa-a (mmHg-a)] denotes absolute pressure.
- [kPa-g (mmHg-g)] denotes gauge pressure (relative pressure).
- On the Techstream, choose the unit of measurement according to the inspection procedure.

MONITOR DESCRIPTION

5 hours* after the ignition switch is turned to off, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

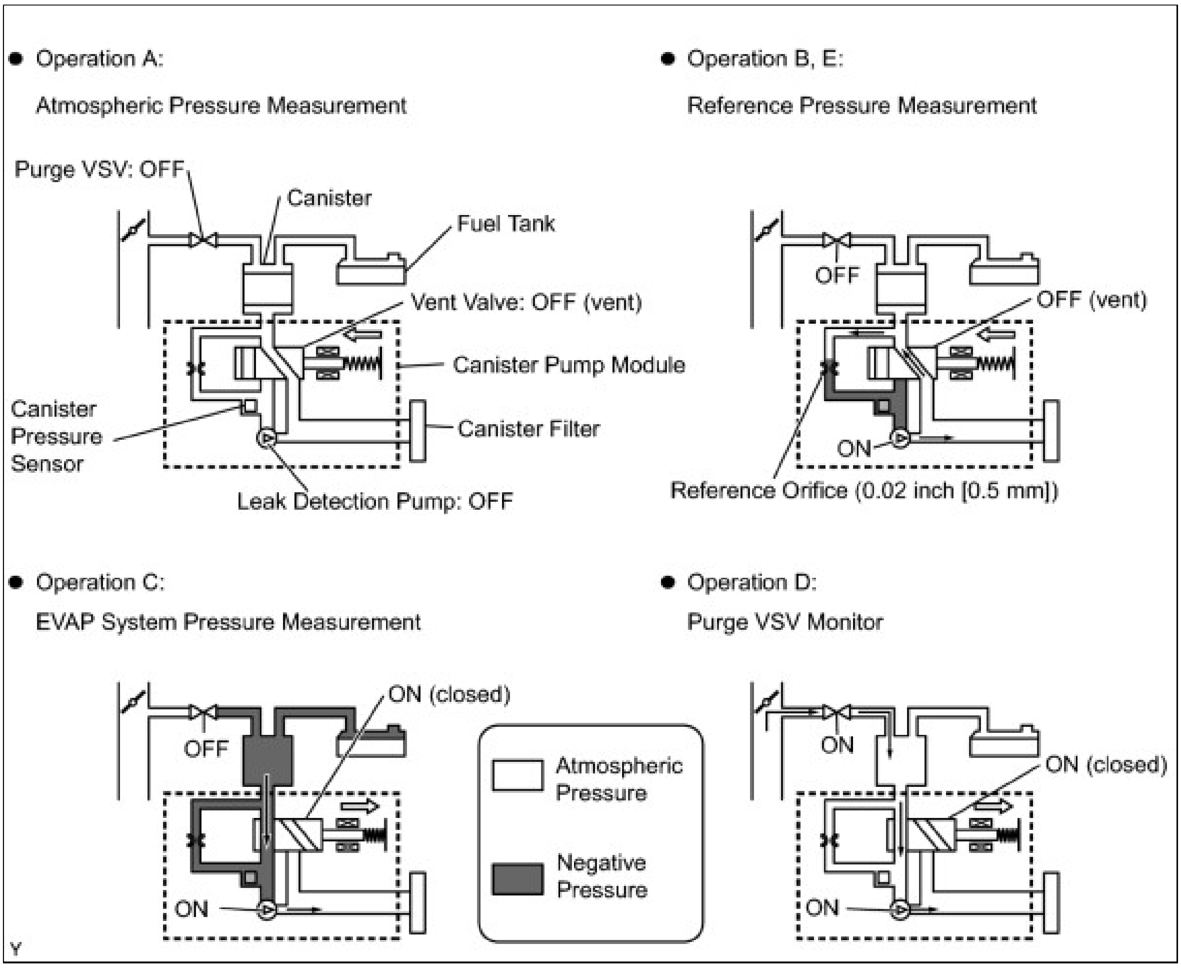
HINT:

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

SEQUENCE	OPERATION	DESCRIPTION	DURATION
-	ECM activation	The key-off monitor is activated by soak timer 5, 7 or 9.5 hours after ignition switch turned OFF.	-

SEQUENCE	OPERATION	DESCRIPTION	DURATION
A	Atmospheric pressure measurement	Vent valve is turned OFF (vent) and the EVAP system pressure is measured by the ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa-a and 110 kPa-a (525 mmHg-a and 825 mmHg-a), the ECM cancels EVAP system monitor.	60 seconds
B	First reference pressure measurement	In order to determine the reference pressure, the leak detection pump creates negative pressure (vacuum) through the reference orifice and then the ECM checks if the leak detection pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut the EVAP system. Negative pressure (vacuum) created in the EVAP system, and the EVAP system pressure then measured. The measured value is memorized as it will be used in the leak check. If the EVAP pressure does not stabilize within 15 minutes, the ECM cancels the EVAP system monitor.	15 minutes*
D	Purge VSV monitor	Purge VSV is opened and then the EVAP system pressure is measured by the ECM. A large increase indicates normality.	10 seconds
E	Second reference pressure measurement	After a second reference pressure measurement, the leak check is performed by comparing the first and second reference pressure. If stabilized system pressure is higher than the second reference pressure, the ECM determines that the EVAP system is leaking.	60 seconds
-	Final check	Atmospheric pressure is measured and then the monitor result is recorded by the ECM.	-

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

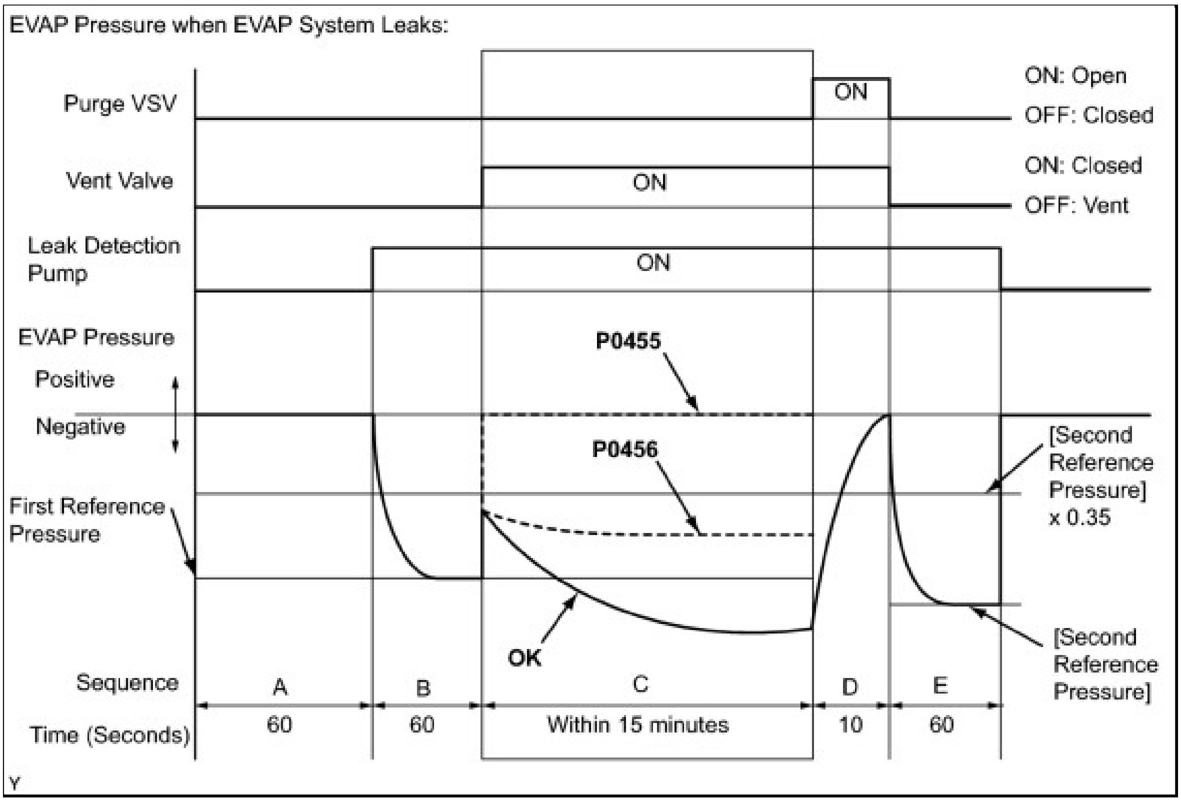


(a) P0455: EVAP gross leak

In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than [second reference pressure x 0.35] (near atmospheric pressure), the ECM determines that the EVAP system has a large leak, illuminates the MIL and sets the DTC (2 trip detection logic).

(b) P0456: EVAP very small leak

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



MONITOR STRATEGY

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

TYPICAL ENABLING CONDITIONS

P0455 (pattern A), P0456

Monitor runs whenever following DTCs are not present	None
Atmospheric pressure	70 to 110 kPa-a (525 to 825 mmHg-a)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Ignition switch	OFF
Time after key off	5 or 7 or 9.5 hours

Canister pressure sensor malfunction (P0451, P0452 and P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of following conditions met before key off	Conditions 1 and 2
1. Duration that vehicle is driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4 to 35°C (40 to 95°F)
Intake air temperature	4.4 to 35°C (40 to 95°F)

P0455 (pattern B)

Atmospheric pressure	70 to 110 kPa-a (525 to 825 mmHg-a)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Ignition switch	OFF
Canister pressure sensor malfunction (P0451, P0452 and P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of following conditions met before key off	Conditions 1 and 2
1. Duration that vehicle driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4 to 45°C (40 to 113°F)
Intake air temperature	4.4 to 45°C (40 to 113°F)

TYPICAL MALFUNCTION THRESHOLDS

P0455: EVAP Gross Leak

EVAP pressure when vacuum introduction complete	Higher than reference pressure x 0.35

P0456: EVAP Small Leak

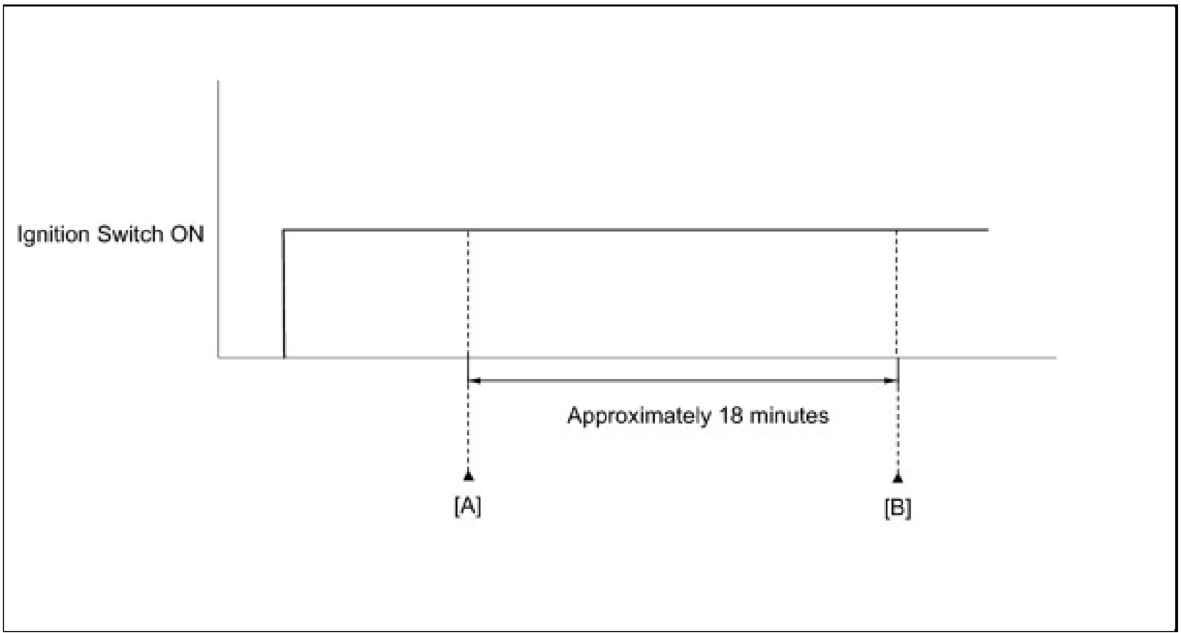
EVAP pressure when vacuum introduction	Between reference pressure and reference pressure

complete	x 0.35

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode [A].
7. After the "Evaporative System Check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0455 or P0456.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	DTC judgment completed System normal
ABNORMAL	DTC judgment completed System abnormal
INCOMPLETE	DTC judgment not completed Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	Unable to perform DTC judgment Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

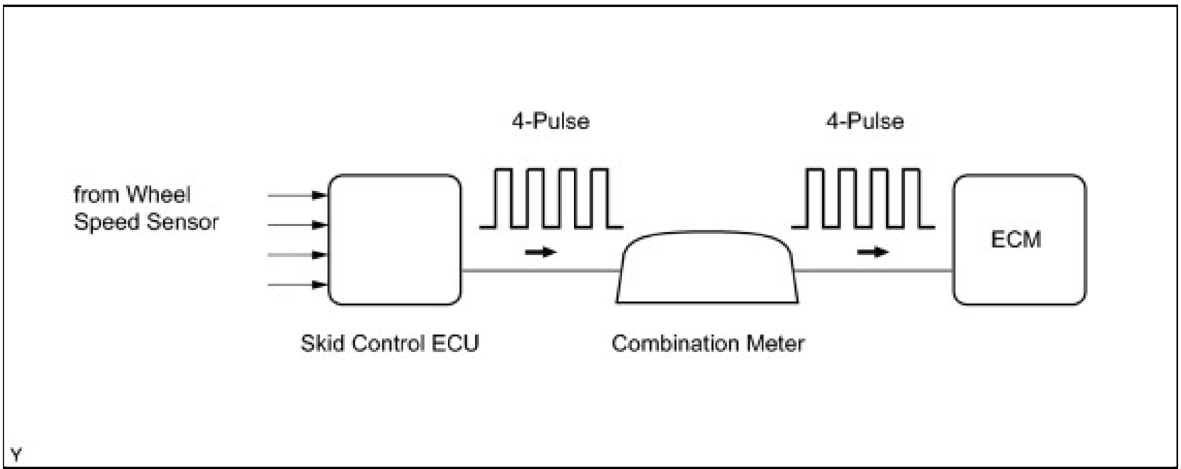
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

Last Modified: 3-10-2010	6.4 C	From: 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM0000012ME04HX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0500: Vehicle Speed Sensor "A" (2010 Corolla)		

DTC	P0500	Vehicle Speed Sensor "A"

DESCRIPTION

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



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0500	While vehicle being driven, no vehicle speed sensor signal transmitted to ECM (2 trip detection logic: M/T models) (1 trip detection logic: A/T models)	• Open or short in speed signal circuit • Speed meter circuit (wheel speed sensor, skid control ECU) • Combination meter • ECM

MONITOR DESCRIPTION

Automatic Transaxle Models:

The ECM assumes that the vehicle is being driven when the vehicle speed sensor signal is being transmitted by the combination meter. If there is no signal from the combination meter, despite the ECM detecting the speed signal from the speed sensor NC, the ECM interprets this as a malfunction in the speed signal circuit. The ECM then illuminates the MIL and sets the DTC.

Manual Transaxle Models:

The ECM assumes that the vehicle is being driven when the indicated engine speed is more than 2,000 rpm and the engine load calculated by the ECM is more than a certain level or the idle fuel-cut operation* is being executed. If there is no signal from the vehicle speed sensor, despite these conditions being met, the ECM interprets this as a malfunction in the speed signal circuit. The ECM then illuminates the MIL and sets the DTC.

*: Idle fuel-cut is executed when the throttle valve is fully closed and engine speed is over 2800 rpm.

MONITOR STRATEGY

Related DTCs	P0500: Vehicle speed sensor "A" pulse input error
Required Sensors/Components (Main)	Vehicle speed sensor Combination meter Skid control ECU
Required Sensors/Components (Related)	Park/neutral position switch Engine coolant temperature sensor Crankshaft position sensor Throttle position sensor Mass air flow meter
Frequency of Operation	Continuous
Duration	2 seconds: A/T models 8 seconds: M/T models, Case 1 4.7 seconds: M/T models, Case 2
MIL Operation	Immediate: A/T models 2 driving cycles: M/T models
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

M/T Models, Case 1

Monitor runs whenever following DTCs are not present	None
Engine coolant temperature	70°C (158°F) or more
Engine speed	2000 to 5000 rpm
Engine load	31.9 % or more
Fuel-cut at high engine speed	Not executing

M/T Models, Case 2

Monitor runs whenever following DTCs are not present	None

Ignition switch	ON
Starter	OFF
Battery voltage	8 V or more

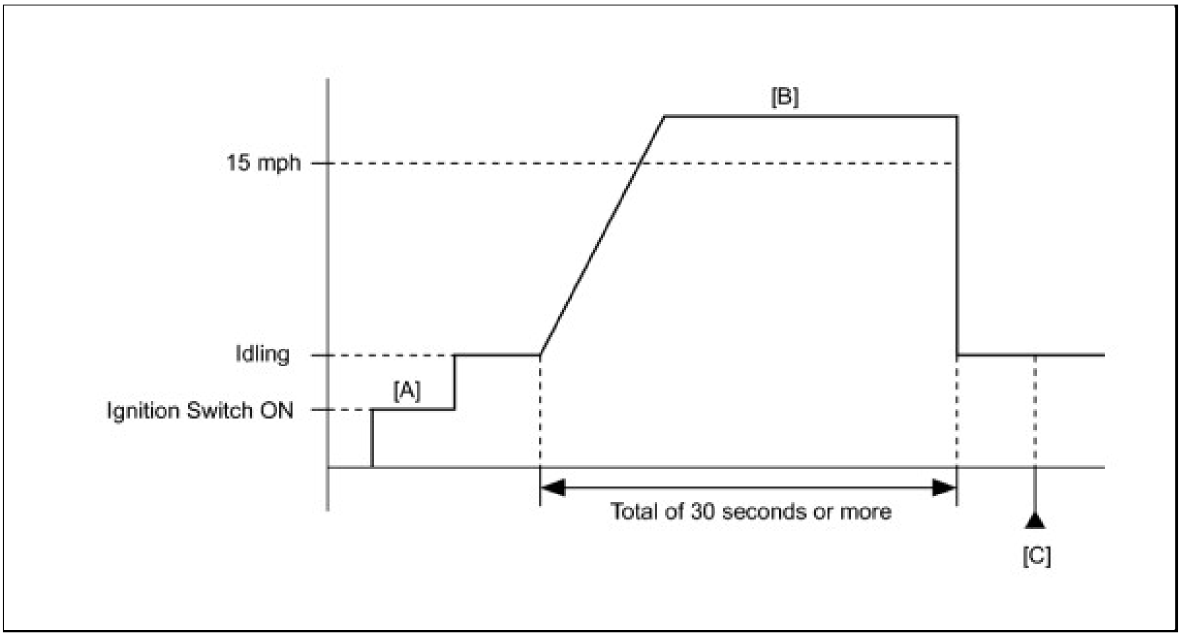
A/T Models

Monitor runs whenever following DTCs are not present	None
Time after ignition switch OFF to ON	3 seconds or more
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF
Engine	Running
Transmission counter gear revolution	300 rpm or more
When either condition below is met	Condition A or B
A. When both conditions below are met	-
Engine coolant temperature	20°C (68°F) or higher
Time after park/neutral position switch turned from on to off	2 seconds or more
B. When both conditions below are met	-
Engine coolant temperature	Below 20°C (68°F)
Time after park/neutral position switch turned from on to off	30 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

Vehicle speed sensor signal	No pulse input

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Drive the vehicle at 15 mph (24 km/h) or more for a total of 30 seconds or more [B].
8. Stop the vehicle.
9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0500.
11. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

12. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
13. Read Pending DTCs.

    HINT:

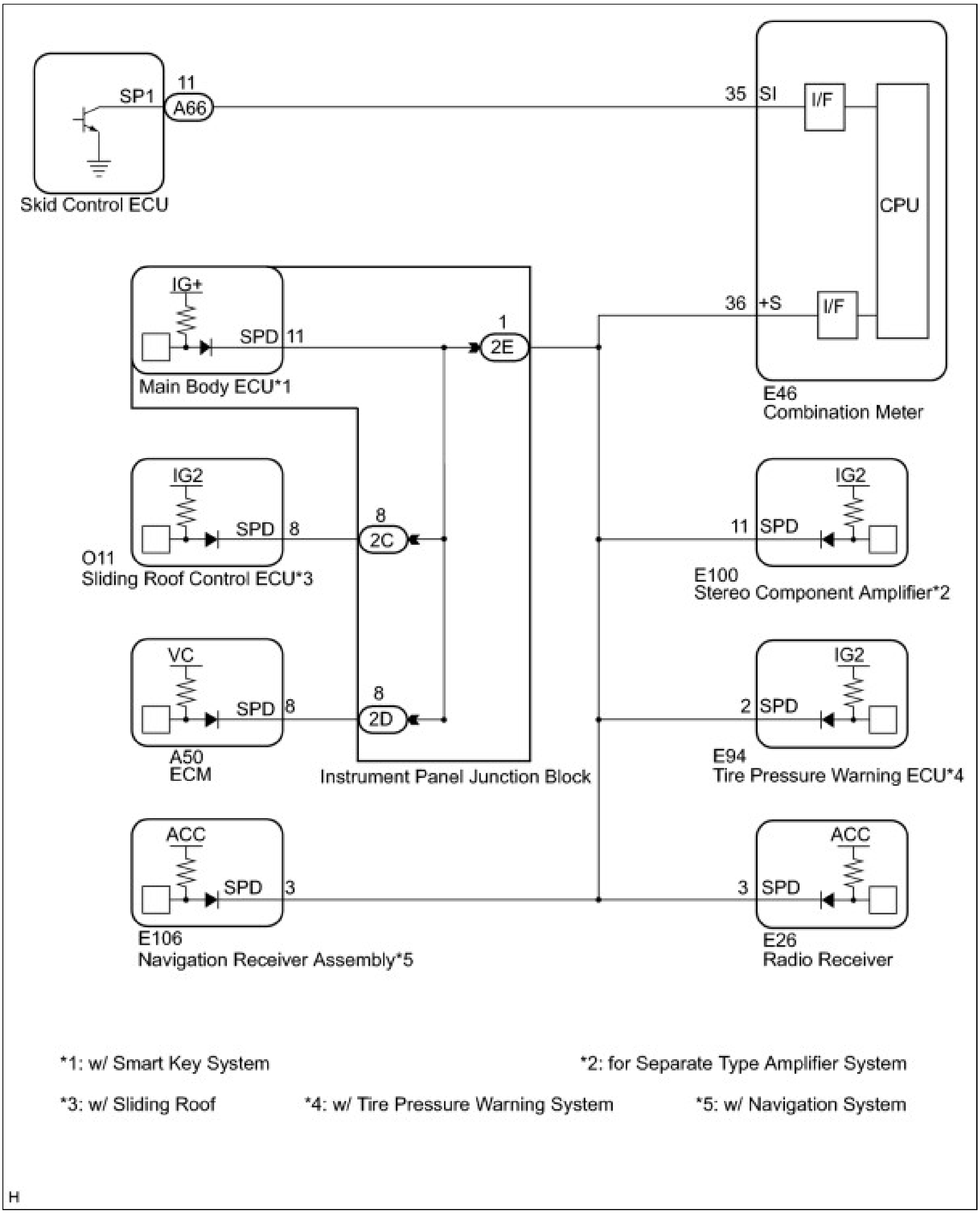
    If a pending DTC is output, the system is malfunctioning.

14. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (VEHICLE SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to the ON position.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Vehicle Speed.

(e) Drive the vehicle.

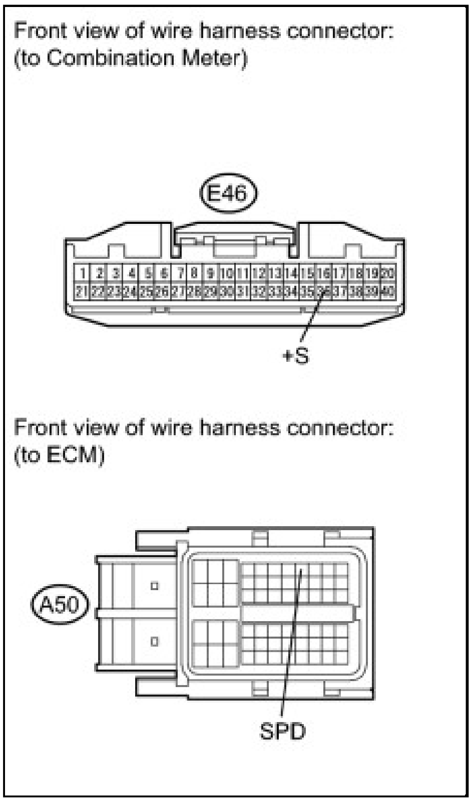
(f) Read the value displayed on the Techstream.

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

NG ▶ **CHECK HARNESS AND CONNECTOR (ECM - COMBINATION METER)**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	CHECK HARNESS AND CONNECTOR (ECM - COMBINATION METER)



(a) Disconnect the ECM connector.

(b) Disconnect the combination meter connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E46-36 (+S) - A50-8 (SPD)	Always	Below 1 Ω

(d) Reconnect the ECM connector.

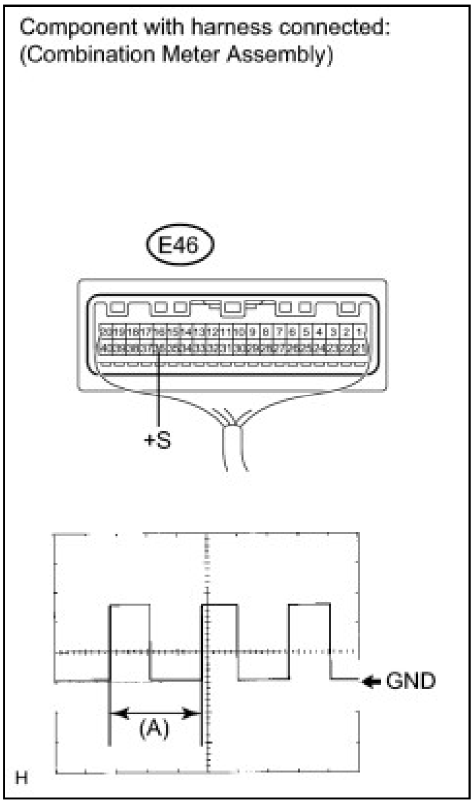
(e) Reconnect the combination meter connector.

NG ▶ **CHECK HARNESS AND CONNECTOR (ECM - INSTRUMENT PANEL JUNCTION BLOCK)**

OK

▼

3.	CHECK COMBINATION METER ASSEMBLY (SPD SIGNAL WAVEFORM)



(a) Check the output waveform.

(1) Remove the combination meter assembly with the connector(s) still connected.

(2) Connect an oscilloscope to terminals E46-36 (+S) and body ground.

(3) Turn the ignition switch to ON.

(4) Turn the wheel slowly.

(5) Check the signal waveform according to the condition(s) in the table below.

ITEM	CONDITION
Tool setting	5 V/DIV., 20 ms/DIV.

OK:
The waveform is displayed as shown in the illustration.

HINT:

When the system is functioning normally, one wheel revolution generates 4 pulses. As the vehicle speed increases, the width

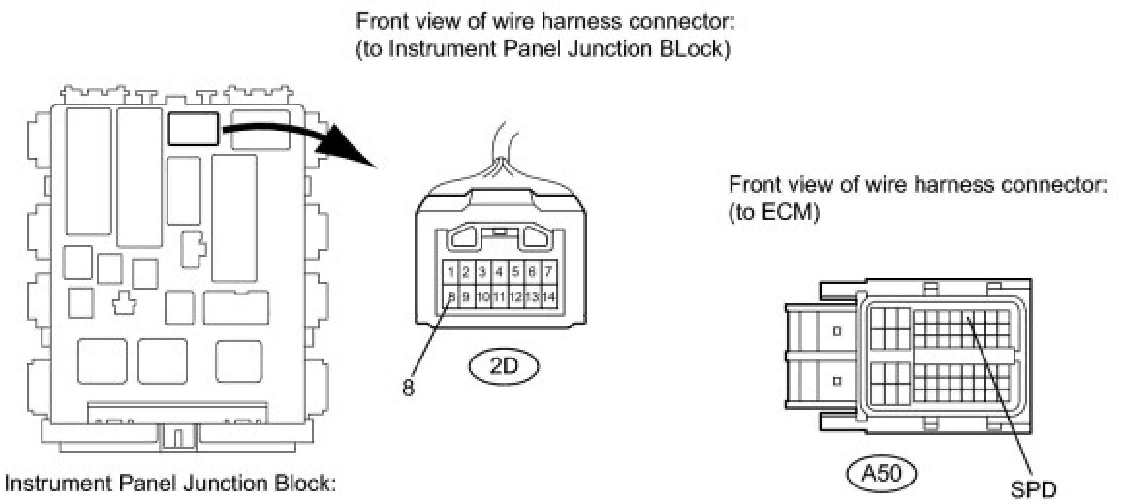
indicated by (A) in the illustration narrows.

NG ▶ GO TO METER / GAUGE SYSTEM

OK ▶ REPLACE ECM

4.	CHECK HARNESS AND CONNECTOR (ECM - INSTRUMENT PANEL JUNCTION BLOCK)

(a) Disconnect the ECM connector.



(b) Disconnect the instrument panel junction block connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2D-8 - A50-8 (SPD)	Always	Below 1 Ω

(d) Reconnect the ECM connector.

(e) Reconnect the instrument panel junction block connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - INSTRUMENT PANEL JUNCTION BLOCK)**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (INSTRUMENT PANEL JUNCTION BLOCK)**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000XCT08OX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0504: Brake Switch "A" / "B" Correlation (2010 Corolla)		

DTC	**P0504**	**Brake Switch "A" / "B" Correlation**

DESCRIPTION

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

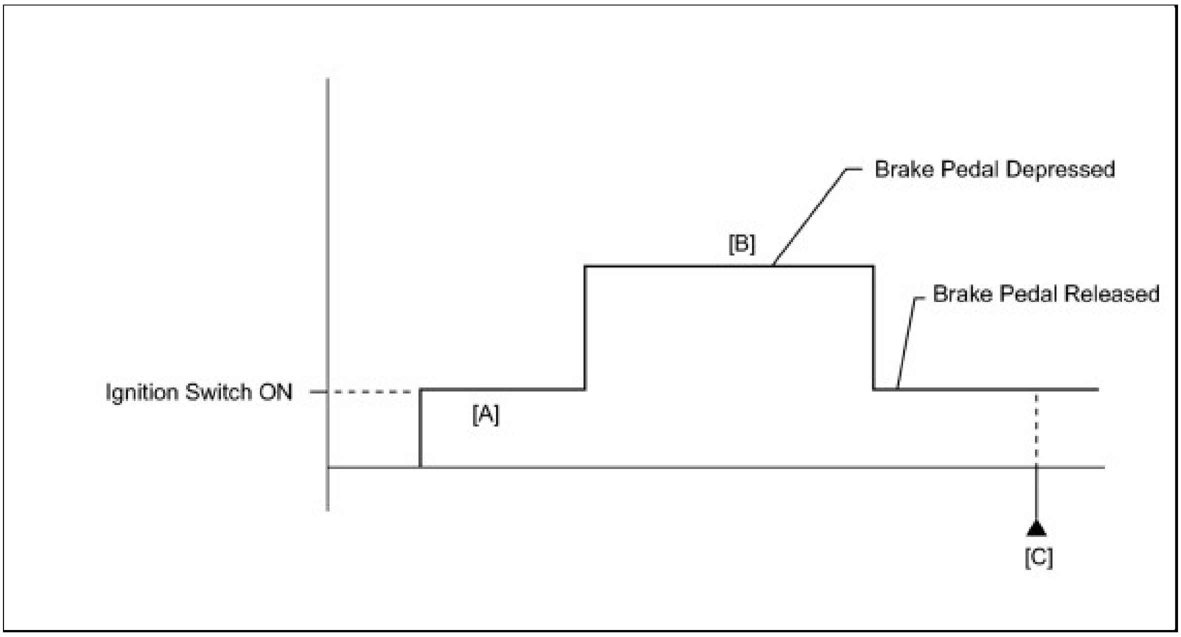
HINT:

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

SIGNAL	BRAKE PEDAL RELEASED	IN TRANSITION	BRAKE PEDAL DEPRESSED
STP	OFF	ON	ON
ST1-	ON	ON	OFF

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0504	Conditions (a), (b) and (c) continue for 0.5 seconds or more (1 trip detection logic): (a) Ignition switch ON (b) Brake pedal released (c) STP signal OFF when ST1- signal OFF	• Short in stop light switch signal circuit • STOP fuse • IGN fuse • Stop light switch • ECM

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Depress and release the brake pedal [B].
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0504.
9. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

    HINT:

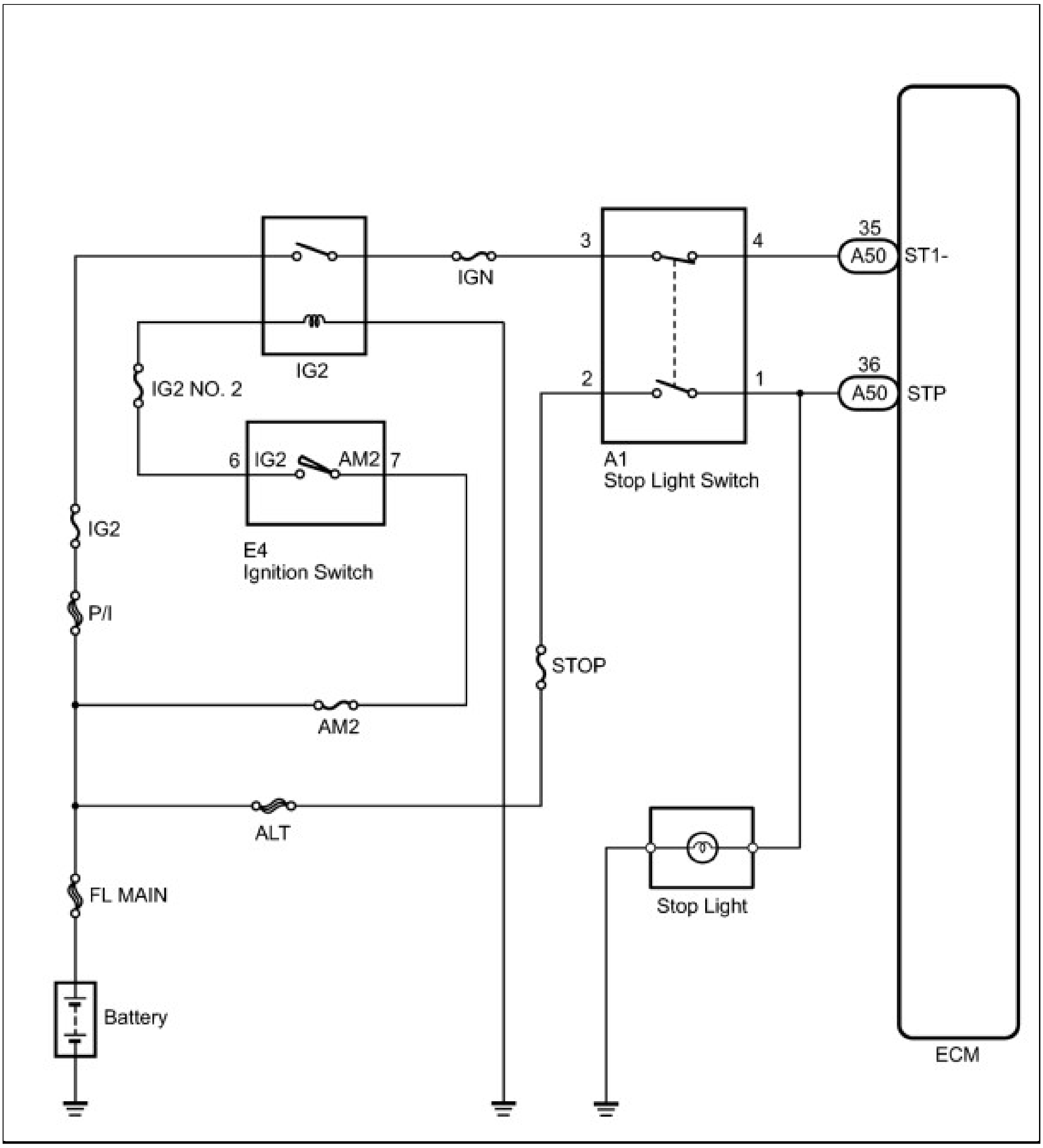
    If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- STP signal conditions can be checked using the Techstream.
    a. Connect the Techstream to the DLC3.
    b. Turn the ignition switch to ON.
    c. Turn the Techstream on.
    d. Enter the following menus: Powertrain / Engine and ECT / Stop Light Switch.

e. Check the STP signal when the brake pedal is depressed and released.

BRAKE PEDAL OPERATION	SPECIFIED CONDITION
Depressed	STP signal ON
Released	STP signal OFF

PROCEDURE

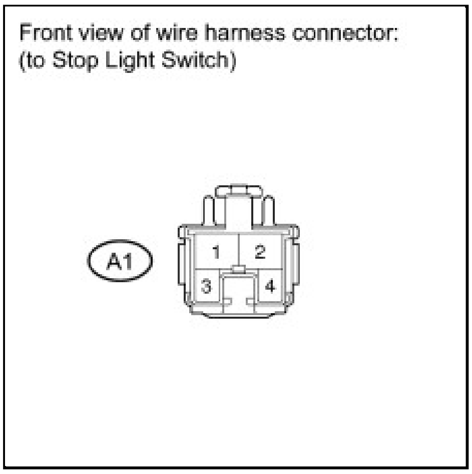
1.	INSPECT STOP LIGHT SWITCH (TERMINAL VOLTAGE)

(a) Disconnect the stop light switch connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A1-2 - Body ground	Always	11 to 14 V
A1-3 - Body ground	Ignition switch ON	11 to 14 V



(c) Reconnect the stop light switch connector.

NG ▶ **INSPECT FUSES (STOP AND IGN FUSES)**

OK

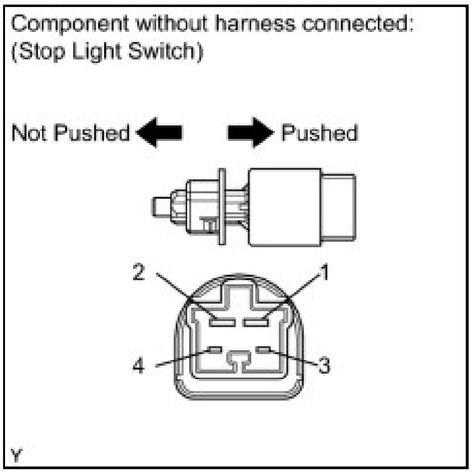
2.	INSPECT STOP LIGHT SWITCH

(a) Remove the stop light switch.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
1 - 2	Switch pin not pushed	Below 1 Ω
	Switch pin pushed	10 kΩ or higher
3 - 4	Switch pin not pushed	10 kΩ or higher
	Switch pin pushed	Below 1 Ω



(c) Reinstall the stop light switch.

NG ▶ **REPLACE STOP LIGHT SWITCH**

OK ▼

3.	**INSPECT ECM (STP AND ST1- VOLTAGE)**

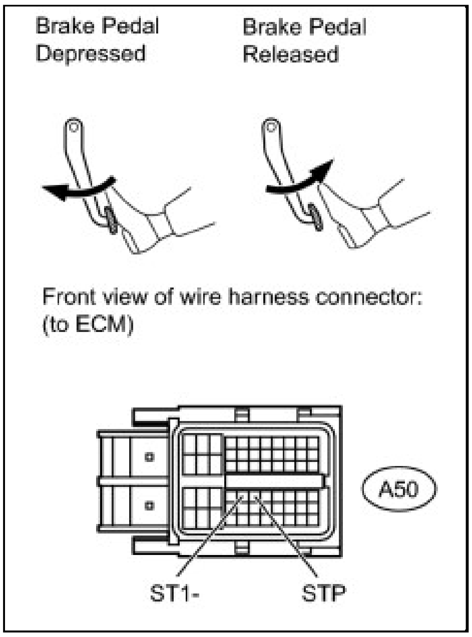
(a) Disconnect the ECM connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-35 (ST1-) - Body ground	Brake pedal released	11 to 14 V
	Brake pedal depressed	0 to 3 V



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-36 (STP) - Body ground	Brake pedal released	0 to 3 V
	Brake pedal depressed	11 to 14 V

(d) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

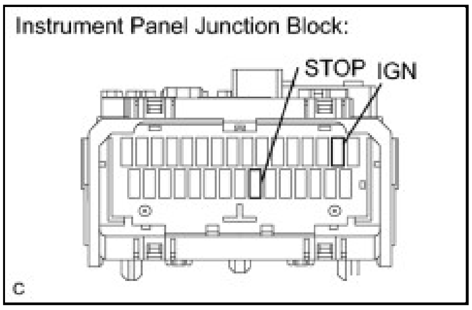
OK ▶ **REPLACE ECM**

4.	INSPECT FUSES (STOP AND IGN FUSES)

(a) Remove the STOP and IGN fuses from the instrument panel junction block.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
STOP fuse	Always	Below 1 Ω
IGN fuse		

(c) Reinstall the STOP and IGN fuses.

NG ▶ **REPLACE FUSE (STOP AND/OR IGN FUSE)**

OK ▶ **REPAIR OR REPLACE**

HARNESS OR CONNECTOR (BATTERY - STOP LIGHT SWITCH)

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000T8M09PX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0505: Idle Control System Malfunction (2010 Corolla)		

DTC	P0505	Idle Control System Malfunction

DESCRIPTION

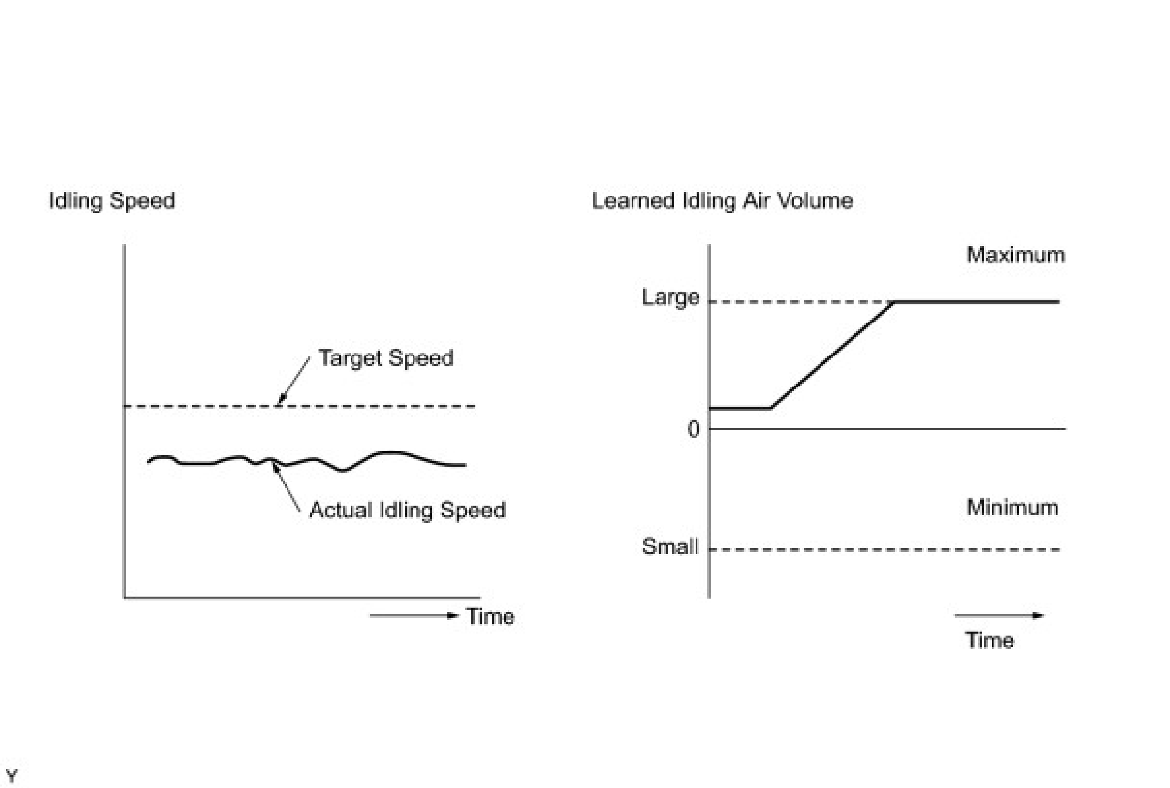
The idle speed is controlled by the electronic throttle control system. The electronic throttle control system is comprised of: 1) a one valve type throttle body; 2) a throttle actuator, which operates the throttle valve; 3) a throttle position sensor, which detects the opening angle of the throttle valve; 4) an accelerator pedal position sensor, which detects the accelerator pedal position; and 5) the ECM, which controls the electronic throttle control system. Based on the target idle speed, the ECM controls the throttle actuator to provide the proper throttle valve opening angle.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0505	idle speed continues to vary greatly from target idle speed (2 trip detection logic)	• Electronic throttle control system • Intake system • PCV hose connections • ECM

MONITOR DESCRIPTION

The ECM monitors the idle speed and idle air flow volume to conduct idle speed control. The ECM determines that the idle speed control system is malfunctioning if the following conditions apply:

- The learned idle air flow volume remains at the maximum or minimum volume 5 times or more during a drive cycle.
- After driving at a vehicle speed of 6.25 mph (10 km/h) or more, the actual engine idle speed varies from the target idle speed by less than -100 rpm or 150 rpm or more when the A/C and NSW are off, or less than -100 rpm or 200 rpm or more when the A/C or NSW are on, 5 times or more during a driving cycle, the ECM illuminates the MIL and sets the DTC.



MONITOR STRATEGY

Related DTCs	P0505: Idle speed control function
Required Sensors/Components (Main)	Electronic throttle control system
Required Sensors/Components (Related)	Crankshaft position sensor Engine coolant temperature sensor Vehicle speed sensor
Frequency of Operation	Once per driving cycle
Duration	10 minutes (Idling after warming up)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

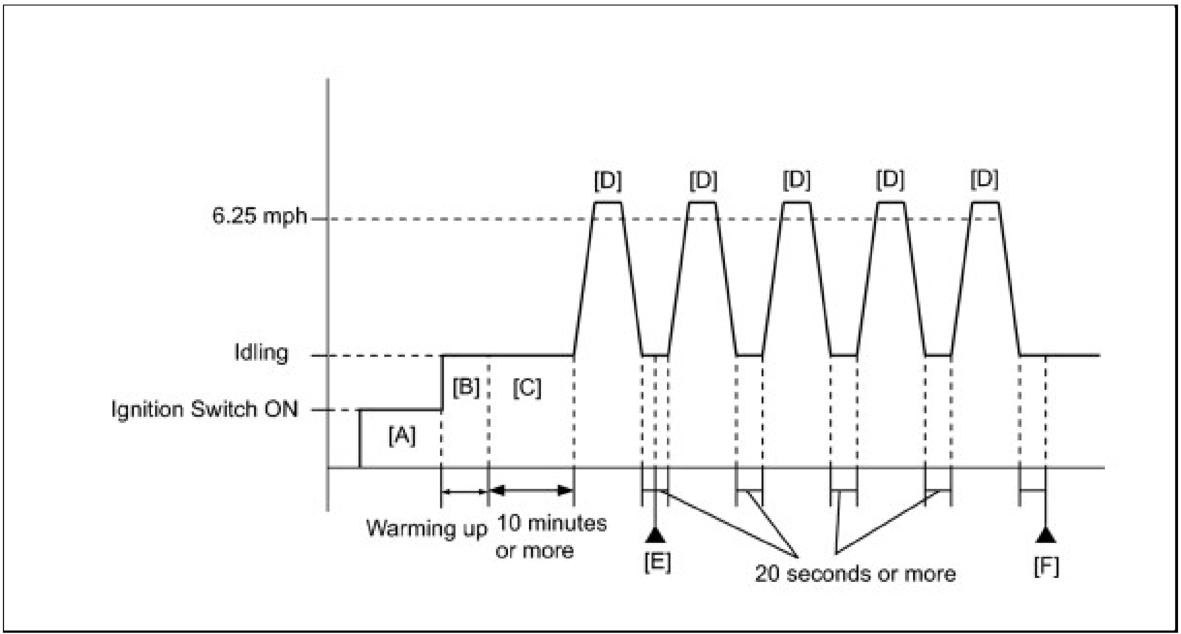
Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System bank 1- Advance) P0012 (VVT System bank 1- Retard) P0016 (VVT System bank 1- Misalignment) P0031, P0032 (Air Fuel Ratio Sensor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter)

	P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121 P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter) P0451, P0452, P0453 (EVAP System) P0500 (Vehicle Speed Sensor) P0606, P0607 (Heated Oxygen Sensor - Sensor 2) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)
Engine	Running

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) Either of the following conditions is met:	Condition A or B
A. Engine speed - target engine speed	Less than -100 rpm, or 150 rpm or more (A/C off and NSW off)
B. Engine speed - target engine speed	Less than -100 rpm, or 200 rpm or more (A/C on or NSW on)
(b) Vehicle condition	Stop after vehicle was driven by 6.25 mph (10 km/h) or more
2. Frequency that both of the following conditions (a) and (b) are met	Once
(a) Either of the following conditions is met:	Condition A or B
A. Engine speed - target engine speed	Less than -100 rpm, or 150 rpm or more (A/C off and NSW off)
B. Engine speed - target engine speed	Less than -100 rpm, or 200 rpm or more (A/C on or NSW on)
(b) Idle air control flow rate learning valve	1.1 L/sec or less, or 6.0 L/sec or more

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or more) with all the accessories switched off [B].
7. Idle the engine for 10 minutes or more [C].
8. Accelerate the vehicle to 6.25 mph (10 km/h) or more, and then idle the engine [D].
9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0505.
11. Check the DTC judgment result [E].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, repeat step [D] 4 times, allowing 20 seconds or more between each repetition, and then check the DTC judgment result [F].

12. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
13. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

14. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- The following conditions may also cause DTC P0505 to be set:
    a. The floor carpet overlapping slightly onto the accelerator pedal, causing the accelerator pedal to be slightly depressed and therefore the throttle valve position to be slightly open.
    b. The accelerator pedal being not fully released.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

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

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	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**

(a) Check PCV hose.

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

NG ▶ **REPAIR OR REPLACE PCV HOSE**

OK
▼

3.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks INFO .

OK:
No leak in intake system.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK
▼

4.	INSPECT THROTTLE BODY (THROTTLE VALVE)

(a) Check the throttle valve condition.

OK:

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

NG ▶ **REPLACE THROTTLE BODY**

OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000001BFY042X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P050A: Cold Start Idle Air Control System Performance (2010 Corolla)		

DTC	**P050A**	**Cold Start Idle Air Control System Performance**

MONITOR DESCRIPTION

This monitor will run when the engine is started at an engine coolant temperature of -10 to 50°C (14 to 122°F). The DTC can be set after the engine idles for 13 seconds (2 trip detection logic).

The DTC is designed to monitor the idle air control at cold start. When the engine is started at an engine coolant temperature of lower than 50°C (122°F), the ECM measures the accumulated mass air flow at idle. If it does not reach the specified level within 10 seconds, the ECM interprets this as a malfunction. The MIL is illuminated and a DTC is set when the malfunction is detected in consecutive driving cycles (2 trip detection logic).

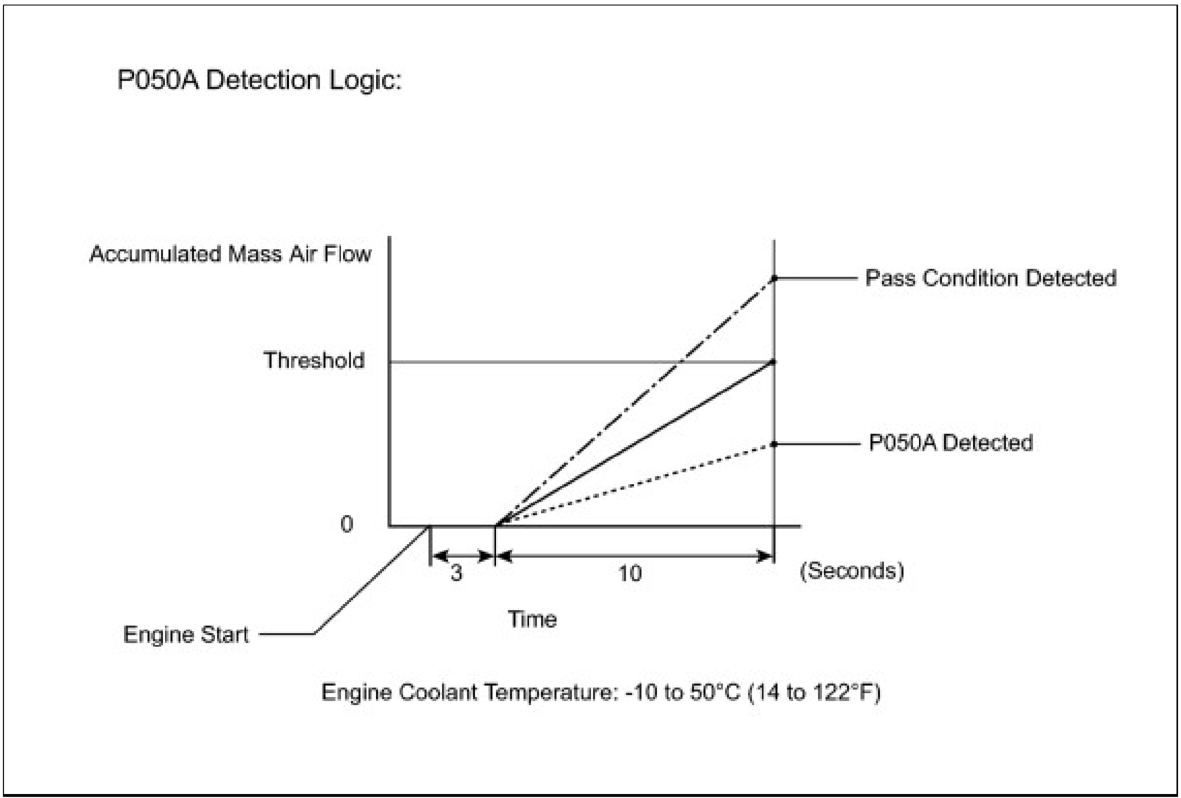
The Electronic throttle control system controls the idle speed. The electronic throttle control system operates the throttle actuator to open and close the throttle valve, and adjusts the intake air amount to achieve the target idle speed.

NOTICE:

When the negative battery terminal is disconnected during inspections or repairs, the idle speed control learning values are cleared. This DTC cannot be set with the idle speed control learning values cleared.

HINT:

The Idle speed control learning is performed when the engine is warmed up and has been idling for 5 minutes.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P050A	Insufficient mass air flow at cold start (2 trip detection logic)	• Throttle body • Mass air flow meter • PCV system • Air cleaner filter element • Intake system • VVT system • ECM

MONITOR STRATEGY

Related DTCs	P050A: Cold start idle air speed control system
Required Sensors / Components (Main)	Throttle body
Required Sensors / Components (Related)	Mass air flow meter Engine coolant temperature sensor
Frequency of Operation	Once per driving cycle
Duration	10 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

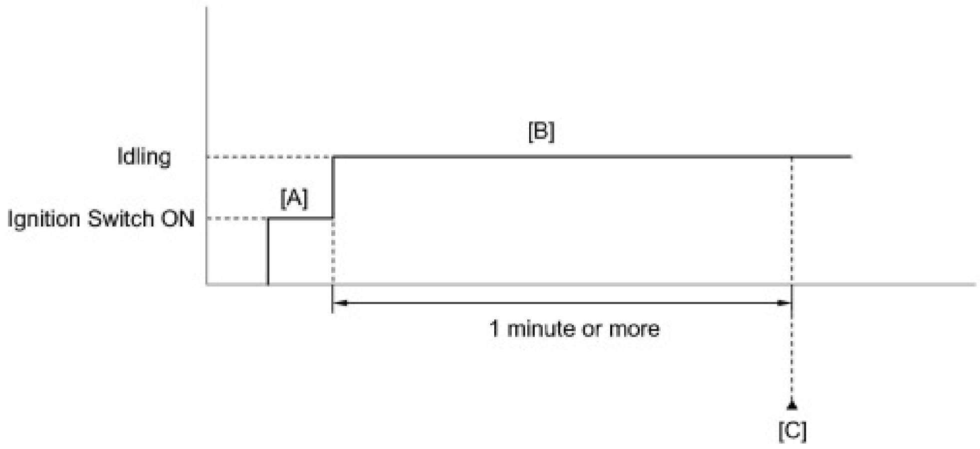
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System bank 1- Advance) P0012 (VVT System bank 1- Retard) P0016 (VVT System bank 1- Misalignment) P0102, P0103 (Mass Air Flow Meter) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121 P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter) P0500 (Vehicle Speed Sensor) P0606, P0607 (Heated Oxygen Sensor - Sensor 2) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)
Battery voltage	8 V or more
Time after engine start	3 seconds or more
Starter	OFF
Engine coolant temperature at engine start	-10°C (14°F) or more
Engine coolant temperature	-10 to 50°C (14 to 122°F)
Engine idling time	3 seconds or more
Fuel-cut	OFF
Vehicle speed	Less than 1.875 mph (3 km/h)
Atmospheric pressure	76 kPa (570 mmHg) or more

TYPICAL MALFUNCTION THRESHOLDS

Accumulated mass air flow	Varies with engine coolant temperature (Example: Less than 27.5 g)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Enter the following menus: Powertrain / Engine / Data List / All Data / Coolant Temp.
7. Check that "Coolant Temp" in the Data List are within the range of -10 to 50°C (14 to 122°F).
8. Start the engine and warm it up until the coolant temperature is the same as the coolant temperature in the freeze frame data.
9. Idle the engine for 1 minute or more [B].
10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P050A.
12. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.

- If the judgment result shows INCOMPLETE or UNKNOWN, idle the engine for 3 minutes, let the engine cool down, and then perform steps [A] through [C].

13. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
14. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

15. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

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

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P050A)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P050A	A
P050A and other DTCs	B

HINT:

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

B ▶ **GO TO DTC CHART**

A ▼

2.	**READ VALUE USING TECHSTREAM (FUEL TRIM)**

HINT:

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

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / A/F Control System / Short FT #1 and Long FT #1.

(e) Read the values displayed on the Techstream.

(f) Add together the Short FT #1 and Long FT #1 values to obtain the total Fuel Trim.

OK:
Total of Short FT #1 and Long FT #1 values is between -20% and 20%.

NG ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE OIL CONTROL VALVE)**

OK ▼

3.	**INSPECT THROTTLE BODY**

(a) Check that there are no deposits around the throttle valve.

OK:
No deposits around the throttle valve.

NG ▶ **REPAIR OR REPLACE THROTTLE BODY**

OK

4.	**REPLACE ECM**

(a) Replace ECM INFO .

NEXT ▶ **CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)**

5.	**PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE OIL CONTROL VALVE)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream ON.

(d) Warm up the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(f) Check the engine speed while operating the oil control valve using the Techstream.

OK:

TESTER OPERATION	SPECIFIED CONDITION
Oil Control Valve OFF	Normal engine speed
Oil Control Valve ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

NG ▶ **CHECK AND REPAIR VVT SYSTEM**

OK

6.	CHECK PCV SYSTEM

(a) Start the engine.

(b) Pinch the positive crankcase ventilation (PCV) hose.

(c) Check the engine rpm.

OK:
The engine rpm changes when the PCV hose is pinched.

NG ▶ **REPAIR OR REPLACE PCV SYSTEM**

OK ▼

7.	CHECK AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

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

OK:
The air cleaner filter element sub-assembly is not excessively contaminated with dirt or oil.

NG ▶ **REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

OK ▼

8.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks in the intake system.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK

9.	**REPLACE MASS AIR FLOW METER**

(a) Replace mass air flow meter INFO .

NEXT CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)

10.	**REPAIR OR REPLACE THROTTLE BODY**

(a) Clean or replace throttle body INFO .

NEXT CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)

11.	**CHECK AND REPAIR VVT SYSTEM**

HINT:

Refer to DTC P0011 Inspection Procedure INFO

NEXT CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)

12.	**REPAIR OR REPLACE PCV SYSTEM**

NEXT CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)

13.	**REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

NEXT ▶ CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)

14.	REPAIR OR REPLACE INTAKE SYSTEM

NEXT ▶ CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)

15.	CHECK WHETHER DTC OUTPUT RECURS (DTC P050A)

NOTICE:

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

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Switch the ECM from normal mode to check mode using the Techstream INFO .

(f) Start the engine and idle it for one minute.

OK:

Stable fast idle

(g) Read DTCs.

OK:

No DTC is output.

NEXT ▶ END

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000T8P0D4X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0560: System Voltage (2010 Corolla)		

DTC	**P0560**	**System Voltage**

MONITOR DESCRIPTION

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

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0560	Open in ECM back up power source circuit (1 trip detection logic)	• Open in back up power source circuit • Battery • Battery terminals • EFI MAIN fuse • ECM

HINT:

If DTC P0560 is set, the ECM does not store other DTCs or the data stored in the ECM may be partly erased.

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 illuminated after next engine start)
Sequence of Operation	None

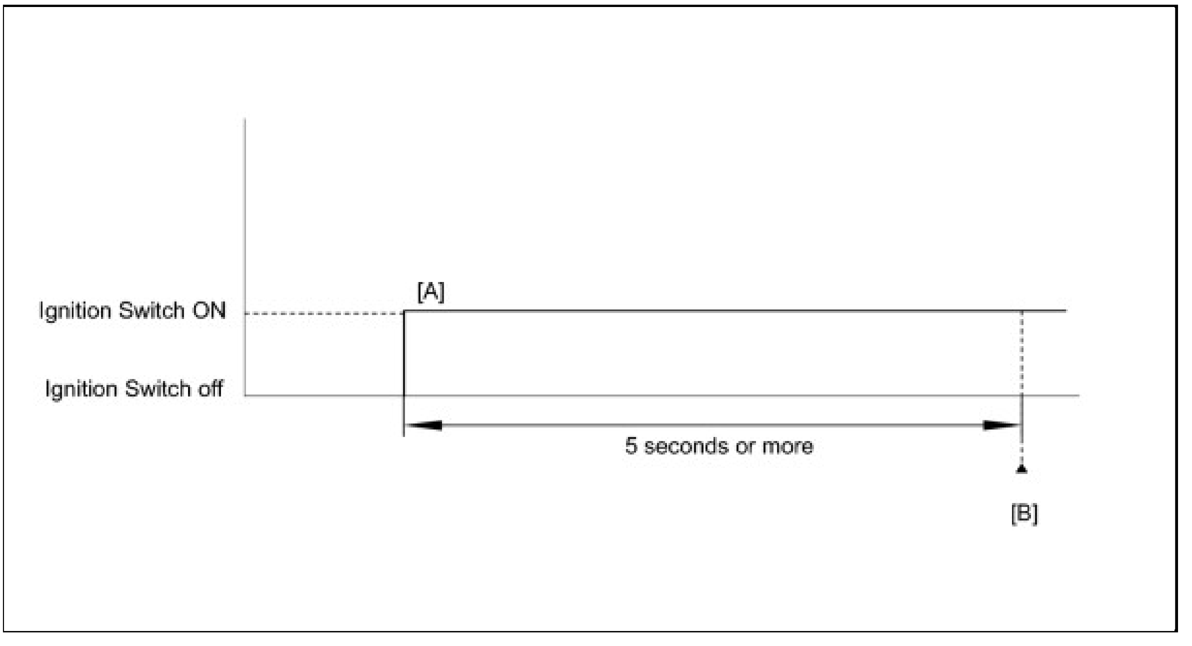
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

ECM power source	Less than 3.5 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 5 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0560.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling

TECHSTREAM DISPLAY	DESCRIPTION
	conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

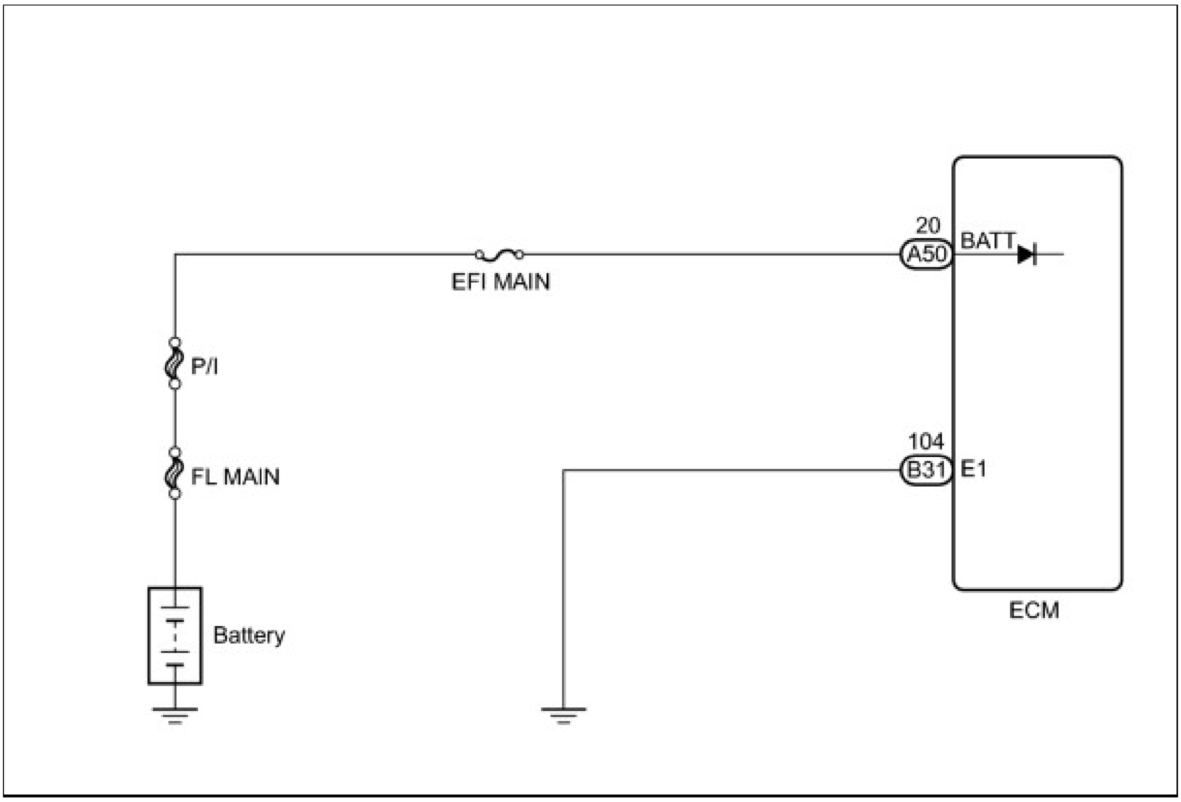
If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

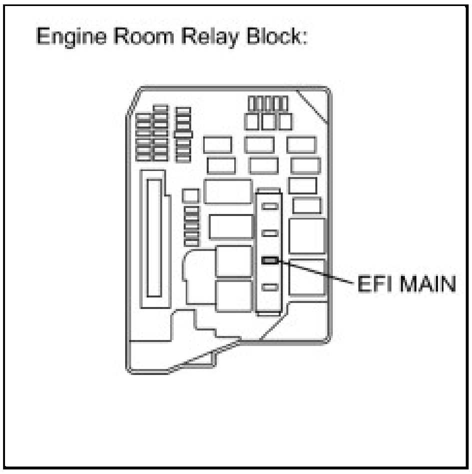
1.	**INSPECT FUSE (EFI MAIN)**

(a) Remove the EFI MAIN fuse from the engine room relay block.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION



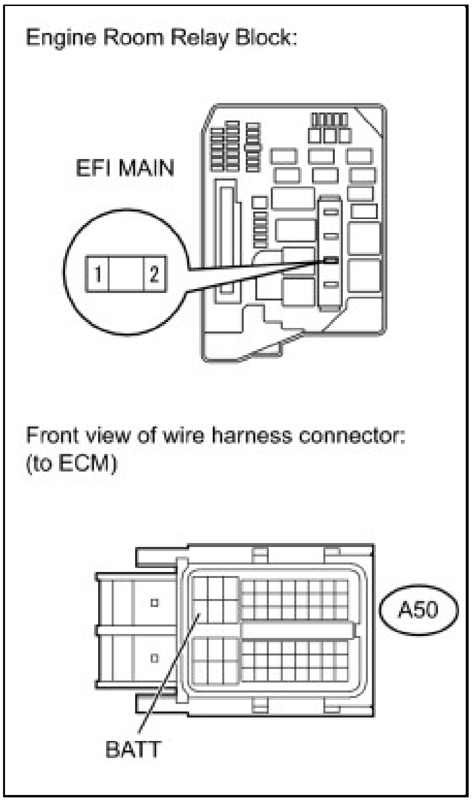
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN Fuse	Always	Below 1 Ω

(c) Reinstall the EFI MAIN fuse.

NG ▶ **REPLACE FUSE (EFI MAIN)**

OK ▼

2.	CHECK HARNESS AND CONNECTOR (ECM - EFI MAIN FUSE - BATTERY)



(a) Disconnect the negative battery terminal.

(b) Disconnect the positive battery terminal.

(c) Remove the EFI MAIN fuse from the engine room relay block.

(d) Disconnect the ECM connector.

(e) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN fuse (2) - A50-20 (BATT)	Always	Below 1 Ω
Battery positive terminal - EFI MAIN fuse (1)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN fuse (2) or	Always	10 kΩ or higher

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-20 (BATT) - Body ground		
Battery positive terminal or EFI MAIN fuse (1) - Body ground	Always	10 kΩ or higher

(f) Reinstall the EFI MAIN fuse.

(g) Reconnect the ECM connector.

(h) Reconnect the positive battery terminal.

(i) Reconnect the negative battery terminal.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - EFI MAIN FUSE - BATTERY)**

OK ▼

3.	INSPECT BATTERY

(a) Check that the battery is not discharged or weak.

OK:
Battery is not discharged or weak

NG ▶ **CHARGE OR REPLACE BATTERY**

OK ▼

4.	CHECK BATTERY TERMINAL

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

OK:

Battery terminals are not loose or corroded

NG ▶ **REPAIR OR REPLACE BATTERY TERMINAL**

OK ▼

5.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch to OFF and turn the Techstream OFF.

(f) Start the engine and turn the Techstream ON.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

Result:

RESULT	PROCEED TO
P0560	A
No output	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000002KQO02ZX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0604: Random Access Memory (RAM) (2010 Corolla)		

DTC	**P0604**	**Random Access Memory (RAM)**

MONITOR DESCRIPTION

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

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0604	ECM RAM errors	ECM

MONITOR STRATEGY

Related DTCs	P0606: ECM RAM error
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	None
Frequency of operation	Continuous
Duration	6 times
MIL operation	Immediate
Sequence of operation	None

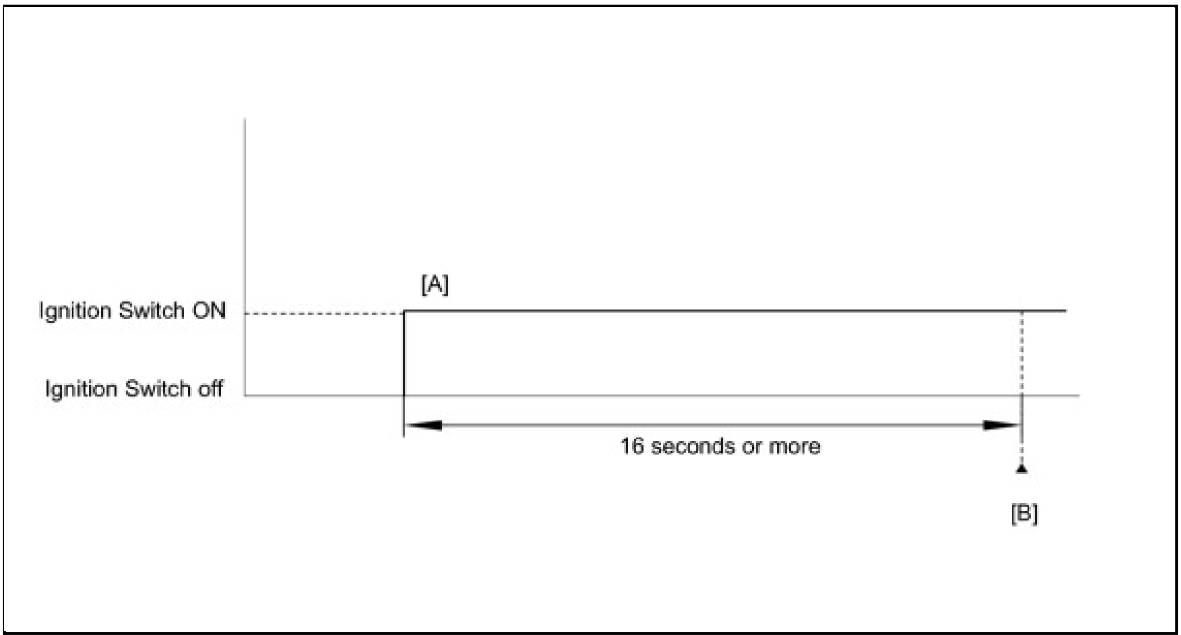
TYPICAL ENABLING CONDITIONS

None	-

TYPICAL MALFUNCTION THRESHOLDS

Main CPU and sub CPU mirroring	Fail

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 16 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0604.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**READ OUTPUT DTC (DTC P0604)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTC .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(m) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC is not output	A
DTC P0604 is output	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000003242024X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0606: ECM / PCM Processor (2010 Corolla)		

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

MONITOR DESCRIPTION

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

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0606	• ECM main CPU error • ECM sub CPU error • Cruise control cancel circuit malfunction	ECM

MONITOR STRATEGY

Related DTC	P0606: ECM range check
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	16 seconds
MIL Operation	Immediate
Sequence of Operation	None

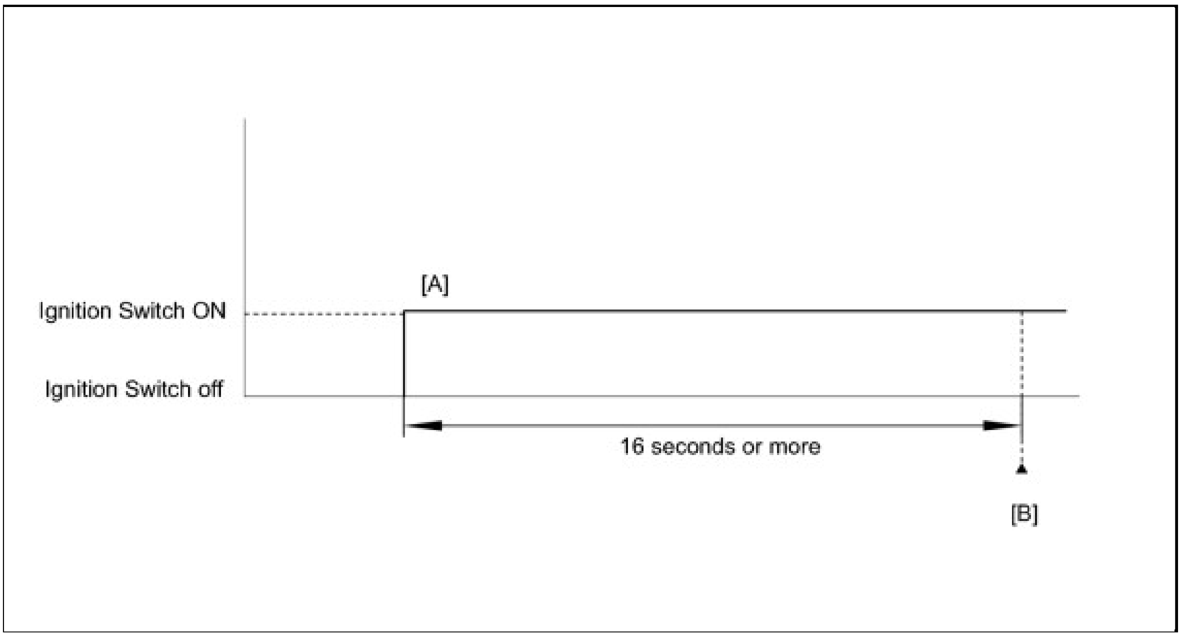
TYPICAL ENABLING CONDITIONS

Monitor runs whenever the following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

CPU reset	Occurred

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 16 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0606.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	**READ OUTPUT DTC (DTC P0606)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(m) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC is not output	A
DTC P0606 is output	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000002I3S03ZX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0607: Control Module Performance (2010 Corolla)		

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

MONITOR DESCRIPTION

The ECM continuously monitors its internal processors (CPUs) and Heated Oxygen (HO2) sensor transistors. This self-check ensures that the ECM is functioning properly.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0607	• ECM CPUs malfunction • Heated Oxygen (HO2) sensor transistors (built into ECM) malfunction	• ECM • Heated oxygen sensor • Exhaust gas leak
	For Mexico models: ECM CPU error	• ECM

MONITOR STRATEGY

Related DTCs	None
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	Heated oxygen sensor
Frequency of operation	Continuous
Duration	60 seconds
MIL operation	Immediate
Sequence of operation	None

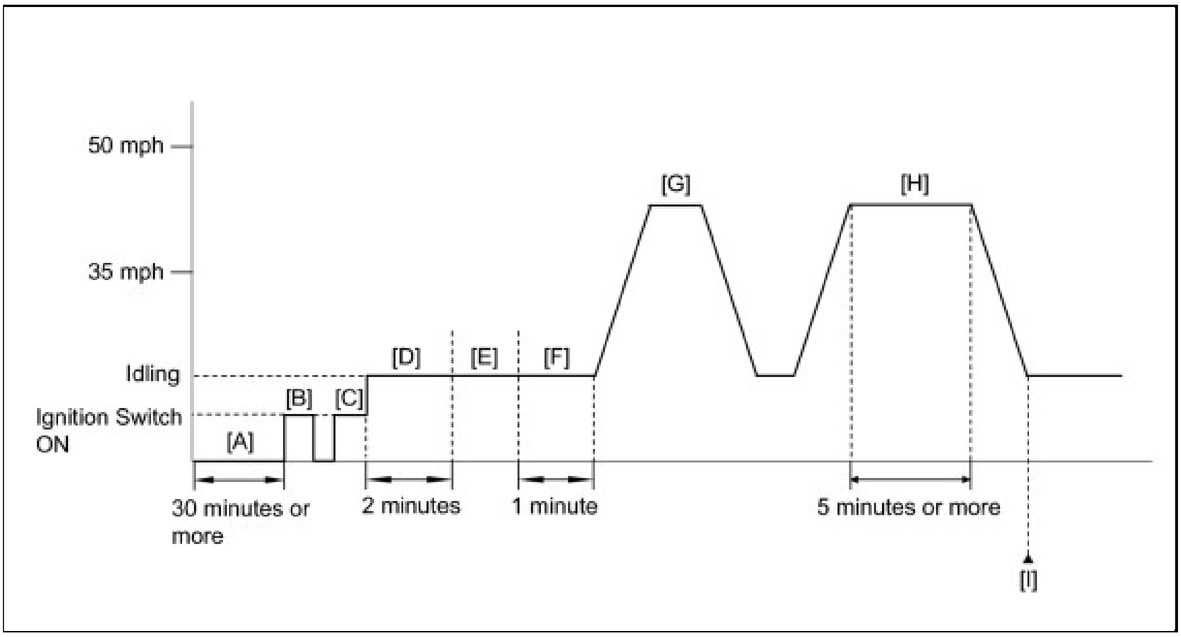
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
Engine	Running
Estimated HO2 sensor temperature	450 to 800°C (842 to 1472°F)

TYPICAL MALFUNCTION THRESHOLDS

HO2 sensor transistors	Fail

CONFIRMATION DRIVING PATTERN



1. Stop the engine for 30 minutes or more [A].
2. Connect the Techstream to the DLC3.
3. Turn the ignition switch to ON and turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO [B].
5. Turn the ignition switch off.
6. Turn the ignition switch to ON and turn the Techstream on [C].
7. Start the engine, and wait 2 minutes [D].
8. Warm up the engine until the engine coolant temperature is 75°C (167°F) or higher [E].
9. Idle the engine for 1 minute [F].
10. Accelerate the vehicle to 50 mph (80 km/h) and stop the vehicle [G].
11. Drive the vehicle at 35 to 50 mph (56 to 80 km/h) for 5 minutes or more [H].
12. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
13. Input the DTC: P0607, P0136, P0137 or P0138.
14. Check the DTC judgment result [I].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal

TECHSTREAM DISPLAY	DESCRIPTION
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [D] through [H].

15. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
16. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

17. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT

(a) Connect the Techstream to the DLC3.

(b) Turn the engine switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs .

Result:

RESULT	PROCEED TO
DTC P0607 and P0136, P0137 or P0138 are output	A
DTC P0607 is output	B

B **CHECK FOR EXHAUST GAS LEAK**

A

2.	**INSPECT DTC (P0136, P0137 OR P0138)**

(a) Inspect the P0136, P0137 or P0138 flowchart.

HINT:

- If P0136 is output, troubleshoot for that DTC first . Then proceed to "INSPECT ECM".
- If P0137 is output, troubleshoot for that DTC first . Then proceed to "INSPECT ECM".
- If P0138 is output, troubleshoot for that DTC first . Then proceed to "INSPECT ECM".
- If DTC P0607 and P0136, P0137 or P0138 are output, the output voltage of the heated oxygen sensor may remain close to 0 V or become high (around 1 V or more).

NEXT **INSPECT ECM**

3.	**CHECK FOR EXHAUST GAS LEAK**

(a) Allow the engine to idle and rev the engine.

(b) Check for exhaust gas leaks around the heated oxygen sensor.

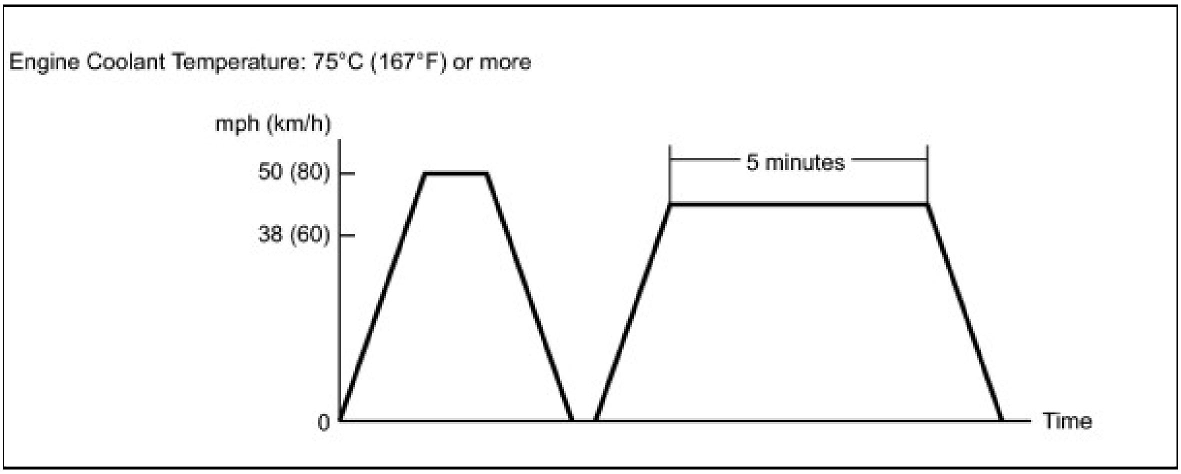
If any exhaust gas leaks are present, repair it and proceed to "PERFORM CONFIRMATION DRIVING PATTERN". If no exhaust gas leaks are present, proceed to "PERFORM CONFIRMATION DRIVING PATTERN".

HINT:

- If no exhaust gas leaks are present, a malfunction in the heated oxygen sensor circuit is suspected.
- If any exhaust gas leaks are present around the heated oxygen sensor, noise appears in the output voltage of the heated oxygen sensor.

NEXT

4.	PERFORM CONFIRMATION DRIVING PATTERN



(a) Clear the DTC INFO .

(b) Connect the Techstream to the DLC3.

(c) Start the engine.

(d) Turn the Techstream on.

(e) Warm up the engine until the engine coolant temperature becomes 75° (167°F) or more.

(f) Perform the driving pattern.

(1) Accelerate the vehicle until 50 mph (80 km/h) and stop the vehicle.

(2) Drive the vehicle by 38 to 50 mph (60 to 80 km/h) for 5 minutes or more.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result:

RESULT	PROCEED TO

RESULT	PROCEED TO
DTC P0607 and P0136, P0137 or P0138 are output	A
DTC P0607 is output	B
DTC is not output	C

C ▶ **INSPECT ECM**

B ▶ **REPLACE ECM**

A

▼

5.	INSPECT DTC (P0136, P0137 OR P0138)

(a) Inspect the P0136, P0137 or P0138 flowchart.

HINT:

- If P0136 is output, troubleshoot for that DTC first INFO . Then proceed to "INSPECT ECM".
- If P0137 is output, troubleshoot for that DTC first INFO . Then proceed to "INSPECT ECM".
- If P0138 is output, troubleshoot for that DTC first INFO . Then proceed to "INSPECT ECM".
- If DTC P0607 and P0136, P0137 or P0138 are output, the output voltage of the heated oxygen sensor may remain close to 0 V or become high (around 1 V or more).

NEXT

▼

6.	INSPECT ECM

(a) Clear the DTC INFO .

(b) Stop the engine and wait for 30 minutes.

(c) Connect the Techstream to the DLC3.

(d) Start the engine and allow it to idle for 2 minutes.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(g) Read the DTCs INFO .

Result:

RESULT	PROCEED TO
DTC is not output	A
DTC P0607 is output	B

B ▶ **REPLACE ECM**

A ▶ **END**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000TA00E2X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0617: Starter Relay Circuit High (2010 Corolla)		

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

MONITOR DESCRIPTION

While the engine is being cranked, battery voltage is applied to terminal STA of the ECM. If the ECM detects the starter (STA) signal while the vehicle is being driven, it determines that there is a malfunction in the STA circuit. The ECM then illuminates the MIL and sets the DTC.

This monitor runs when the vehicle is driven at 12.4 mph (20 km/h) for over 20 seconds.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0617	When conditions (a), (b) and (c) are met, positive (+B) battery voltage 10.5 V or more applied to ECM for 20 seconds (1 trip detection logic) • (a) Vehicle speed 12.4 mph (20 km/h) or more • (b) Engine speed 1000 rpm or more • (c) STA signal ON	• Park/neutral position switch or clutch pedal switch • ST relay circuit • Ignition switch • ECM

MONITOR STRATEGY

Related DTCs	P0617: Starter signal
Required Sensors/Components (Main)	ST relay Park/neutral position switch Ignition switch
Required Sensors/Components (Related)	Vehicle Speed Sensor Crankshaft position sensor
Frequency of Operation	Continuous
Duration	20 seconds
MIL Operation	Immediate
Sequence of Operation	None

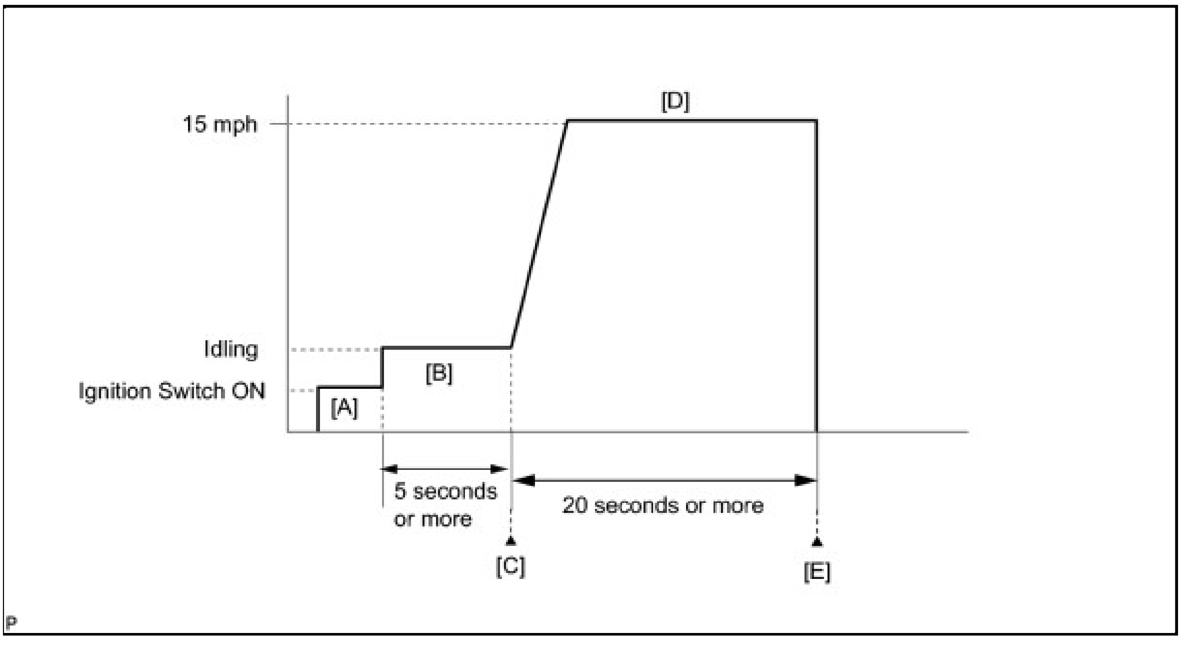
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Battery voltage	10.5 V or more
Vehicle speed	12.4 mph (20 km/h) or more
Engine speed	1000 rpm or more

TYPICAL MALFUNCTION THRESHOLDS

Starter signal	ON

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Idle the engine for 5 minutes or more [B].
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0617.
9. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed

TECHSTREAM DISPLAY	DESCRIPTION
	System normal
ABNORMAL	DTC judgment completed System abnormal
INCOMPLETE	DTC judgment not completed Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	Unable to perform DTC judgment Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [D] and [E].

10. Drive the vehicle at 15 mph (24 km/h) or more for 20 seconds or more [D].
11. Check the DTC judgment result [E].
12. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
13. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

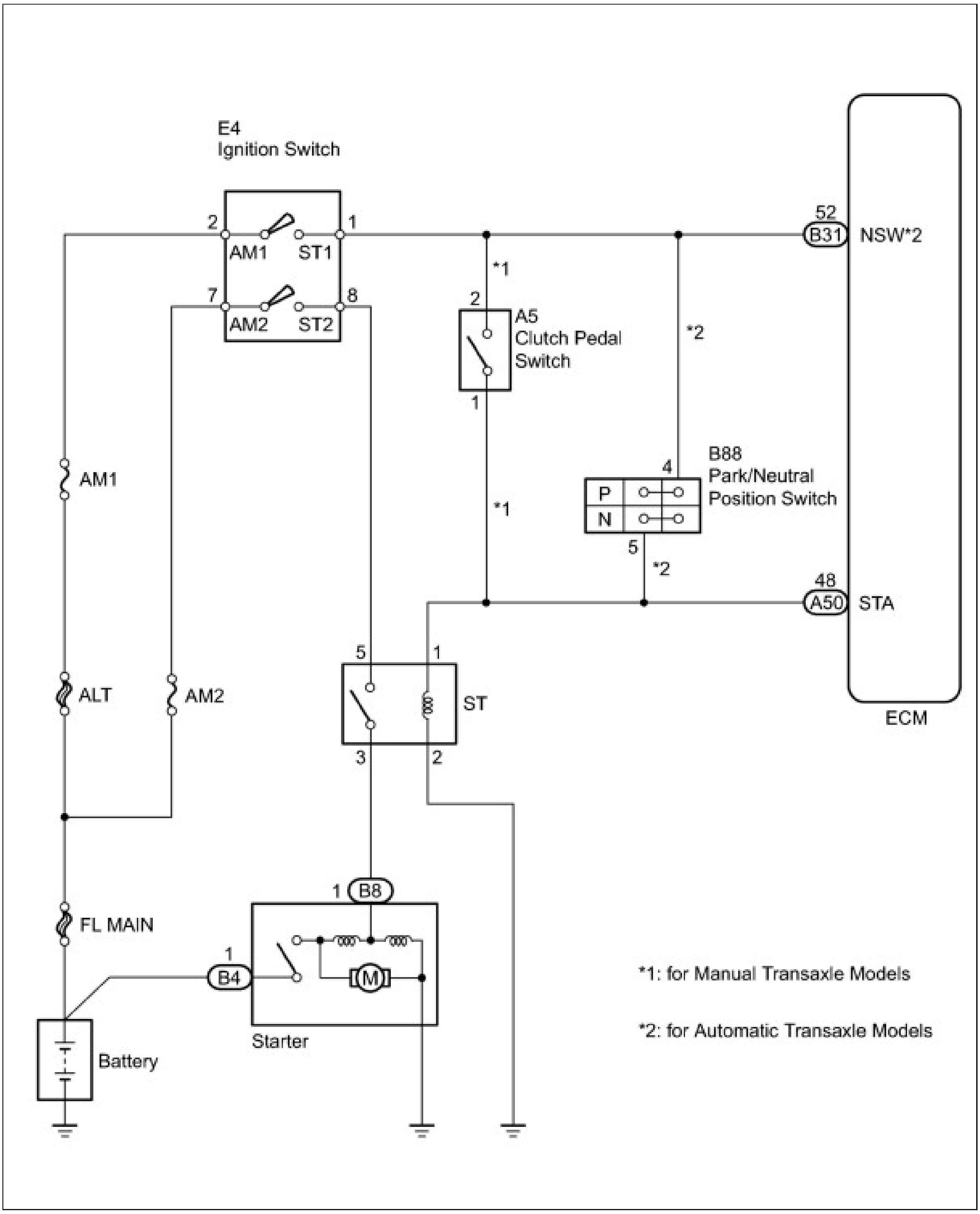
14. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

For the detail of the park/neutral position switch circuit, refer to the DTC P0705 INFO .



INSPECTION PROCEDURE

HINT:

- The following troubleshooting flowchart is based on the premise that the engine cranks normally.

  If the engine will not crank, proceed to the problem symptoms table INFO .
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine

was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Starter Signal.

(e) Check the value displayed on the Techstream when the ignition switch is turned to the ON and START positions.

OK:

IGNITION SWITCH POSITION	STARTER SIGNAL
ON	OFF
START	ON

Result:

RESULT	PROCEED TO
OK	A
NG (Manual transaxle Model)	B
NG (Automatic transaxle Model)	C

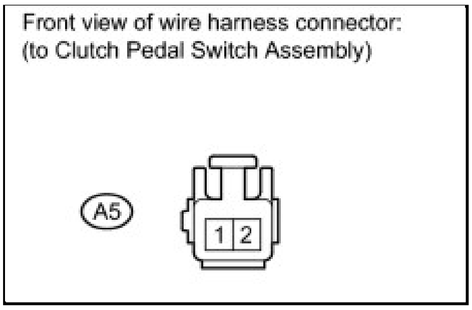
C ▶ **READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

B ▶ **READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	**READ VALUE USING TECHSTREAM (STARTER SIGNAL)**

(a) Disconnect the clutch pedal switch connector.



(b) Connect Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Starter Signal.

(f) Check the value displayed on the Techstream when the ignition switch is turned to ON.

Result:

STARTER SIGNAL	PROCEED TO
Remains ON	A
OFF	B

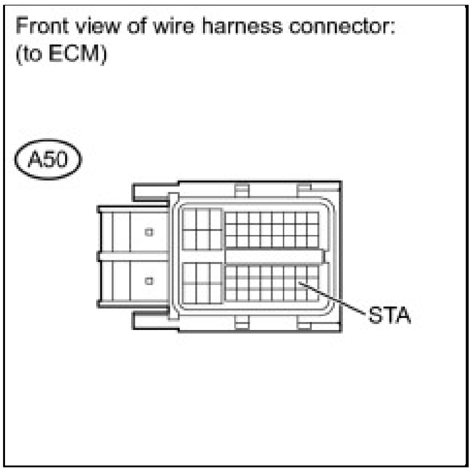
(g) Reconnect the clutch pedal switch connector.

B INSPECT CLUTCH PEDAL SWITCH

A

3.	INSPECT ECM (STA TERMINAL VOLTAGE)

(a) Disconnect the clutch pedal switch or the park/neutral position switch connector.



(b) Disconnect the ECM connector.

(c) Turn the ignition switch to ON.

(d) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION	PROCEED TO
STA (A50-48) - Body ground	Ignition switch ON	11 to 14 V	A
		Below 1.5 V	B

(e) Reconnect the clutch pedal switch or the park/neutral position switch connector.

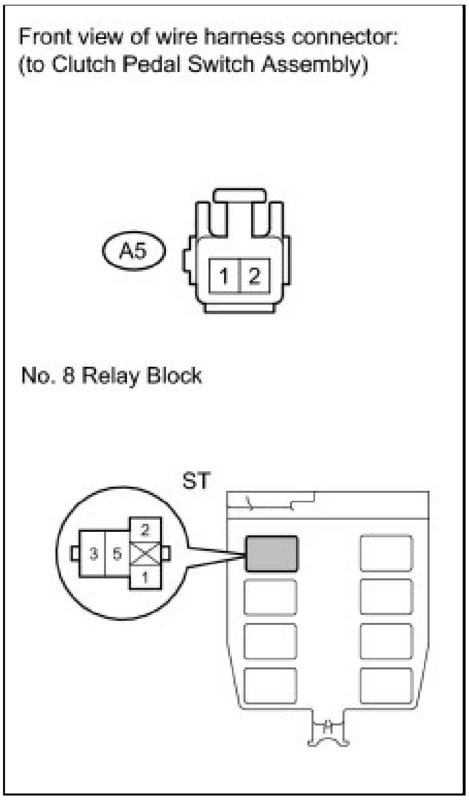
(f) Reconnect the ECM connector.

B ▶ **REPLACE ECM**

A ▼

4.	CHECK HARNESS AND CONNECTOR (CLUTCH PEDAL SWITCH - ST RELAY)

(a) Disconnect the clutch pedal switch connector.



(b) Remove the ST relay from the No. 8 relay block.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
ST Relay terminal 1 - A5-1	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
ST Relay terminal 1 or A5-1 - Body ground	Always	10 kΩ or higher

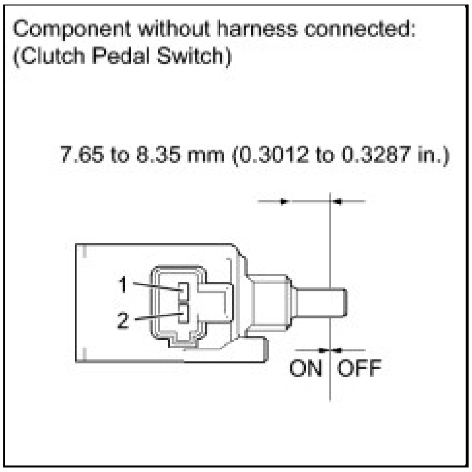
(d) Reconnect the clutch pedal switch connector.

(e) Reinstall the ST relay.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (CLUTCH PEDAL SWITCH - ST RELAY)**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - CLUTCH PEDAL SWITCH)**

5.	INSPECT CLUTCH PEDAL SWITCH



(a) Disconnect the clutch pedal switch connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
1 - 2	OFF (free)	10 kΩ or higher

Result:

RESULT	PROCEED TO
Outside standard range	A
Within standard range	B

(c) Reconnect the clutch pedal switch connector.

B ▶ **INSPECT IGNITION SWITCH**

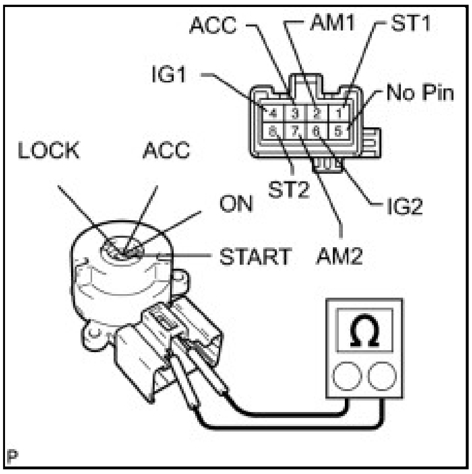
A
▼

6.	REPLACE CLUTCH PEDAL SWITCH

(a) Replace the clutch pedal switch INFO .

NEXT

7.	**INSPECT IGNITION SWITCH**



(a) Remove the ignition switch.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

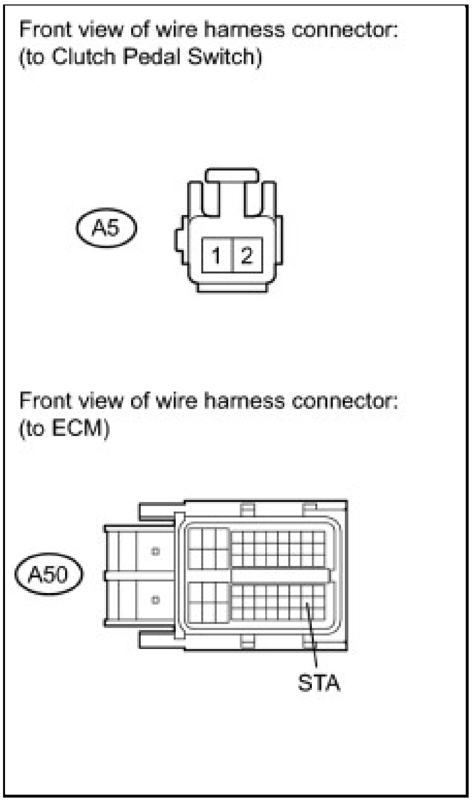
TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
All Terminals	LOCK	10 kΩ or higher
2 (AM1) - 3 (ACC)	ACC	Below 1 Ω
2 (AM1) - 3 (ACC) - 4 (IG1)	ON	
7 (AM2) - 6 (IG2)		
2 (AM1) - 4 (IG1) - 1 (ST1)	START	
7 (AM2) - 6 (IG2) - 8 (ST2)		

(c) Reinstall the ignition switch.

NG REPLACE IGNITION SWITCH

OK

8.	CHECK HARNESS AND CONNECTOR (CLUTCH PEDAL SWITCH - ECM)



(a) Disconnect the ECM connector.

(b) Disconnect the clutch pedal switch connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A5-1 - A50-48 (STA)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A5-1 or A50-48 (STA) - Body ground	Always	10 kΩ or higher

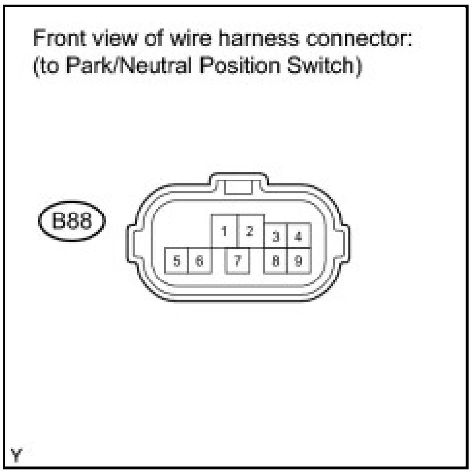
(d) Reconnect the ECM connector.

(e) Reconnect the clutch pedal switch connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (CLUTCH PEDAL SWITCH - ECM)**

OK REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION SWITCH - CLUTCH PEDAL SWITCH)

9.	READ VALUE USING TECHSTREAM (STARTER SIGNAL)



(a) Disconnect the park/neutral position switch connector.

(b) Connect Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Starter Signal.

(f) Check the value displayed on the Techstream when the ignition switch is turned to ON.

Result:

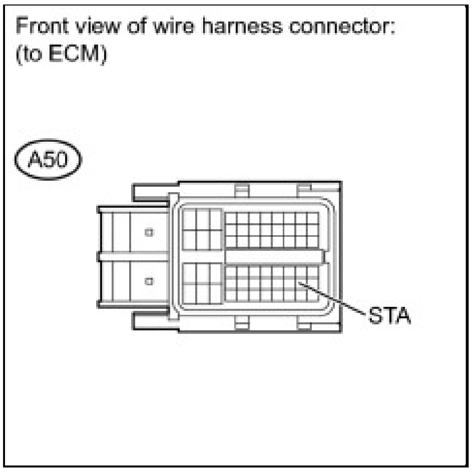
STARTER SIGNAL	PROCEED TO
Remains ON	A
OFF	B

(g) Reconnect the park/neutral position switch connector.

B INSPECT PARK/NEUTRAL POSITION SWITCH

A

10.	**INSPECT ECM (STA TERMINAL VOLTAGE)**



(a) Disconnect the clutch pedal switch or the park/neutral position switch connector.

(b) Disconnect the ECM connector.

(c) Turn the ignition switch to ON.

(d) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION	PROCEED TO
STA (A50-48) - Body ground	Ignition switch ON	11 to 14 V	A
		Below 1.5 V	B

(e) Reconnect the clutch pedal switch or the park/neutral position switch connector.

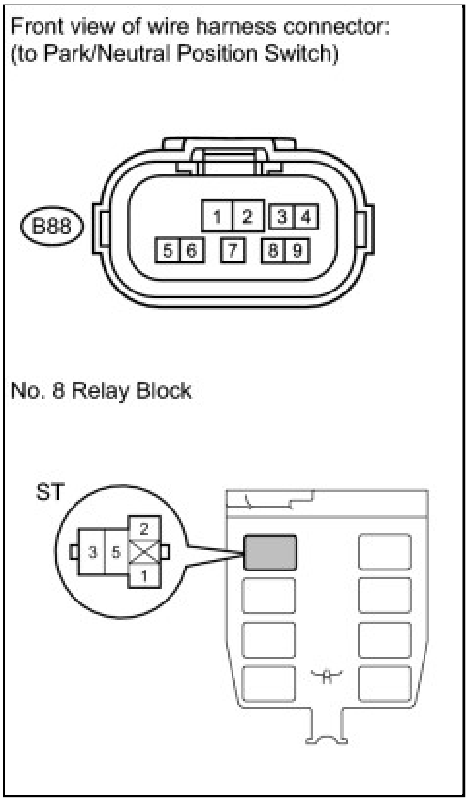
(f) Reconnect the ECM connector.

B **REPLACE ECM**

A

11.	**CHECK HARNESS AND CONNECTOR (PARK/NEUTRAL POSITION SWITCH - ST RELAY)**

(a) Disconnect the park/neutral position switch connector.



(b) Remove the ST relay from the No. 8 relay block.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B88-5 - ST Relay terminal 1	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B88-5 or ST Relay terminal 1 - Body ground	Always	10 kΩ or higher

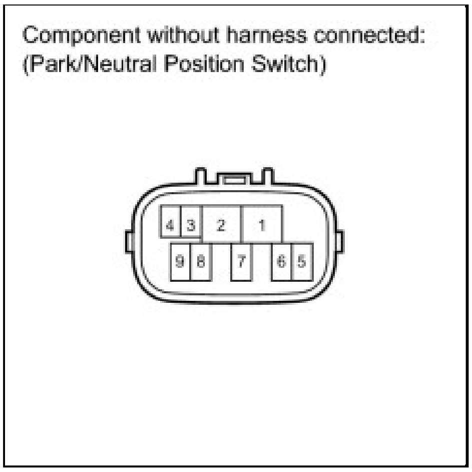
(d) Reconnect the park/neutral position switch connector.

(e) Reinstall the ST relay.

NG **REPAIR OR REPLACE HARNESS OR CONNECTOR (PARK/NEUTRAL POSITION SWITCH - ST RELAY)**

OK **REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - PARK/NEUTRAL POSITION SWITCH)**

12.	INSPECT PARK/NEUTRAL POSITION SWITCH



(a) Disconnect the park/neutral position switch connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
4 - 5	Shift lever position except P and N	10 kΩ or higher
2 - 5	All shift lever positions (P, R, N, D and S)	10 kΩ or higher

Result:

RESULT	PROCEED TO
Outside standard range	A
Within standard range	B

(c) Reconnect the park/neutral position switch connector.

B ▶ REPLACE PARK/NEUTRAL POSITION SWITCH

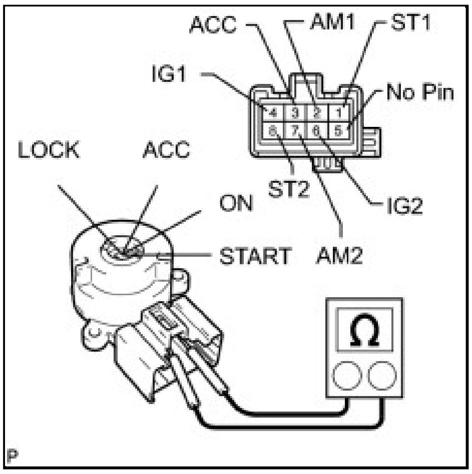
A ▼

13.	REPLACE PARK/NEUTRAL POSITION SWITCH

(a) Replace the park/neutral position switch INFO .

NEXT

14. INSPECT IGNITION SWITCH



(a) Remove the ignition switch.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

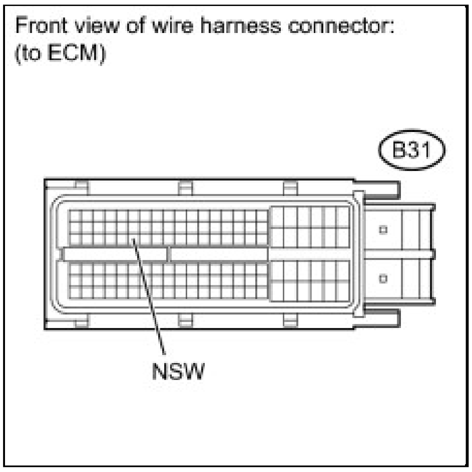
TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
All Terminals	LOCK	10 kΩ or higher
2 (AM1) - 3 (ACC)	ACC	Below 1 Ω
2 (AM1) - 3 (ACC) - 4 (IG1)	ON	
7 (AM2) - 6 (IG2)		
2 (AM1) - 4 (IG1) - 1 (ST1)	START	
7 (AM2) - 6 (IG2) - 8 (ST2)		

(c) Reinstall the ignition switch.

NG **REPLACE IGNITION SWITCH**

OK

15.	INSPECT ECM (NSW TERMINAL VOLTAGE)



(a) Disconnect the park/neutral position switch connector.

(b) Disconnect the ECM connector.

(c) Turn the ignition switch to ON.

(d) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION	PROCEED TO
NSW (B31-52) - Body ground	Ignition switch ON	11 to 14 V	A
		Below 1.5 V	B

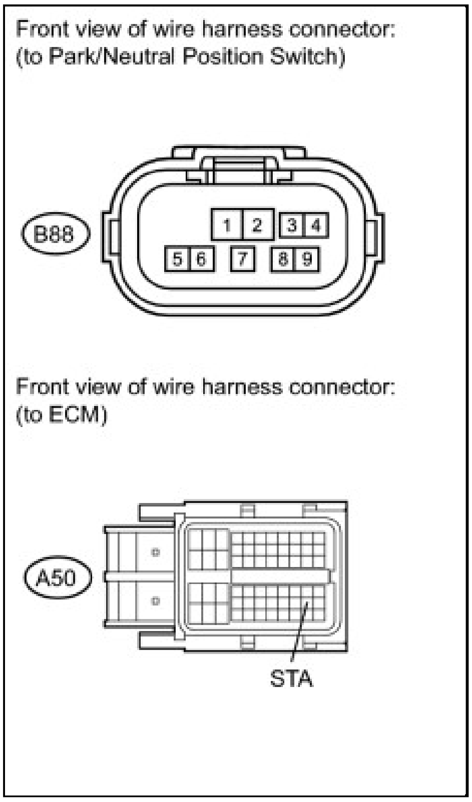
(e) Reconnect the park/neutral position switch connector.

(f) Reconnect the ECM connector.

B ▶ **REPLACE ECM**

A

16.	CHECK HARNESS AND CONNECTOR (PARK/NEUTRAL POSITION SWITCH - ECM)



(a) Disconnect the park/neutral position switch connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B88-5 or A50-48 (STA) - Body ground	Always	10 kΩ or higher

(d) Reconnect the park/neutral position switch connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (PARK/NEUTRAL POSITION SWITCH - ECM)**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION SWITCH - PARK/NEUTRAL POSITION SWITCH)**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000002Z1R020X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P060A: Internal Control Module Monitoring Processor Performance (2010 Corolla)		

DTC	**P060A**	**Internal Control Module Monitoring Processor Performance**

MONITOR DESCRIPTION

The main CPU and sub CPU of the ECM communicate with each other. The main CPU monitors the communications and WDC pulses from the sub CPU. When the signal malfunctions below are detected, the DTC is stored.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P060A	ECM sub CPU error	ECM

MONITOR STRATEGY

Related DTCs	P060A: ECM CPU error
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	16 seconds
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

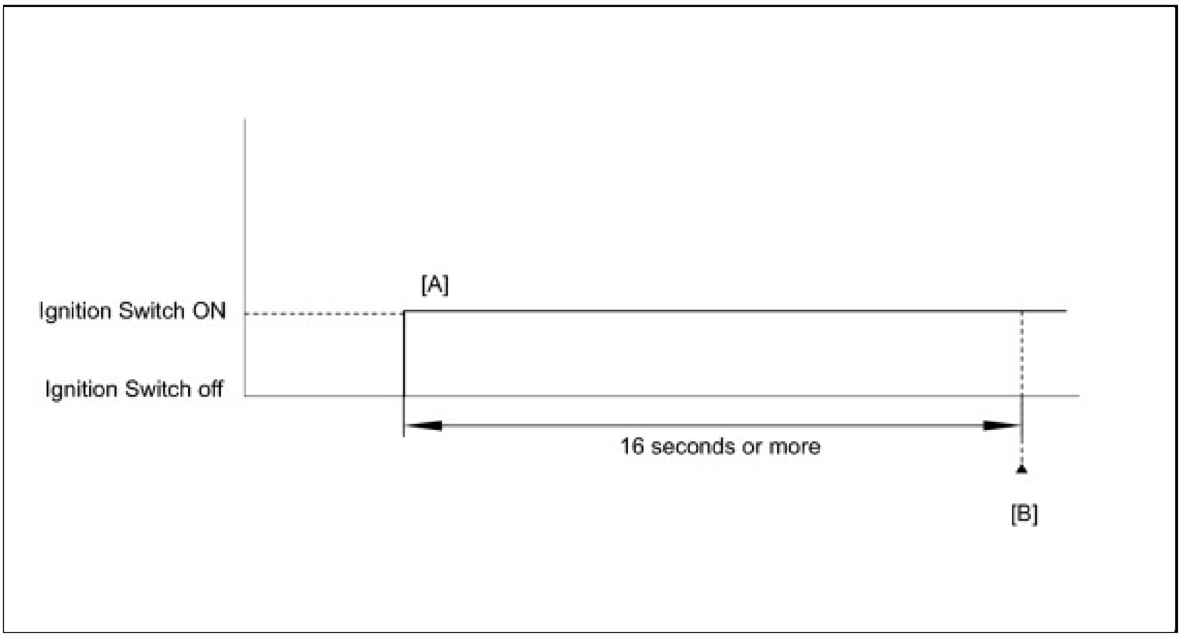
None	-

TYPICAL MALFUNCTION THRESHOLDS

When either condition below is met:	Condition 1 or 2
1. When all conditions below are met:	-
- CPU reset	1 time or more

- Learned throttle position - Learned accelerator pedal position	0.4 V or more
- Electronic throttle actuator	OFF
2. CPU reset	2 times or more

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 16 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P060A.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling

TECHSTREAM DISPLAY	DESCRIPTION
	conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	READ OUTPUT DTC (DTC P060A)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(m) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P060A	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000002Z1S03CX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P060D: Internal Control Module Accelerator Pedal Position Performance (2010 Corolla)		

DTC	**P060D**	**Internal Control Module Accelerator Pedal Position Performance**

MONITOR DESCRIPTION

The ECM monitors the input signals of the Accelerator Pedal Position (APP) sensor No. 1. When the input signals and control signals deviate, the DTC is stored.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P060D	ECM main CPU error	ECM

MONITOR STRATEGY

Related DTCs	P060D: Internal control module, Accelerator pedal position
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	1 second
MIL operation	Immediate
Sequence of operation	None

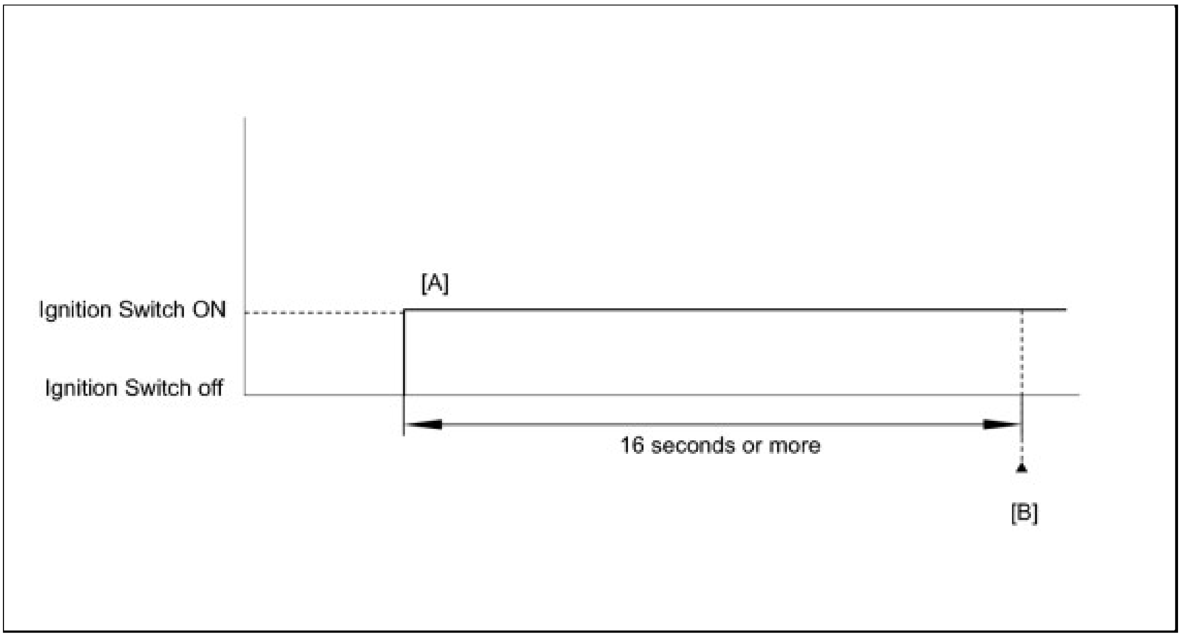
TYPICAL ENABLING CONDITIONS

None	-

TYPICAL MALFUNCTION THRESHOLDS

Difference of main APP and sub APP	0.3 V or more

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 16 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P060D.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	READ OUTPUT DTC (DTC P060D)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(m) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A

RESULT	PROCEED TO
P060D	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000002Z1T01ZX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P060E: Internal Control Module Throttle Position Performance (2010 Corolla)		

DTC	**P060E**	**Internal Control Module Throttle Position Performance**

MONITOR DESCRIPTION

The ECM monitors the input signals of the throttle position sensor No. 1 and stop light switch. When the ECM monitors the input signals of the throttle position sensor No. 1 and the STP signal of the stop light switch, if the input signals and control signals deviate, the DTC is stored.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P060E	ECM main CPU error	ECM

MONITOR STRATEGY

Related DTCs	P060E: Internal control module, Throttle position
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	1 second
MIL operation	Immediate
Sequence of operation	None

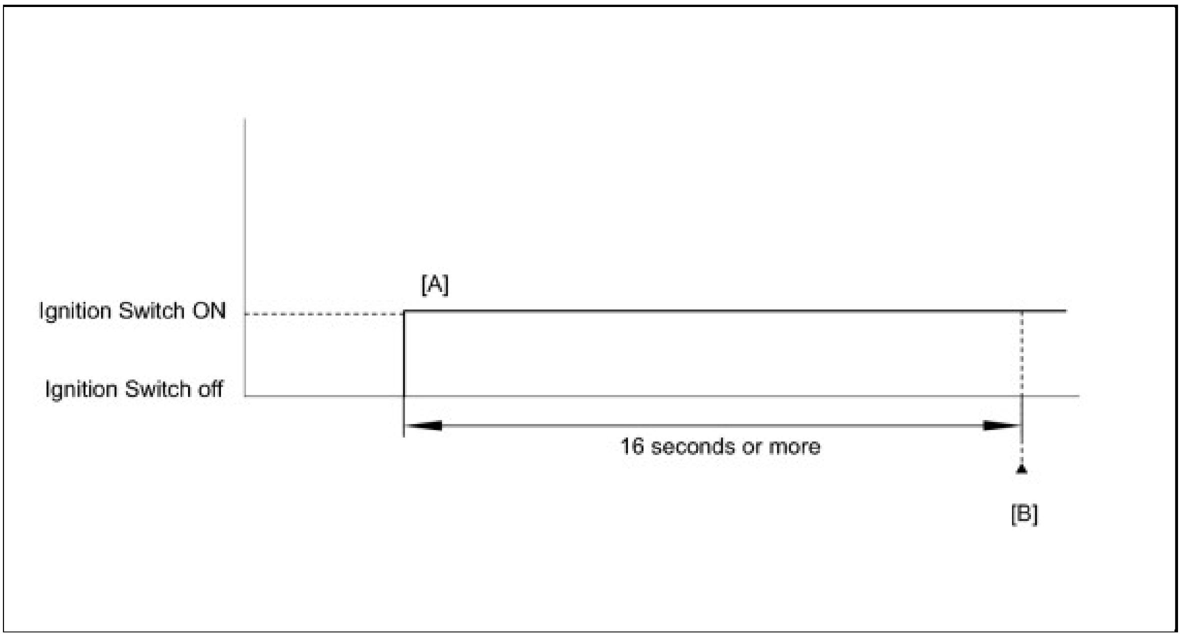
TYPICAL ENABLING CONDITIONS

DMA communication error	Not detected

TYPICAL MALFUNCTION THRESHOLDS

When one of following conditions is met:	Condition 1 or 2
1. Difference of main throttle position and sub throttle position	0.3 V or more
2. Difference of main brake switch signal and sub brake switch signal	Different

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 16 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P060E.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	**READ OUTPUT DTC (DTC P060E)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(m) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P060E	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000003Q7C008X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P062F: Internal Control Module EEPROM Error (2010 Corolla)		

DTC	**P062F**	**Internal Control Module EEPROM Error**

DESCRIPTION

The ECM monitors its internal operation and it stores this DTC when it detects an internal malfunction.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P062F	An ECM internal error (EEPROM)	ECM

MONITOR DESCRIPTION

The ECM monitors its internal operation. If the internal operation is malfunctioning, the ECM illuminates the MIL and stores a DTC.

MONITOR STRATEGY

Related DTCs	P062F: Internal control module EEPROM error
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Once per driving cycle
Duration	11 seconds
MIL operation	Immediate
Sequence of operation	None

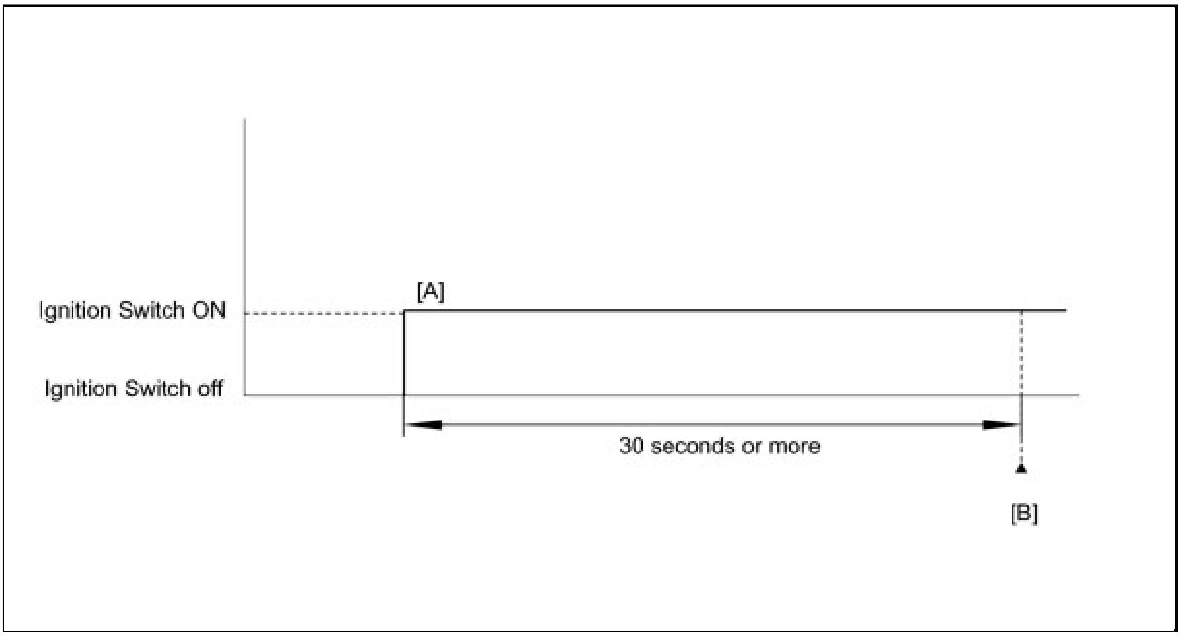
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None
Time after engine start	10 seconds or more
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

Permanent fault code data	Mismatch (3 times or more)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 30 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P062F.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling

TECHSTREAM DISPLAY	DESCRIPTION
	conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	**READ OUTPUT DTC (DTC P062F)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(m) Read DTCs.

Result

RESULT	PROCEED TO
No output	A
P062F	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PGD03MX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0630: VIN not Programmed or Mismatch - ECM / PCM (2010 Corolla)		

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

MONITOR DESCRIPTION

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

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0630	When either condition below is met: • VIN not stored in ECM • Input VIN in ECM not accurate	ECM

MONITOR STRATEGY

Related DTCs	P0630: VIN not programmed
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.065 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

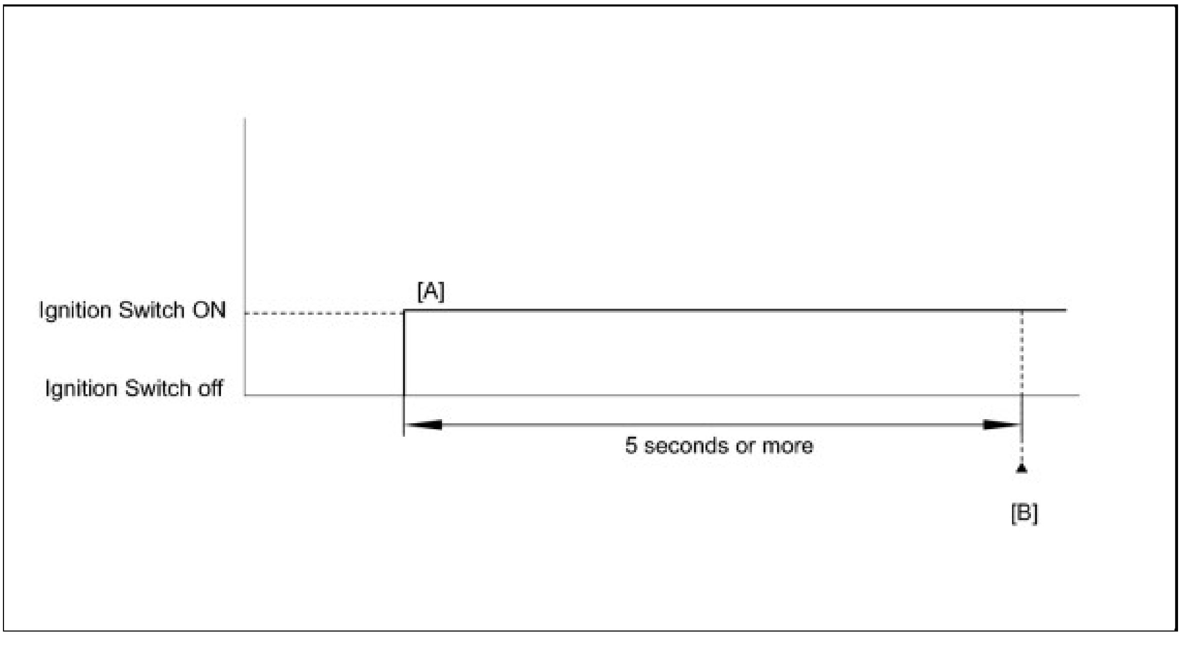
TYPICAL MALFUNCTION THRESHOLDS

VIN code	Not programmed

COMPONENT OPERATING RANGE

VIN code	Programmed

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 5 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0630.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	DTC judgment completed System normal
ABNORMAL	DTC judgment completed System abnormal

TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	READ OUTPUT DTC (DTC P0630)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P0630	A
P0630 and other DTCs	B

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

NOTICE:

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

B ▶ GO TO DTC CHART

A

▼

2.	**INPUT VIN**

(a) Input the VIN INFO .

NEXT ▶ END

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000002I3U04DX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0657: Actuator Supply Voltage Circuit / Open (2010 Corolla)		

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

MONITOR DESCRIPTION

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

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0657	Throttle actuator power supply error	ECM

MONITOR STRATEGY

Related DTCs	P0657: Electronic throttle control system power supply
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	Throttle actuator
Frequency of operation	Once per driving cycle
Duration	Within 1 second
MIL operation	Immediate
Sequence of operation	None

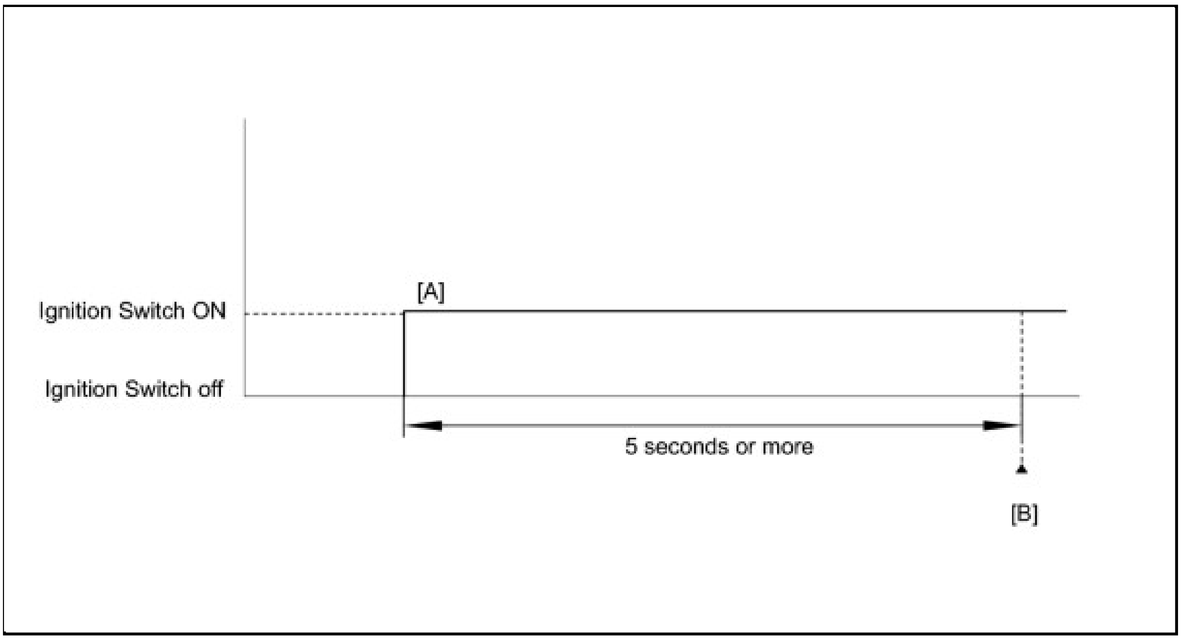
TYPICAL ENABLING CONDITIONS

Ignition switch	ON to OFF

TYPICAL MALFUNCTION THRESHOLDS

Throttle actuator power supply	7 V or more

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) .
4. Turn the ignition switch off and turn the Techstream off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 5 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0657.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**READ OUTPUT DTC (DTC P0657)**

(a) Clear the DTC INFO .

(b) Turn the ignition switch OFF.

(c) Disconnect the cable from the negative battery terminal and wait for 1 minute.

(d) Connect the cable to the negative battery terminal.

(e) Turn the ignition switch to ON for 10 seconds.

(f) Turn the ignition switch off.

(g) Turn the ignition switch to ON.

(h) Check DTC.

OK:
P0657 is not present.

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000001DN902WX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P0724: Brake Switch "B" Circuit High (2010 Corolla)		

DTC	**P0724**	**Brake Switch "B" Circuit High**

DESCRIPTION

The purpose of this circuit is to prevent the engine from stalling when brakes are suddenly applied while driving with the lock-up torque converter clutch on.

When the brake pedal is depressed, this switch sends a signal to the ECM. Then the ECM cancels the operation of the lock-up clutch while braking is in progress.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0724	Stop light switch remains ON even when vehicle repeats 5 cycles of STOP (less than 1.86 mph [3 km/h]) and GO (18.65 mph [30 km/h] or more) (2 trip detection logic)	• Short in stop light switch signal circuit • Stop light switch • ECM

MONITOR DESCRIPTION

This DTC indicates that the stop light switch remains ON. When the stop light switch remains ON during "stop and go" driving, the ECM interprets this as a fault in the stop light switch, the MIL comes on and the ECM stores the DTC. The vehicle must stop (less than 1.86 mph [3 km/h]) and go (18.65 mph [30 km/h] or more) 5 times during 2 driving cycles, in order to detect a malfunction.

MONITOR STRATEGY

Related DTCs	P0724: Stop light switch/Range check/Rationality
Required sensors/Components (Main)	Stop light switch
Required sensors/Components (Related)	Speed sensor
Frequency of Operation	Continuous
Duration	5 times
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

The stop light switch remains ON during GO and STOP 5 times.

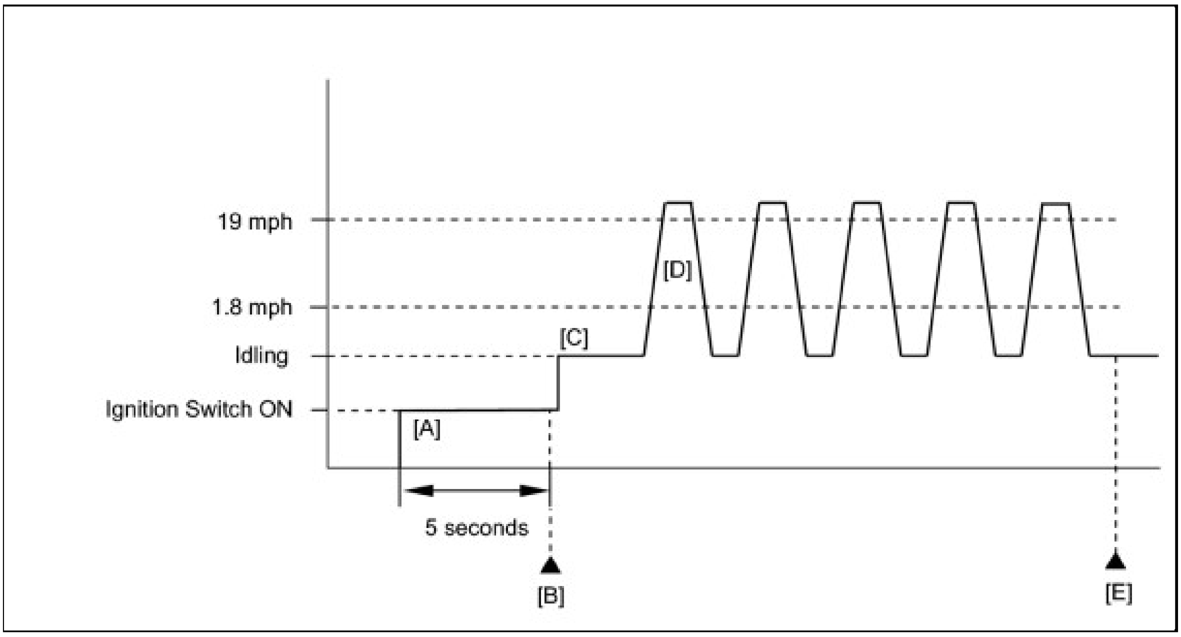
GO and STOP are Defined as Follows;

Monitor runs whenever following DTCs are not present	None
GO: Vehicle speed	18.65 mph (30 km/h) or more
STOP: Vehicle speed	Less than 1.86 mph (3 km/h)

TYPICAL MALFUNCTION THRESHOLDS

Stop light switch status	Stuck ON

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 5 seconds after clear DTCs.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0724.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [C] through [E].

10. Start the engine [C].
11. Accelerate the vehicle to 19 mph (30 km/h) or more, depress the brake pedal and decelerate the vehicle to 1.8 mph (3 km/h) or less [D]. Repeat step [D] 5 times.
12. Check the DTC judgment result [E].
13. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
14. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

15. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0504 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (STOP LIGHT SWITCH)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Stop Light Switch.

(e) Read the values displayed on the Techstream.

Result:

ITEM	MEASUREMENT ITEM: RANGE (DISPLAY)	NORMAL CONDITION
Stop Light Switch	Stop light switch status: ON or OFF	• ON: Brake pedal is depressed • OFF: Brake pedal is released

NG ▶ **INSPECT STOP LIGHT SWITCH**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

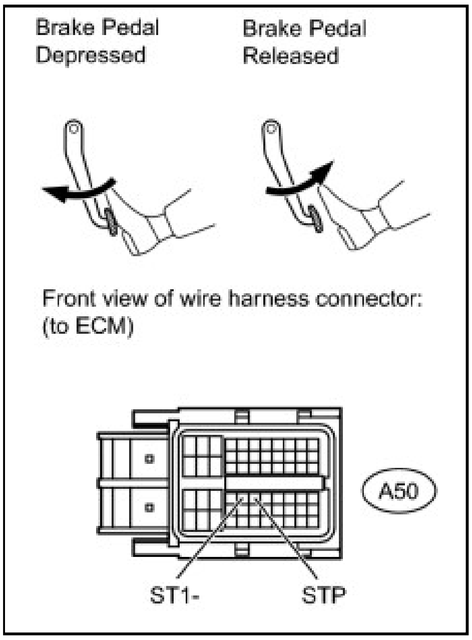
2.	INSPECT STOP LIGHT SWITCH INFO

NG ▶ **REPLACE STOP LIGHT SWITCH**

OK

▼

3.	CHECK HARNESS AND CONNECTOR (STOP LIGHT SWITCH - ECM)



(a) Disconnect the ECM connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-35 (ST1-) - Body ground	Brake pedal released	11 to 14 V
	Brake pedal depressed	0 to 3 V
A50-36 (STP) - Body ground	Brake pedal released	0 to 3 V
	Brake pedal depressed	11 to 14 V

(d) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (STOP LIGHT SWITCH - ECM)**

OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PFU0ADX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2102,P2103: Throttle Actuator Control Motor Circuit Low (2010 Corolla)		

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 opens and closes the throttle valve using an electric motor and 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. This feedback allows the ECM to appropriately control the throttle actuator and monitor the throttle opening angle as the ECM responds to driver inputs.

HINT:

This electronic throttle control system does not use a throttle cable.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2102	Conditions (a) and (b) continue for 2 seconds (1 trip detection logic): (a) Throttle actuator duty ratio 80% or more (b) Throttle actuator current less than 0.5 A	• Open in throttle actuator circuit • Throttle actuator • ECM
P2103	Either of following conditions is met (1 trip detection logic): • Hybrid IC diagnosis signal fail • Hybrid IC current limiter port fail	• Short in throttle actuator circuit • Throttle actuator • Throttle valve • Throttle body • ECM

MONITOR DESCRIPTION

The ECM monitors the electrical current through the electronic actuator, and detects malfunctions and open circuits in the throttle actuator based on the current value. If the current is outside the standard range, the ECM determines that there is a malfunction in the throttle actuator. In addition, if the throttle valve does not function properly (for example, stuck on), the ECM determines that there is a malfunction. The ECM then illuminates the MIL and sets a DTC.

Example:

When the electrical current is less than 0.5 A and the throttle actuator duty ratio exceeds 80%, the ECM interprets this as the current being outside the standard range, and illuminates the MIL and sets a DTC.

If the malfunction is not repaired successfully, the DTC can be set when the engine is quickly revved to a high rpm several times after the engine has idled for 5 seconds after starting the engine.

MONITOR STRATEGY

Related DTCs	P2102: Throttle actuator current (low current) P2103: Throttle actuator current (high current)
Required Sensors/Components (Main)	Throttle actuator (throttle body)
Required Sensors/Components (Related)	None
Frequency of Operation	Continuous
Duration	P2102: 2 seconds P2103: 0.6 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None

P2102:

Throttle actuator	ON
Duty-cycle to open throttle actuator	80% or more
Throttle actuator power supply	8 V or more
Motor current change during latest 0.016 seconds	Less than 0.2 A

P2103:

Throttle actuator	ON
Either of the following conditions 1 or 2 is met:	-
1. Throttle actuator power supply	8 V or more

2. Throttle actuator power	ON
Battery voltage	8 V or more
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

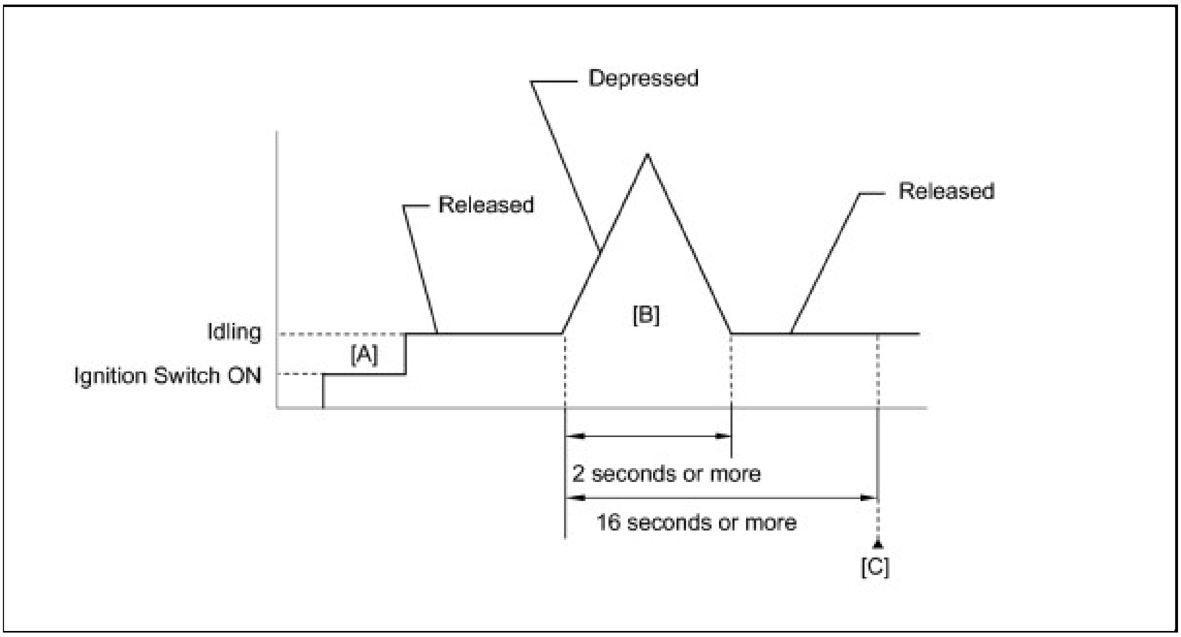
P2102:

Throttle actuator current	Less than 0.5 A

P2103:

Either of following conditions is met:	A or B
A. Hybrid IC diagnosis signal	Fail
B. Hybrid IC current limiter port	Fail

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. With the vehicle stationary, fully depress the accelerator pedal and quickly release it [B].
8. Check that 16 seconds or more have elapsed from the instant when the accelerator pedal is

first depressed.

9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P2102 or P2103.
11. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal
ABNORMAL	- DTC judgment completed - System abnormal
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] through [C] again.

12. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
13. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

14. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

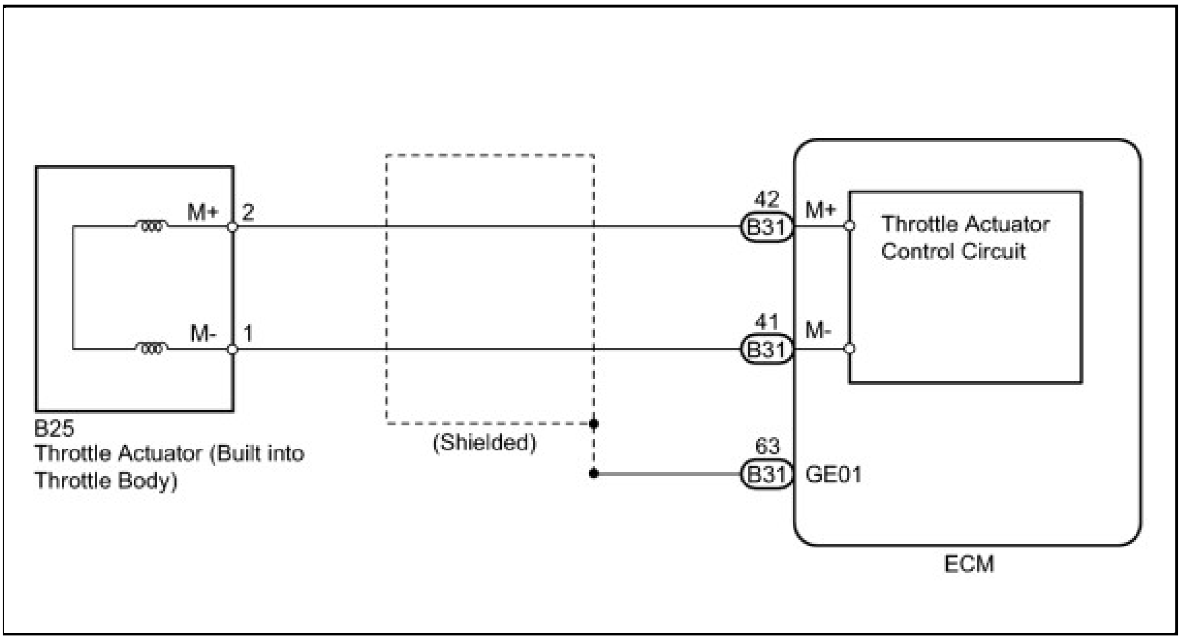
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When either of these DTCs, as well as other DTCs relating to electronic throttle control system malfunctions, is set, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by 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 allow the vehicle to continue running at a minimal speed. If the accelerator pedal is depressed gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned off.

WIRING DIAGRAM



INSPECTION PROCEDURE

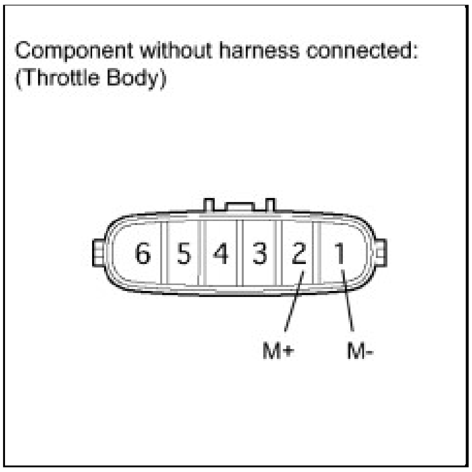
HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- The throttle actuator current (Throttle Motor Current) and the throttle actuator duty ratio (Throttle Motor Open Duty / Throttle Motor Close Duty) can be read using Techstream. However, the ECM shuts off the throttle actuator current when the electronic throttle control system malfunctions.

PROCEDURE

1.	**INSPECT THROTTLE BODY (RESISTANCE OF THROTTLE ACTUATOR)**

(a) Disconnect the throttle body connector.



(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2 (M+) - 1 (M-)	20°C (68°F)	0.3 to 100 Ω

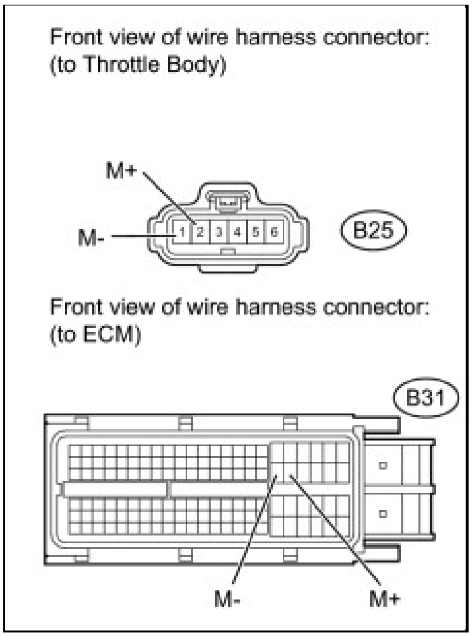
(c) Reconnect the throttle body connector.

NG ▶ **REPLACE THROTTLE BODY**

OK
▼

2.	CHECK HARNESS AND CONNECTOR (THROTTLE BODY - ECM)

(a) Disconnect the throttle body connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B25-2 (M+) - B31-42 (M+)	Always	Below 1 Ω
B25-1 (M-) - B31-41 (M-)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B25-2 (M+) or B31-42 (M+) - Body ground	Always	10 kΩ or higher
B25-1 (M-) or B31-41 (M-) - Body ground	Always	10 kΩ or higher

(d) Reconnect the ECM connector.

(e) Reconnect the throttle body connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (THROTTLE BODY - ECM)**

OK ▼

3.	INSPECT THROTTLE BODY (VISUALLY CHECK THROTTLE VALVE)

(a) Check for foreign objects between the throttle valve and the housing.

OK:

No foreign objects between throttle valve and housing.

NG ▶ **REMOVE FOREIGN OBJECT AND CLEAN THROTTLE BODY**

OK ▼

4.	INSPECT THROTTLE BODY (THROTTLE VALVE)

(a) Check if the throttle valve opens and closes smoothly.

OK:

Throttle valve opens and closes smoothly.

NG ▶ **REPLACE THROTTLE BODY**

OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM00000324401RX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P1607: Cruise Control Input Processor (2010 Corolla)		

DTC	**P1607**	**Cruise Control Input Processor**

MONITOR DESCRIPTION

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

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P1607	ECM internal error	ECM

MONITOR STRATEGY

Related DTC	P1607: Internal control module range check
Required sensors/Components (Main)	ECM
Required sensors /Components (Related)	Cruise control
Frequency of Operation	Continuous
Duration	0.3 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

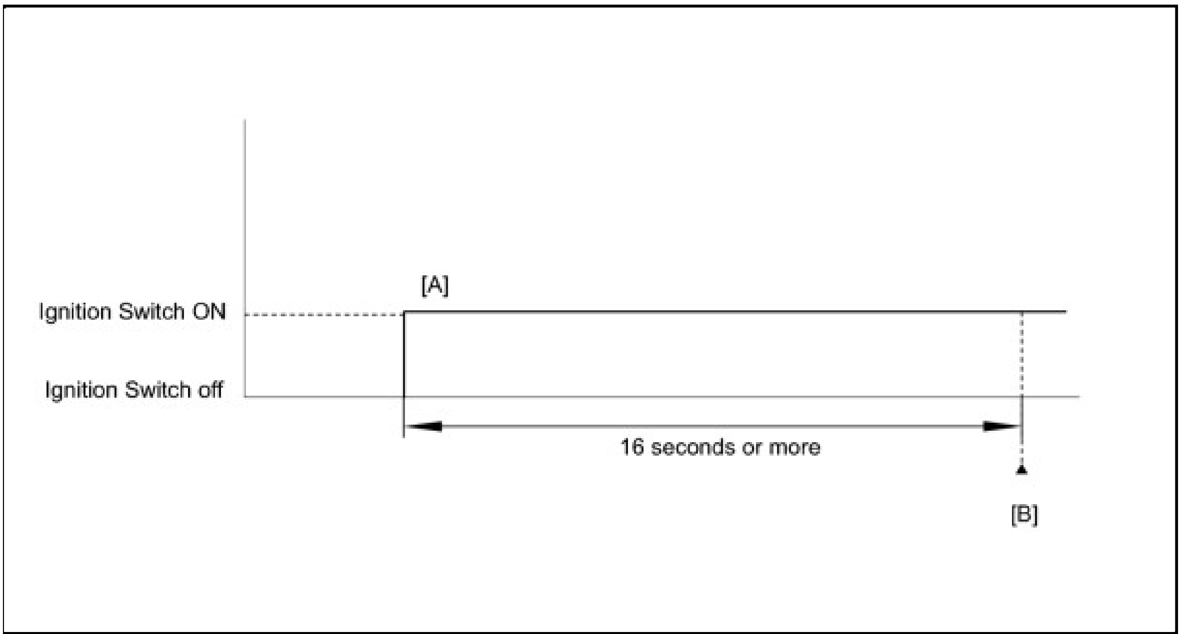
Monitor runs whenever the following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

Cruise control	Forbiddance
When either condition below is met:	-

• Cruise control	Operating
• Low speed control	Operating

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Wait 16 seconds or more.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P1607.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

TECHSTREAM DISPLAY	DESCRIPTION
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	**READ OUTPUT DTC (DTC P1607)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTC INFO .

(e) Turn the ignition switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the ignition switch to ON.

(k) Turn the Techstream on.

(l) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(m) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P1607	B

B **REPLACE ECM**

A **CHECK FOR INTERMITTENT PROBLEMS**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PFV0B7X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2111,P2112: Throttle Actuator Control System - Stuck Open (2010 Corolla)		

DTC	**P2111**	**Throttle Actuator Control System - Stuck Open**

DTC	**P2112**	**Throttle Actuator Control System - Stuck Closed**

DESCRIPTION

The throttle actuator is operated by the ECM, and opens and closes the throttle valve using an electric motor and 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. This feedback allows the ECM to appropriately control the throttle actuator and monitor the throttle opening angle as the ECM responds to driver inputs.

HINT:

This electronic throttle control system does not use a throttle cable.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2111	ECM signals throttle actuator to close, but stuck open (1 trip detection logic)	• Throttle actuator • Throttle body • Throttle valve • ECM
P2112	ECM signals throttle actuator to open, but stuck closed (1 trip detection logic)	• Throttle actuator • Throttle body • Throttle valve • ECM

MONITOR DESCRIPTION

The ECM determines that there is a malfunction in the electronic throttle control system when the throttle valve remains at a fixed angle despite a high drive current from the ECM. The ECM illuminates the MIL and sets a DTC.

If the malfunction is not repaired successfully, the DTC can be set when the accelerator pedal is fully depressed and released quickly (to fully open and close the throttle valve) after the engine is next started.

MONITOR STRATEGY

Related DTCs	P2111: Throttle actuator stuck open P2112: Throttle actuator stuck closed
Required Sensors/Components (Main)	Throttle actuator (throttle body)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P2111 (Throttle Actuator Stuck Open)

All of following conditions are met:	-
System guard* judge condition	ON
Throttle actuator current	2 A or more
Duty cycle to close throttle	80% or more

P2112 (Throttle Actuator Stuck Closed)

All of following conditions are met:	-
System guard* judge condition	ON
Throttle actuator current	2 A or more
Duty cycle to open throttle	80% or more

*System guard set when following conditions are met:	-
Throttle actuator	ON
Throttle actuator duty calculation	Executing
Throttle position sensor fail	Not detected
Throttle actuator current-cut operation	Not executing
Throttle actuator power supply	4 V or more
Throttle actuator fail	Not detected

TYPICAL MALFUNCTION THRESHOLDS

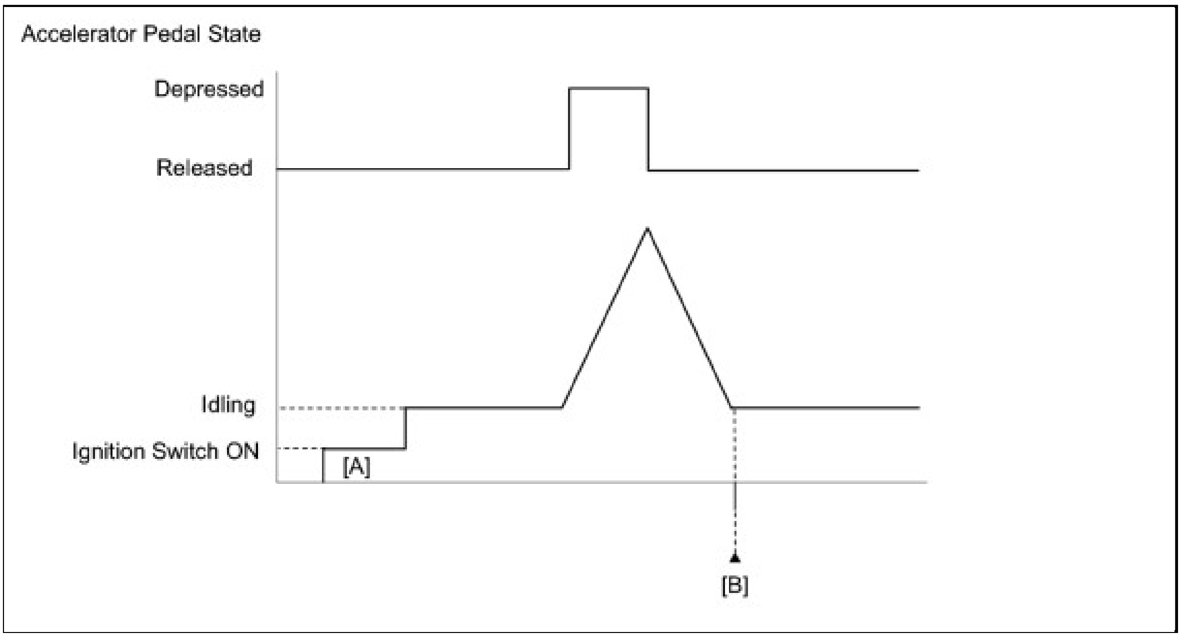
P2111 (Throttle Actuator Stuck Open)

Throttle position sensor voltage change for 0.016 seconds	Less than 0.1 V for 0.5 seconds or more

P2112 (Throttle Actuator Stuck Closed)

Throttle position sensor voltage change for 0.016 seconds	Less than 0.1 V for 0.5 seconds or more

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and fully depress and release the accelerator pedal quickly (to fully open and close the throttle valve).
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P2111 or P2112.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	DTC judgment completed System normal

TECHSTREAM DISPLAY	DESCRIPTION
ABNORMAL	- DTC judgment completed - System abnormal
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When either of these DTCs, as well as other DTCs relating to electronic throttle control system malfunctions, is set, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by 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 allow the vehicle to continue running at a minimal speed. If the accelerator pedal is depressed gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned to off.

WIRING DIAGRAM

Refer to DTC P2102 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	INSPECT THROTTLE BODY (VISUALLY CHECK THROTTLE VALVE)

(a) Check for contamination such as carbon between the throttle valve and the housing. If necessary, clean the throttle body. After cleaning, check that the throttle valve moves smoothly.

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

NG ▶ **REPLACE THROTTLE BODY**

OK ▼

2.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2111 OR P2112)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Start the engine, and fully depress and release the accelerator pedal quickly (to fully open and close the throttle valve).

(f) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(g) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P2111 or P2112	B

B ▶ REPLACE ECM

A ▶ CHECK FOR INTERMITTENT PROBLEMS

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PFW0AFX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2118: Throttle Actuator Control Motor Current Range / Performance (2010 Corolla)		

DTC	P2118	Throttle Actuator Control Motor Current Range / Performance

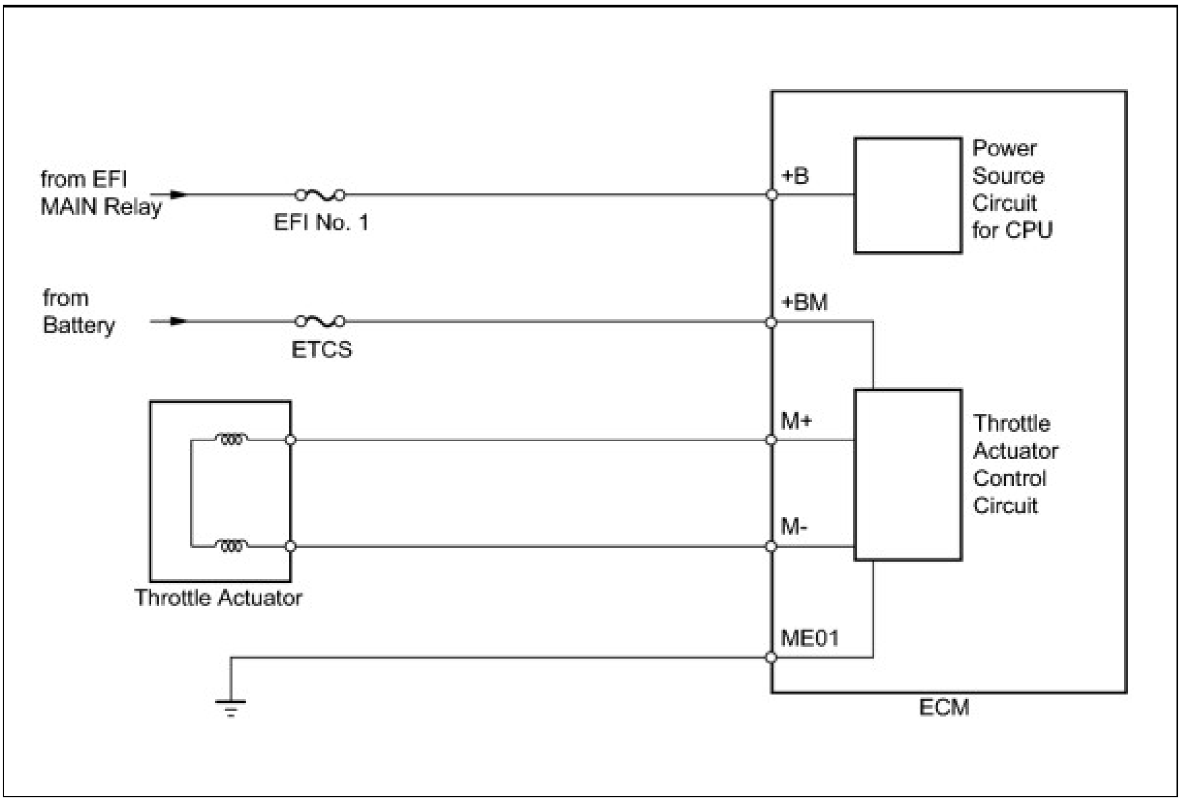
DESCRIPTION

The electronic throttle control system has a dedicated power supply circuit. The voltage (+BM) is monitored and when it is low (less than 4 V), the ECM determines that there is a malfunction in the electronic throttle control system and cuts off the current to the throttle actuator.

When the voltage becomes unstable, the electronic throttle control system itself becomes unstable. For this reason, when the voltage is low, the current to the throttle actuator is cut. If repairs are made and the system returns to normal, turn the ignition switch off. On the next restart, the ECM will allow the current to flow to the throttle actuator.

HINT:

The electronic throttle control system does not use a throttle cable.



DTC	DTC DETECTION CONDITION	TROUBLE AREA

NO.		
P2118	Open in electronic throttle control system power source (+BM) circuit (1 trip detection logic)	• Open in electronic throttle control system power source circuit • Battery • Battery terminals • ETCS fuse • ECM

MONITOR DESCRIPTION

The ECM monitors the battery supply voltage applied to the throttle actuator.

When the power supply voltage (+BM) drops below 4 V for 0.8 seconds or more, the ECM interprets this as an open in the power supply circuit (+BM). The ECM illuminates the MIL and sets the DTC.

If the malfunction is not repaired successfully, the DTC is set 5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P2118: Throttle actuator power supply
Required Sensors/Components (Main)	Throttle actuator, throttle valve (throttle body) ETCS fuse
Required Sensors/Components (Related)	None
Frequency of Operation	Continuous
Duration	0.8 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Battery voltage	8 V or more
Electronic throttle actuator power	ON

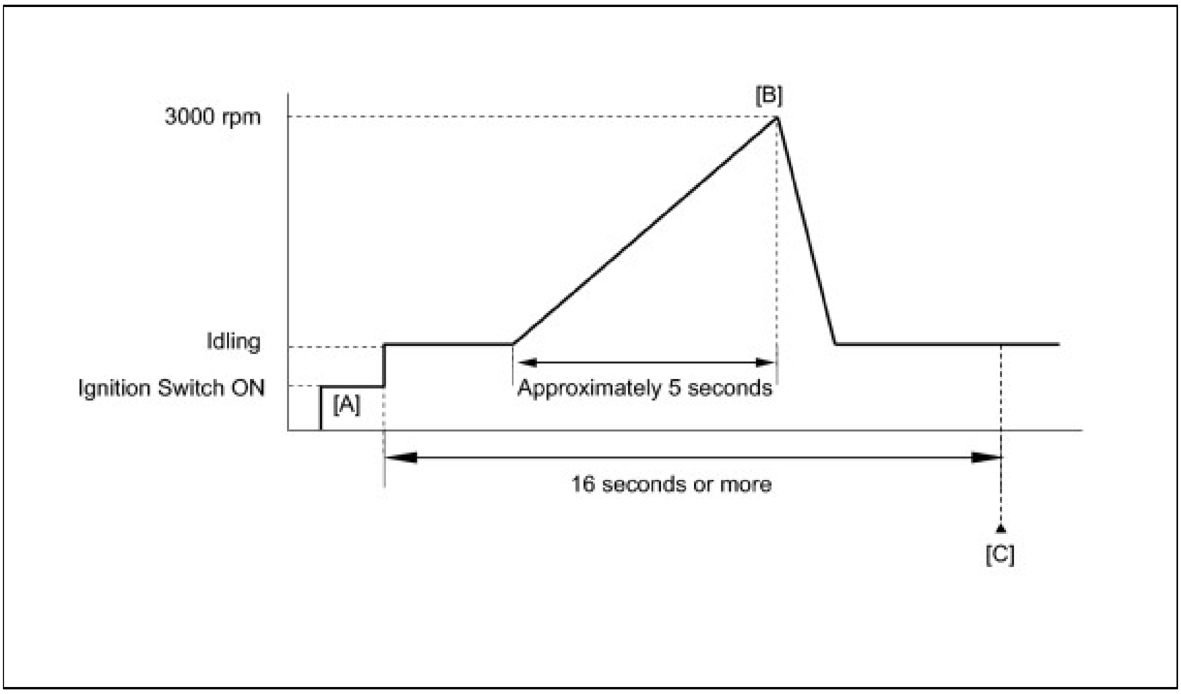
TYPICAL MALFUNCTION THRESHOLDS

Throttle actuator power supply voltage (+BM)	Less than 4 V

COMPONENT OPERATING RANGE

Throttle actuator power supply voltage (+BM)	11 to 14 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Slowly depress the accelerator pedal, raise the engine speed to approximately 3000 rpm for approximately 5 seconds, and then idle the engine [B].
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P2118.
10. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
	DTC judgment not completed

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.

- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C] again.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs .

    HINT:

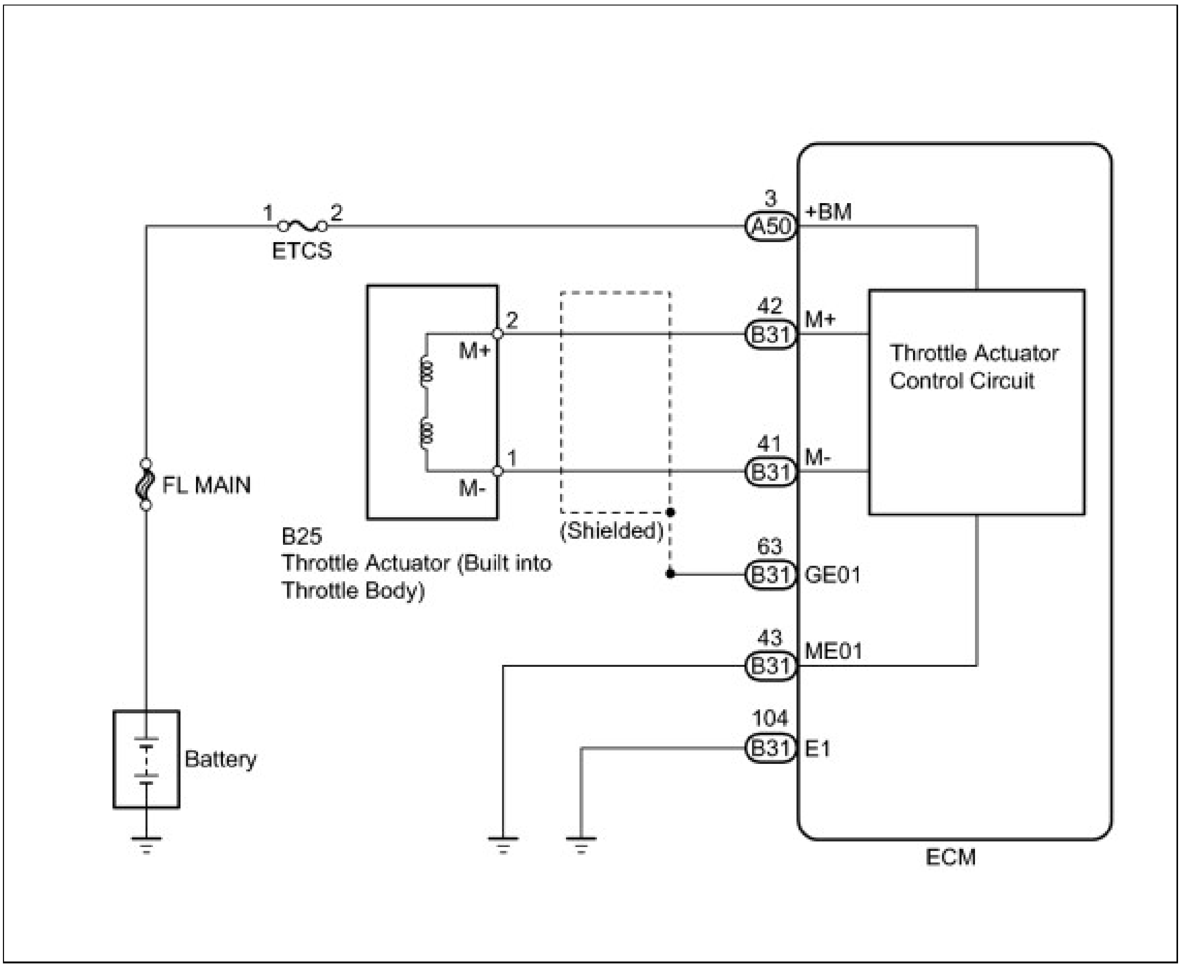
    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

FAIL-SAFE

When this DTC, or other DTCs relating to electronic throttle control system malfunctions, are set, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by 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 allow the vehicle to continue at a minimal speed. If the accelerator pedal is depressed gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned to off.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (+BM VOLTAGE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / +BM Voltage.

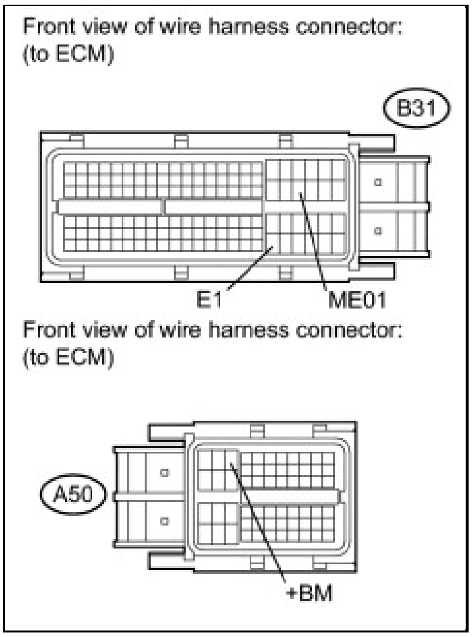
(e) Read the value displayed on the Techstream.

Standard Voltage:
11 to 14 V

NG ▶ **CHECK HARNESS AND CONNECTOR (ECM - BATTERY, BODY GROUND)**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	**CHECK HARNESS AND CONNECTOR (ECM - BATTERY, BODY GROUND)**



(a) Disconnect the ECM connectors.

(b) Measure the voltage according to the value(s) in the table below.

Standard voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-3 (+BM) - Body ground	Always	11 to 14 V

(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B31-43 (ME01) - Body ground	Always	Below 1 Ω
B31-104 (E1) - Body ground		

(d) Reconnect the ECM connectors.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (TERMINALS E1 AND ME01 - BODY**

GROUND)

OK REPLACE ECM

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PFY0AEX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2120,P2122,P2123,P2125,P2127,P2128,P2138: Throttle / Pedal Position Sensor / Switch "D" Circuit (2010 Corolla)		

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**

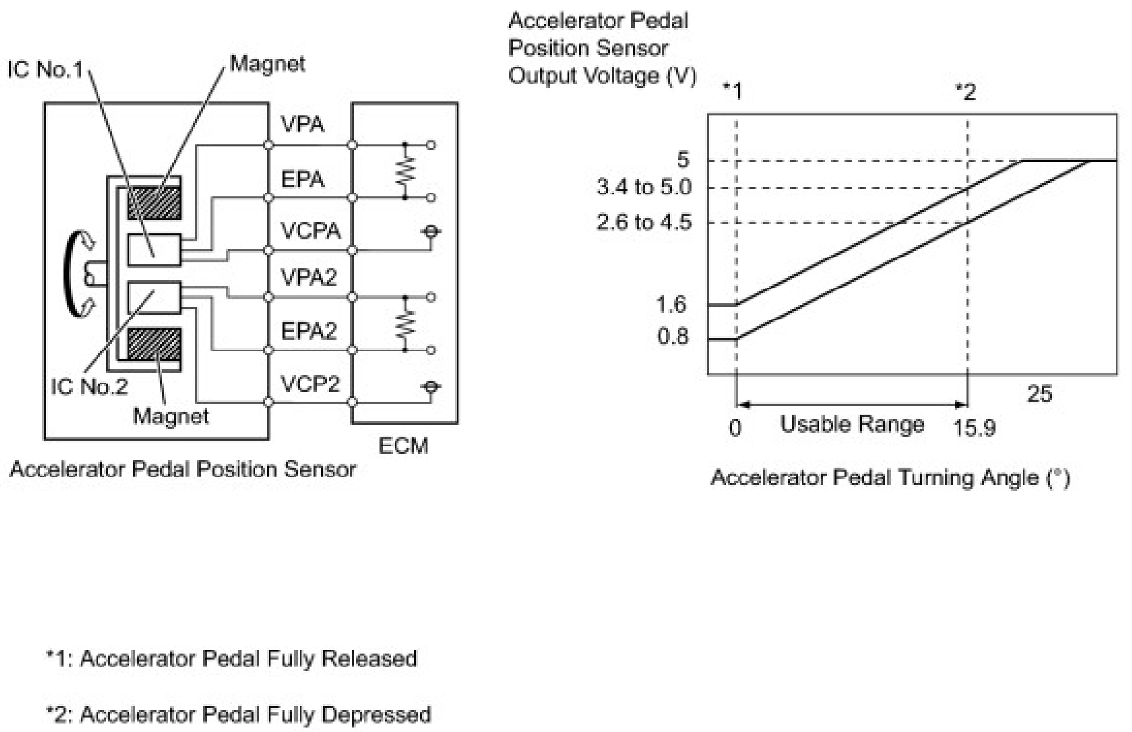
DESCRIPTION

HINT:

- This electronic throttle control system does not use a throttle cable.
- These DTCs relate to the accelerator pedal position sensor.

The accelerator pedal position sensor is mounted on the accelerator pedal bracket and has 2 sensor circuits: VPA (main) and VPA2 (sub). This sensor is a non-contact type and uses Hall-effect elements in order to yield accurate signals even in extreme conditions. The voltage from this sensor, which is applied to terminals VPA and VPA2 of the ECM, varies between 0.5 V and 4.5 V in proportion to the operating angle of the accelerator pedal (throttle valve). A signal from VPA indicates the actual accelerator pedal opening angle (throttle valve opening angle) and is used for engine control. A signal from VPA2 conveys the status of the VPA circuit and is used to check the APP sensor itself.

The ECM monitors the actual accelerator pedal opening angle (throttle valve opening angle) through the signals from VPA and VPA2, and controls the throttle actuator according to these signals.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2120	VPA fluctuates rapidly beyond upper and lower malfunction thresholds for 0.5 seconds or more (1 trip detection logic)	• Accelerator pedal position sensor • ECM
P2122	VPA 0.4 V or less for 0.5 seconds or more when accelerator pedal depressed (1 trip detection logic)	• Accelerator pedal position sensor • Open in VCP1 circuit • Open or ground short in VPA circuit • ECM
P2123	VPA 4.8 V or more for 2.0 seconds or more (1 trip detection logic)	• Accelerator pedal position sensor

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
		• Open in EPA circuit • ECM
P2125	VPA2 fluctuates rapidly beyond upper and lower malfunction thresholds for 0.5 seconds or more (1 trip detection logic)	• Accelerator pedal position sensor • ECM
P2127	VPA2 1.2 V or less for 0.5 seconds or more when accelerator pedal depressed (1 trip detection logic)	• Accelerator pedal position sensor • Open in VCP2 circuit • Open or ground short in VPA2 circuit • ECM
P2128	Conditions (a) and (b) continue for 2.0 seconds or more (1 trip detection logic): (a) VPA2 4.8 V or more (b) VPA between 0.4 V and 3.45 V	• Accelerator pedal position sensor • Open in EPA2 circuit • ECM
P2138	Condition (a) or (b) continues for 2.0 seconds or more (1 trip detection logic): (a) Difference between VPA and VPA2 0.02 V or less (b) VPA 0.4 V or less and VPA2 1.2 V or less	• Short between VPA and VPA2 circuits • Accelerator pedal position sensor • ECM

HINT:

When any of these DTCs are set, check the APP sensor voltage by entering the following menus: Powertrain / Engine and ECT / Data List / ETCS / Accel Sensor Out No. 1 and Accel Sensor Out No. 2.

TROUBLE AREA	ACCEL SENSOR OUT NO. 1 WHEN ACCELERATOR PEDAL RELEASED	ACCEL SENSOR OUT NO. 2 WHEN ACCELERATOR PEDAL RELEASED	ACCEL SENSOR OUT NO. 1 WHEN ACCELERATOR PEDAL DEPRESSED	ACCEL SENSOR OUT NO. 2 WHEN ACCELERATOR PEDAL DEPRESSED
VCP circuit open	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V

TROUBLE AREA	ACCEL SENSOR OUT NO. 1 WHEN ACCELERATOR PEDAL RELEASED	ACCEL SENSOR OUT NO. 2 WHEN ACCELERATOR PEDAL RELEASED	ACCEL SENSOR OUT NO. 1 WHEN ACCELERATOR PEDAL DEPRESSED	ACCEL SENSOR OUT NO. 2 WHEN ACCELERATOR PEDAL DEPRESSED
Open or ground short in VPA circuit	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 5.0 V
Open or ground short in VPA2 circuit	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 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V
Normal condition	0.5 to 1.1 V	1.2 to 2.0 V	2.6 to 4.5 V	3.4 to 5.0 V

HINT:

Accelerator pedal positions are expressed as voltages.

MONITOR DESCRIPTION

When either the output voltage of VPA or VPA2 deviates from the standard range, or the difference between the output voltages of the 2 sensor circuits is less than the threshold, the ECM determines that there is a malfunction in the APP sensor. The ECM then illuminates the MIL and sets a DTC.

Example:

When the output voltage of VPA drops below 0.4 V for more than 0.5 seconds when the accelerator pedal is fully depressed, DTC P2122 is set.

If the malfunction is not repaired successfully, a DTC is set 2 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P2120: Accelerator pedal position sensor 1 range check (fluctuating) P2122: Accelerator pedal position sensor 1 range check (low voltage) P2123: Accelerator pedal position sensor 1 range check (high voltage) P2125: Accelerator pedal position sensor 2 range check (fluctuating) P2127: Accelerator pedal position sensor 2 range check (low voltage) P2128: Accelerator pedal position sensor 2 range check (high

	voltage) P2138: Accelerator pedal position sensor range check (correlation)
Required Sensors/Components (Main)	Accelerator pedal position sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds: P2120, P2122, P2125 and P2127 2.0 seconds: P2123, P2128 and P2138
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Either of following conditions 1 or 2 is met:	-
1. Ignition switch	0.012 seconds or more
2. Throttle actuator power	ON

TYPICAL MALFUNCTION THRESHOLDS

P2120

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

P2122

VPA voltage when VPA2 voltage 0.04 V or more	0.4 V or less

P2123

VPA voltage	4.8 V or more

P2125

Either of following conditions 1 or 2 met:	-
1. VPA2 voltage when VPA voltage 0.04 V or more	1.2 V or less

2. VPA2 voltage when VPA voltage 0.4 to 3.45 V	4.8 V or more

P2127

VPA2 voltage when VPA voltage 0.04 V or more	1.2 V or less

P2128

VPA2 voltage when VPA voltage 0.4 to 3.45 V	4.8 V or more

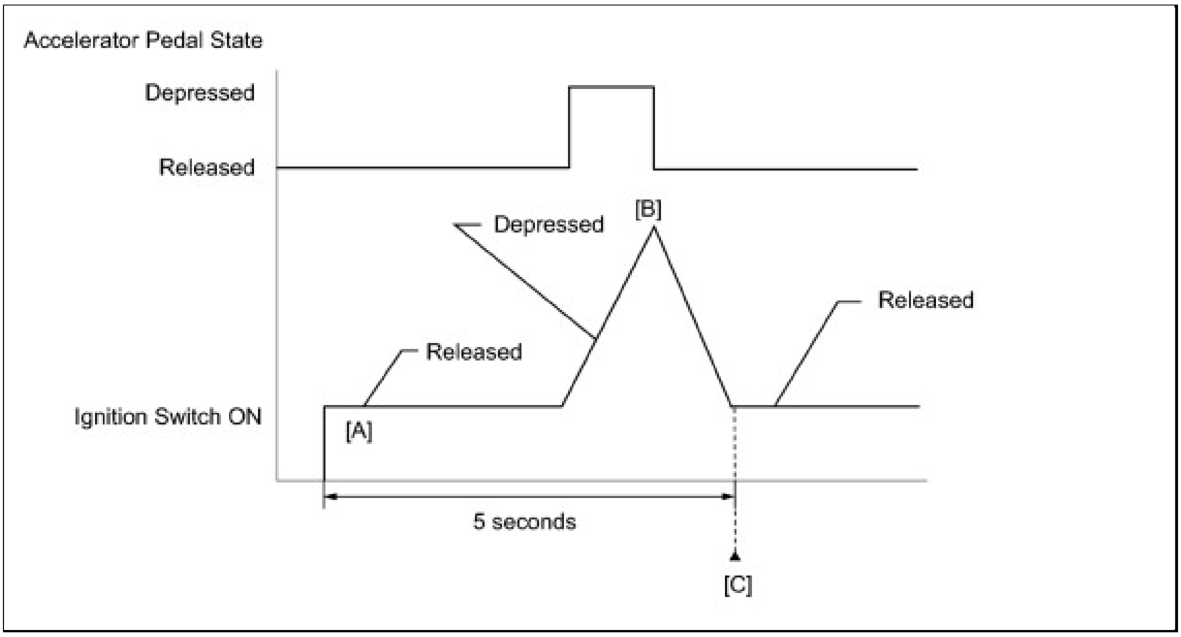
P2138

Either of following conditions A or B met:	-
Condition A	-
Difference between VPA and VPA 2 voltages	0.02 V or less
Condition B	-
VPA voltage	0.4 V or less
VPA2 voltage	1.2 V or less

COMPONENT OPERATING RANGE

VPA voltage	0.4 to 4.8 V
VPA2 voltage	1.2 to 4.8 V
Difference between VPA and VPA2 voltages	More than 0.02 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Fully depress and release the accelerator pedal [B].
7. Check that 5 seconds or more have elapsed since the DTCs were cleared.
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P2120, P2122, P2123, P2125, P2127, P2128 or P2138.
10. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.

- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C] again.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

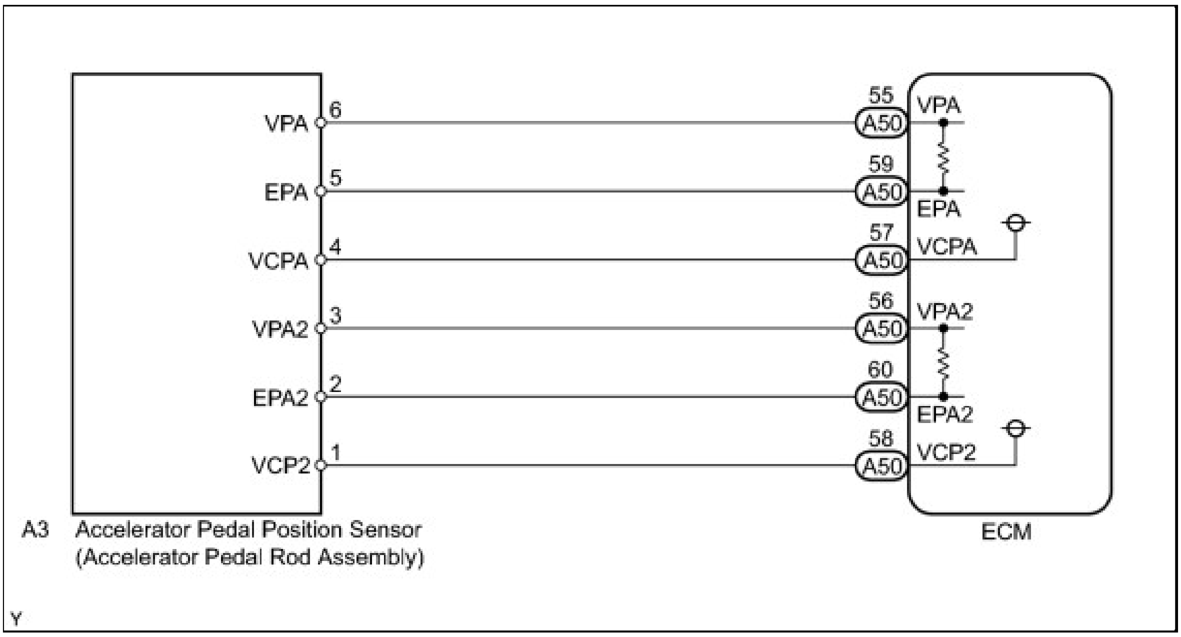
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When any of DTCs P2120, P2121, P2122, P2123, P2125, P2127, P2128 and P2138 are set, the ECM enters fail-safe mode. If either of the 2 sensor circuits malfunctions, the ECM uses the remaining circuit to calculate the accelerator pedal position to allow the vehicle to continue driving. If both of the circuits malfunction, the ECM regards the accelerator pedal as being released. As a result, the throttle valve is closed and the engine idles.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is turned off.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (ACCELERATOR POSITION SENSOR)

(a) Connect Techstream to the DLC3.

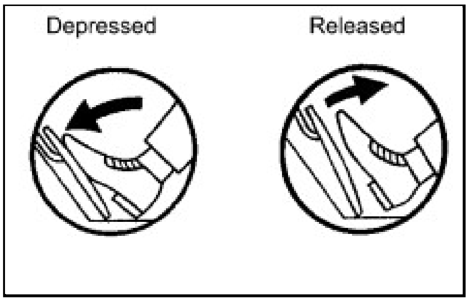
(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / ETCS / Accel Sensor Out No. 1 and Accel Sensor Out No. 2.

(e) Read the value displayed on the Techstream.

Standard Voltage:



ACCELERATOR PEDAL OPERATION	ACCEL SENSOR OUT NO. 1	ACCEL SENSOR OUT NO. 2
Released	0.5 to 1.1 V	1.2 to 2.0 V
Depressed	2.6 to 4.5 V	3.4 to 5.0 V

NG ▶ **CHECK HARNESS AND CONNECTOR (ACCELERATOR PEDAL POSITION SENSOR - ECM)**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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

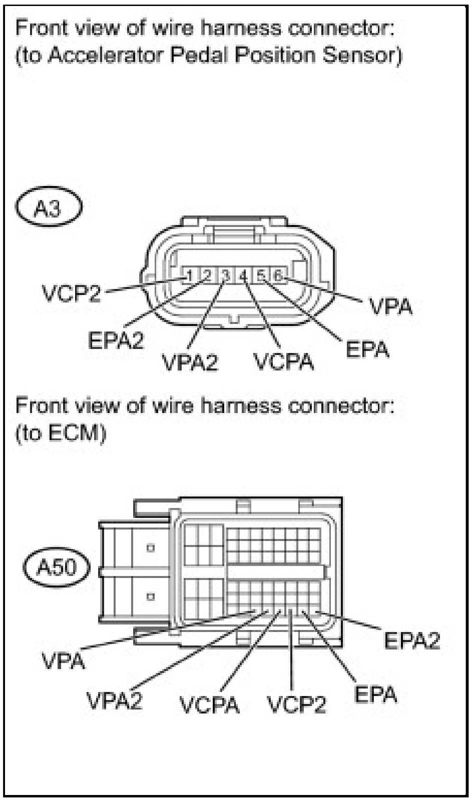
(a) Disconnect the accelerator pedal position sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A3-6 (VPA) - A50-55 (VPA)	Always	Below 1 Ω
A3-5 (EPA) - A50-59 (EPA)	Always	Below 1 Ω
A3-4 (VCPA) - A50-57 (VCPA)	Always	Below 1 Ω
A3-3 (VPA2) - A50-56 (VPA2)	Always	Below 1 Ω
A3-2 (EPA2) - A50-60 (EPA2)	Always	Below 1 Ω
A3-1 (VCP2) - A50-58 (VCP2)	Always	Below 1 Ω



Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A3-6 (VPA) or A50-55 (VPA) - Body ground	Always	10 kΩ or higher
A3-5 (EPA) or A50-59 (EPA) - Body ground	Always	10 kΩ or higher
A3-4 (VCPA) or A50-57 (VCPA) - Body ground	Always	10 kΩ or higher
A3-3 (VPA2) or A50-56 (VPA2) - Body ground	Always	10 kΩ or higher
A3-2 (EPA2) or A50-60 (EPA2) - Body ground	Always	10 kΩ or higher
A3-1 (VCP2) or A50-58 (VCP2) - Body ground	Always	10 kΩ or higher

(d) Reconnect the accelerator pedal position sensor connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ACCELERATOR PEDAL POSITION SENSOR - ECM)**

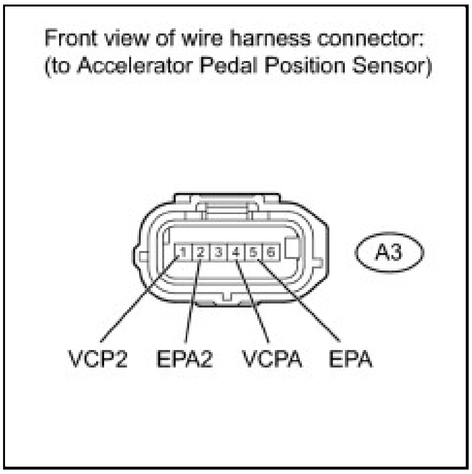
OK ▼

3.	**CHECK ECM (VCPA AND VCP2 VOLTAGE)**

(a) Disconnect the accelerator pedal position sensor connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.



Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
A3-4 (VCPA) - A3-5 (EPA)	Ignition switch ON	4.5 to 5.5 V
A3-1 (VCP2) - A3-2 (EPA2)	Ignition switch ON	4.5 to 5.5 V

(d) Reconnect the accelerator pedal position sensor connector.

NG ▶ **REPLACE ECM**

OK ▼

4.	REPLACE ACCELERATOR PEDAL ROD ASSEMBLY

(a) Replace the accelerator pedal rod assembly INFO .

NEXT

5.	CHECK WHETHER DTC OUTPUT RECURS (ACCELERATOR PEDAL POSITION SENSOR DTCS)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Start the engine.

(f) Allow the engine to idle for 15 seconds or more.

(g) Fully depress and release the accelerator pedal several times quickly.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(i) Read DTCs.

Result:

RESULT	PROCEED TO
P2120, P2122, P2123, P2125, P2127, P2128, and/or P2138	A
No output	B

B ▶ **END**

A ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 J	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000YEQ051X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: EVAP System (2010 Corolla)		

EVAP System

RELATED DTCS

DTC	MONITORING ITEM	SEE PAGE
P043E	Reference orifice clogged (built into canister pump module)	INFO
P043F	Reference orifice high-flow (built into canister pump module)	
P0441	• Purge VSV (Vacuum Switching Valve) stuck closed • Purge VSV stuck open • Purge flow	INFO
P0451	• Canister pressure sensor (built into canister pump module) noise • Canister pressure sensor (built into canister pump module) signal becomes fixed/flat	INFO
P0452	Canister pressure sensor (built into canister pump module) voltage low	
P0453	Canister pressure sensor (built into canister pump module) voltage high	
P0455	EVAP gross leak	INFO
P0456	EVAP small leak	
P2401	Leak detection pump stuck OFF (built into canister pump module)	INFO
P2402	Leak detection pump stuck ON (built into canister pump module)	
P2419	Vent valve stuck closed (built into canister pump module)	INFO
P2420	Vent valve stuck open (vent) (built into canister pump module)	INFO
P2610	Soak timer (built into ECM)	INFO

If any EVAP system DTCs are set, the malfunctioning area can be determined using the table below.

DTC / Malfunctioning Area	P043E P043F	P0441	P0451	P0452	P0453	P0455	P0456	P2401 P2402	P2419	P2420
0.02 inch orifice clogged	●							●	●	
0.02 inch orifice high-flow	●							●	●	
Purge VSV stuck open		●				●				
Purge VSV stuck closed		●								
Pressure sensor stuck			●							
Pressure sensor noise			●							
Pressure sensor low output				●						
Pressure sensor high output					●					
Gross leak		●				●				
Small leak							●			
Vacuum pump stuck OFF	●							●	●	
Vacuum pump stuck ON	●							●	●	
Vent valve stuck closed	●							●	●	
Vent valve stuck open (vent)										●

Y

NOTICE:

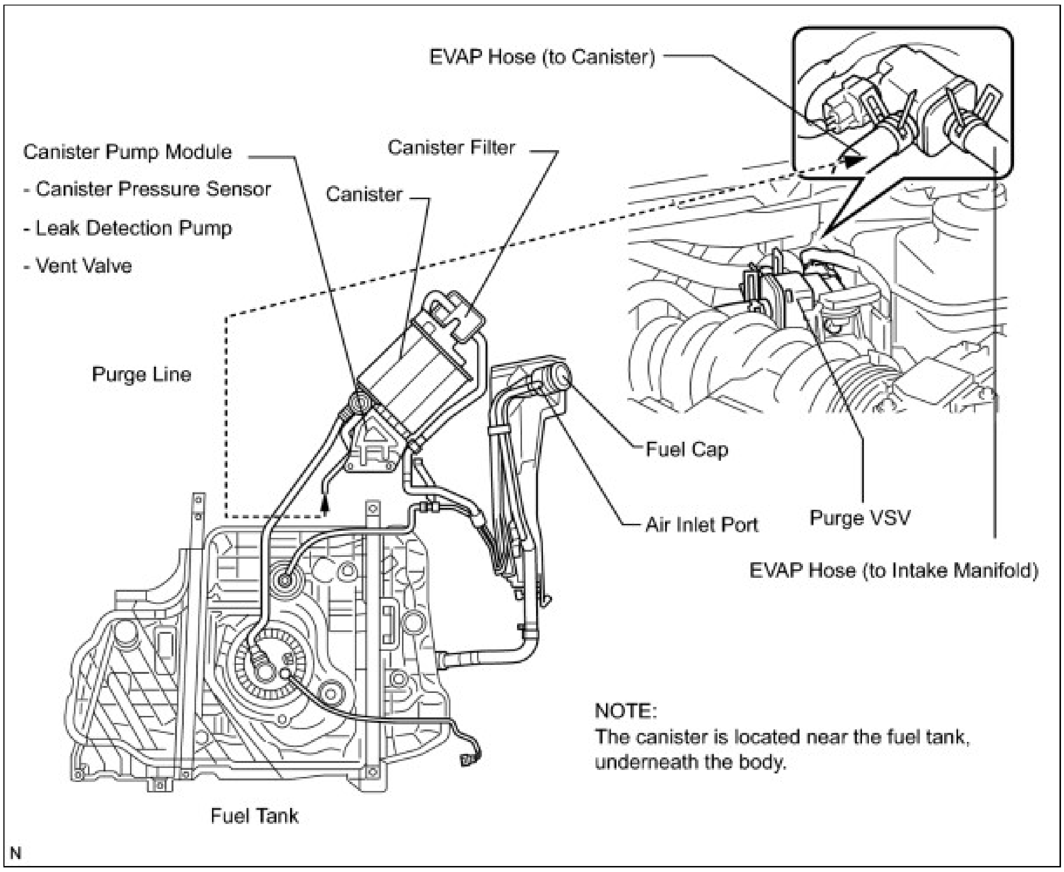
If the reference pressure difference between the first and second checks is greater than the specification, all the DTCs relating to the reference pressure (P043E, P043F, P2401, P2402 and P2419) are stored.

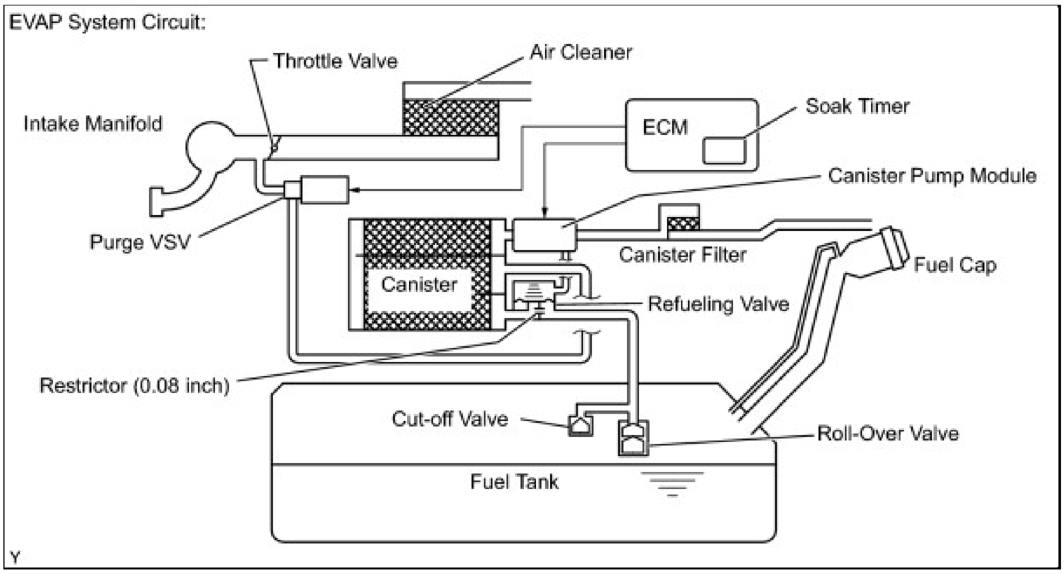
DESCRIPTION

HINT:

Unit expressions

- [kPa-a (mmHg-a)] denotes absolute pressure.
- [kPa-g (mmHg-g)] denotes gauge pressure (relative pressure).
- On the Techstream, choose the unit of measurement according to the inspection procedure.





NOTICE:

To check for leaks in the EVAP system, disconnect the air inlet vent hose and apply pressure from the atmospheric side of the canister.

While the engine is running, if a predetermined condition (closed-loop, etc.) is met, the purge VSV is opened by the ECM and stored fuel vapors in the canister are purged into the intake manifold. The ECM changes the duty cycle ratio of the purge VSV to control purge flow volume.

The purge flow volume is also determined by the intake manifold pressure. Atmospheric pressure is allowed into the canister through the vent valve to ensure that the purge flow is maintained when the negative pressure (vacuum) is applied to the canister.

The following two monitors run to confirm the appropriate EVAP system operation.

1. Key-off monitor

This monitor checks for EVAP (evaporative emission) system leaks and canister pump module malfunctions. The monitor starts 5 hours* after the ignition switch is turned off. At least 5 hours are required for the fuel to cool down to stabilize the EVAP pressure, thus making the EVAP system monitor more accurate.

The leak detection pump creates negative pressure (vacuum) in the EVAP system and the pressure is measured. Finally, the ECM monitors for leaks from the EVAP system, and malfunctions in both the canister pump module and purge VSV, based on the EVAP pressure.

HINT:

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

2. Purge flow monitor

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

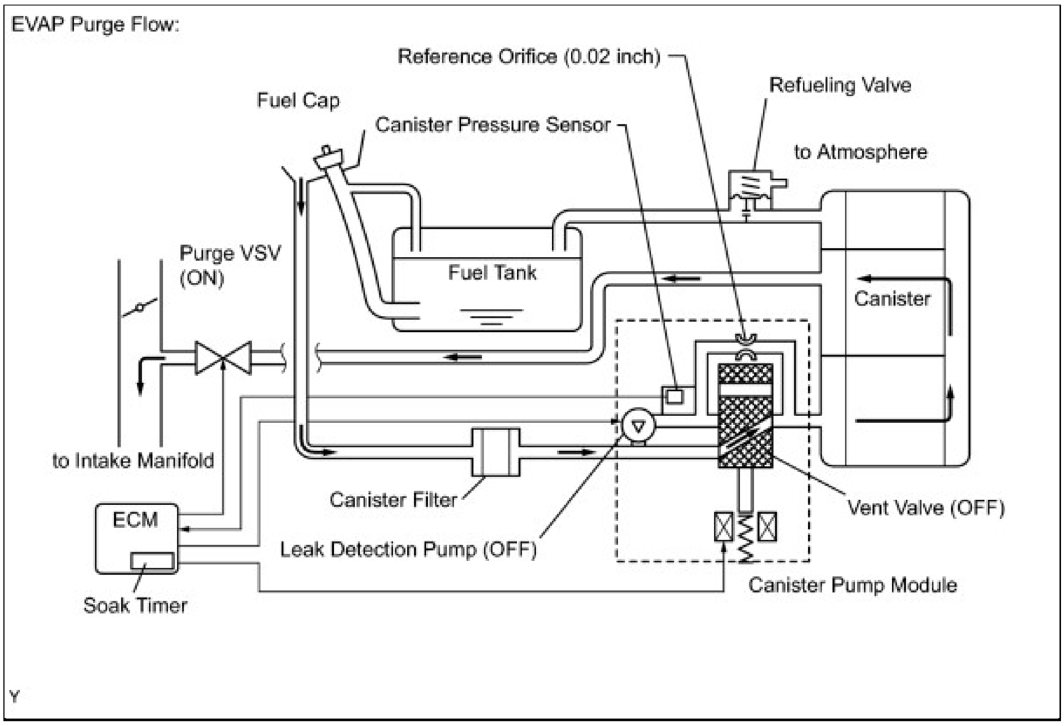
- The 1st monitor

  While the engine is running and the purge VSV (Vacuum Switching Valve) is ON (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.
- The 2nd monitor

  The vent valve is turned ON (closed) and the EVAP pressure is measured. If the variation in the pressure is less than 0.4 kPa-g (3.0 mmHg-g), the ECM interprets this as the purge VSV being stuck closed, and illuminates the MIL and sets DTC P0441 (2 trip detection logic).

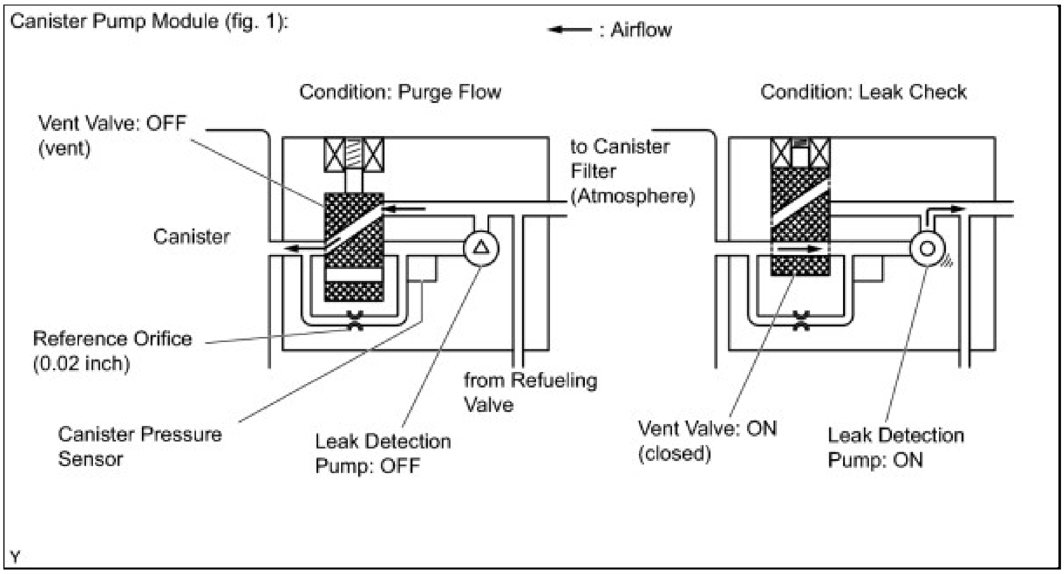
Atmospheric pressure check:

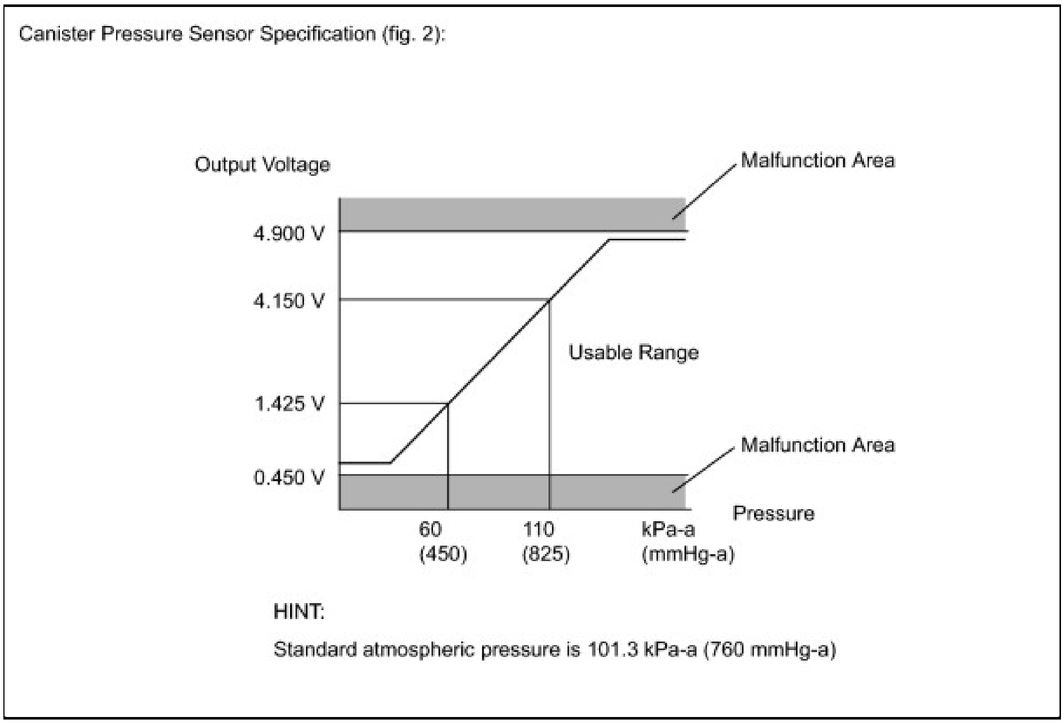
In order to ensure reliable malfunction detection, the variation between the atmospheric pressures, before and after the purge flow monitor is performed, is measured by the ECM.

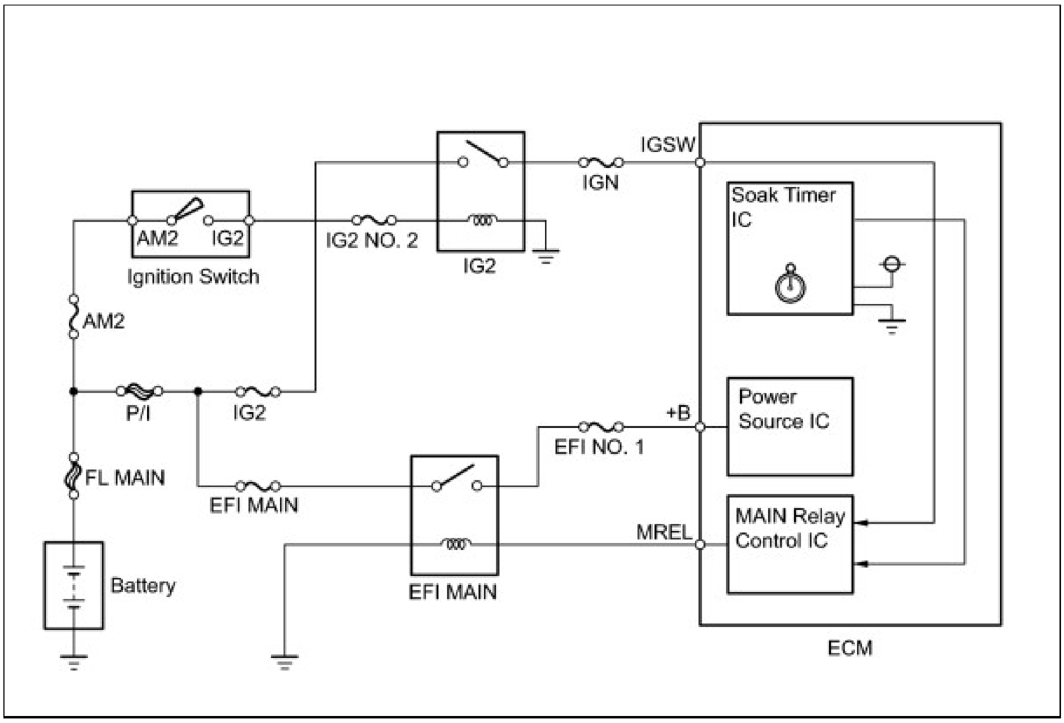


COMPONENT	OPERATION
Canister	Contains activated charcoal to absorb evaporative emissions generated in fuel tank.
Cut-off valve	Located in fuel tank. Valve floats and closes when fuel tank 100% full.
Purge VSV (Vacuum Switching Valve)	Opens or closes line between canister and intake manifold. ECM uses purge VSV to control EVAP purge flow. In order to discharge EVAP absorbed by canister to intake manifold, ECM opens purge VSV. EVAP discharge volume to intake manifold controlled by purge VSV duty cycle ratio (current-carrying time) (Open: ON; Closed: OFF).
Refueling valve	Controls EVAP pressure from fuel tank to canister. Valve consists of diaphragm, spring and restrictor (diameter: 0.08 inch). When fuel vapor and pressure inside fuel tank increase, valve opens. While EVAP purged, valve closes and restrictor prevents large amount of vacuum from affecting pressure in fuel tank. Valve opened while refueling.
Roll-over valve	Located in fuel tank. Valve closed by its own weight when vehicle overturns to prevent fuel from spilling out.
Soak timer	Built into ECM. To ensure accurate EVAP monitor, measures 5 hours (+/-15 min.) after ignition switch turned to OFF. This allows fuel to cool down, stabilizing EVAP pressure. When approximately 5 hours elapsed, ECM activates (refer to fig. 3).
Canister pump module	Consists of (a) to (d) below. Canister pump module cannot be disassembled.
(a) Vent valve	Vents and closes EVAP system. When ECM turns valve ON, EVAP system closed. When ECM turns valve OFF, EVAP system vented. Negative pressure (vacuum) created in EVAP system to check for EVAP leaks by closing purge VSV, turning on vent valve (closed) and operating leak detection pump (refer to fig. 1).
(b) Canister pressure sensor	Indicates pressure as voltages. ECM supplies regulated 5 V to canister pressure sensor, and uses feedback from sensor to monitor EVAP system pressure (refer to fig. 2).
(c) Leak detection pump	Creates negative pressure (vacuum) in EVAP system for leak check.

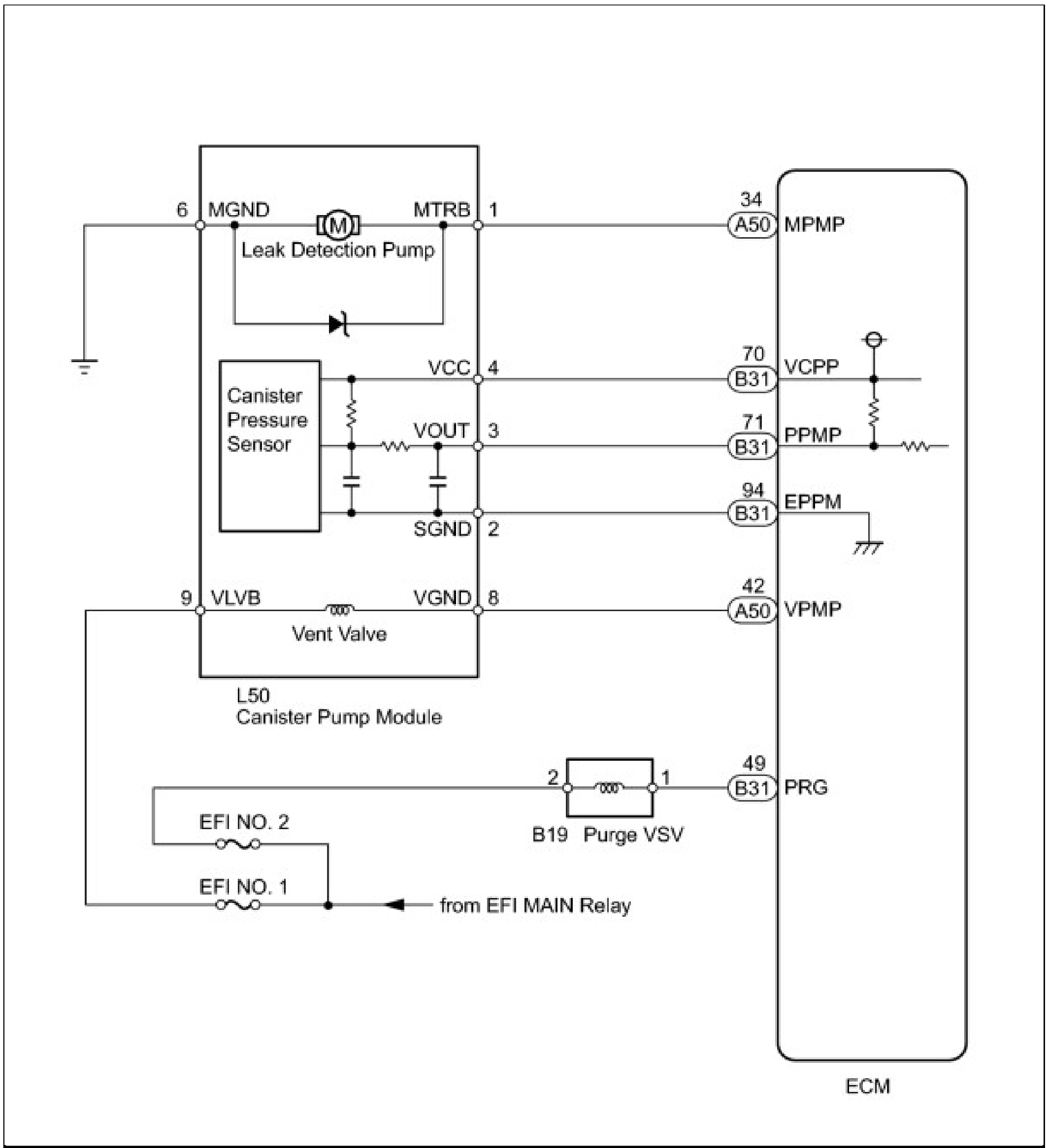
COMPONENT	OPERATION
(d) Reference orifice	Has opening with 0.02 inch diameter. Vacuum produced through orifice by closing purge VSV, turning off vent valve and operating leak detection pump, to monitor reference pressure. Reference pressure indicates small leak of EVAP.







WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

The Techstream is required to conduct the following diagnostic troubleshooting procedure.

HINT:

- Using the Techstream to monitor results enables the EVAP (evaporative emission) system to be confirmed.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CONFIRM DTC**

(a) Turn the ignition switch off and wait for 10 seconds.

(b) Turn the ignition switch to ON.

(c) Turn the ignition switch off and wait for 10 seconds.

(d) Connect the Techstream to the DLC3.

(e) Turn the ignition switch to ON.

(f) Turn the Techstream on.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Confirm DTCs and freeze frame data.

If any EVAP system DTCs are set, the malfunctioning area can be determined using the table below.

Malfunctioning Area \ DTC	P043E P043F	P0441	P0451	P0452	P0453	P0455	P0456	P2401 P2402	P2419	P2420
0.02 inch orifice clogged	●							●	●	
0.02 inch orifice high-flow	●							●	●	
Purge VSV stuck open		●				●				
Purge VSV stuck closed		●								
Pressure sensor stuck			●							
Pressure sensor noise			●							
Pressure sensor low output				●						
Pressure sensor high output					●					
Gross leak		●				●				
Small leak							●			
Vacuum pump stuck OFF	●							●	●	
Vacuum pump stuck ON	●							●	●	
Vent valve stuck closed	●							●	●	
Vent valve stuck open (vent)										●

Y

NEXT

2.	PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of five steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off

valve may be closed. If the cut-off valve is closed, the fuel tank leak check is not possible.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the temperature below 35°C (95°F).

(a) Clear DTCs INFO .

(b) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.

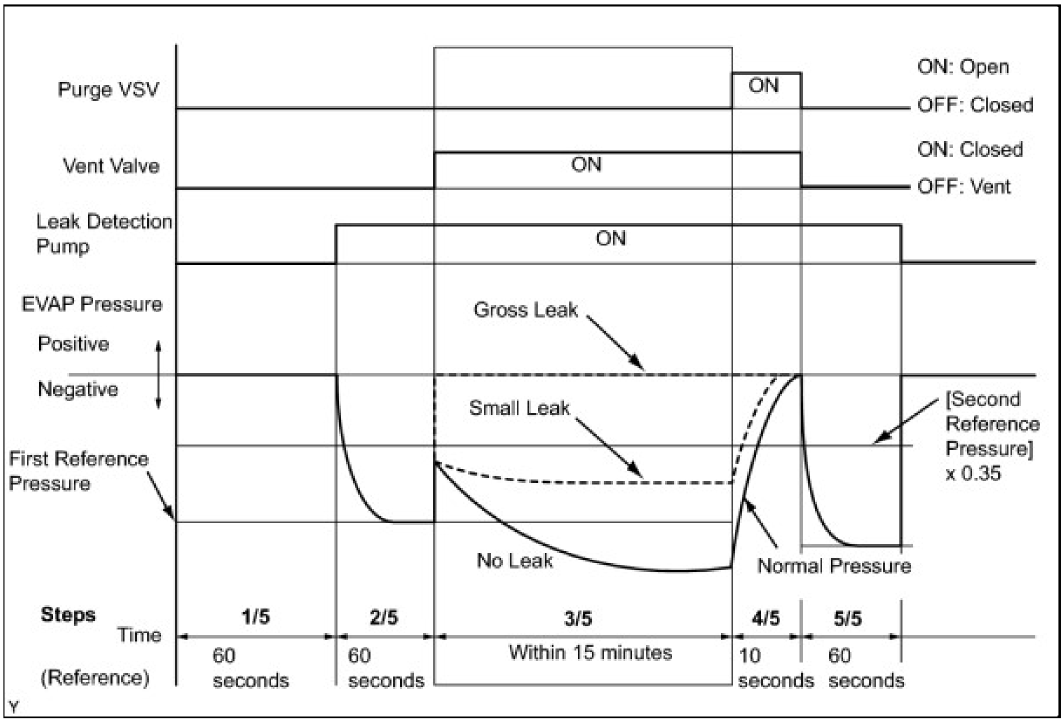
(c) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

HINT:

If no pending DTCs are displayed, perform the MONITOR CONFIRMATION (see "Diagnostic Help" menu). After this confirmation, check for pending DTCs. If no DTCs are displayed, the EVAP system is normal.

NEXT

3.	PERFORM EVAPORATIVE SYSTEM CHECK (MANUAL MODE)



NOTICE:

- In the Evaporative System Check (Manual Mode), perform the series of 5 Evaporative System Check steps manually using the Techstream.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed. If the cut-off valve is closed, the fuel tank leak check is not possible.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results

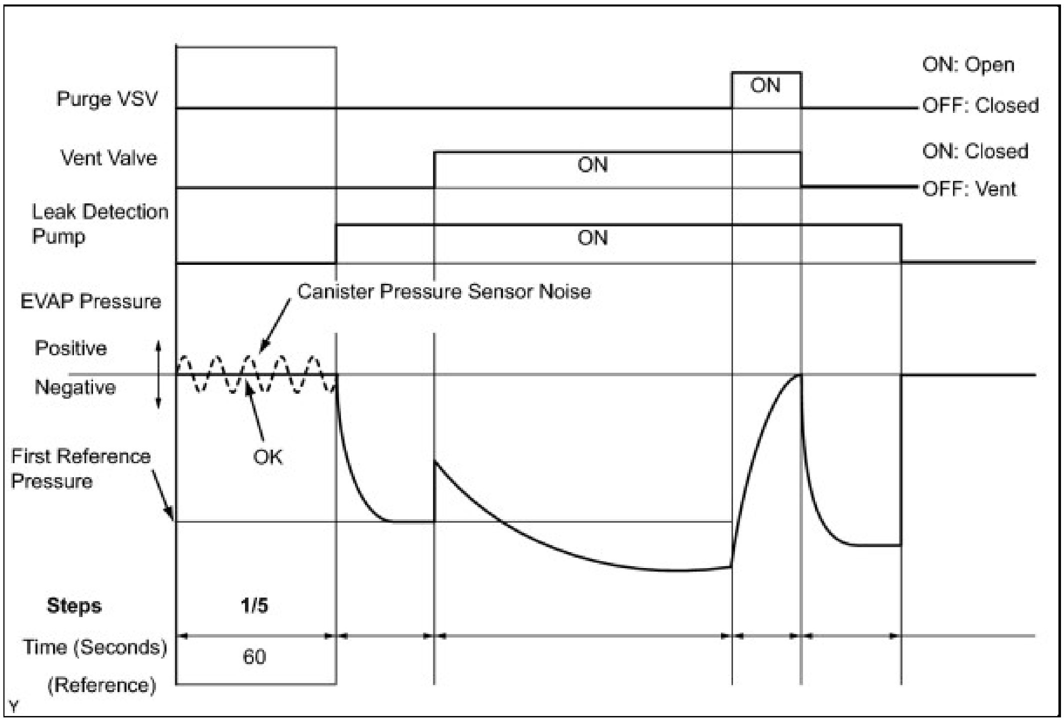
become inaccurate. When performing the Evaporative System Check, keep the temperature below 35°C (95°F).

(a) Clear the DTCs INFO .

(b) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Manual Mode.

NEXT

4.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 1/5)



(a) Check the EVAP pressure in step 1/5.

Result:

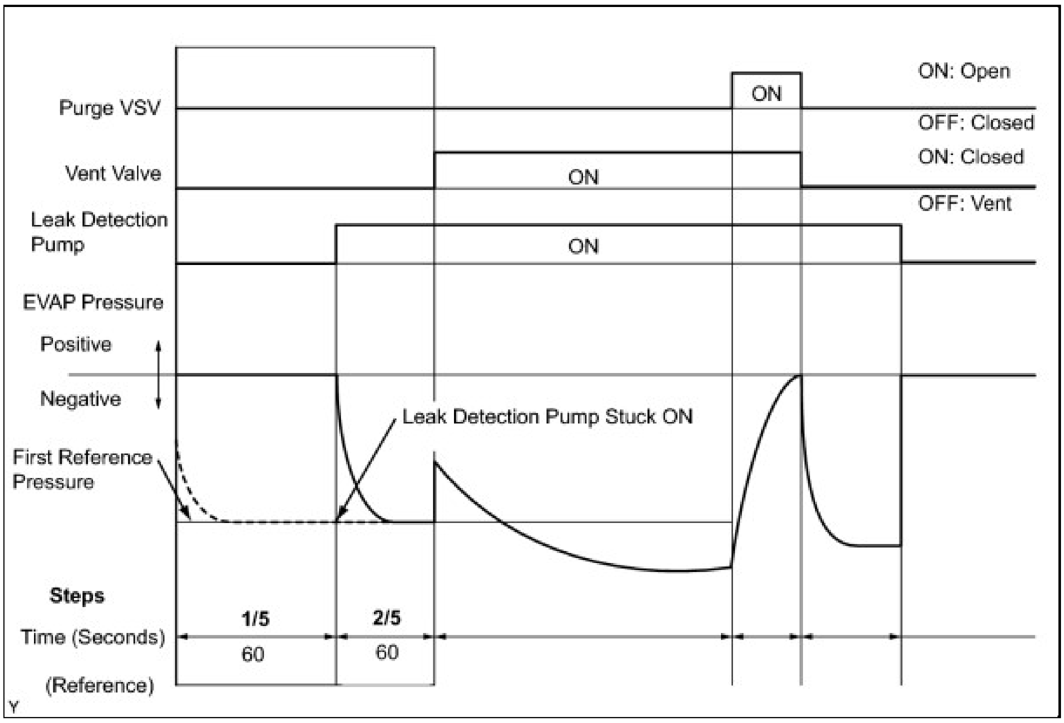
DTCS*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	Virtually no variation in EVAP pressure	Not yet determined	A
P0451	EVAP pressure fluctuates by +/- 0.3 kPa-g (+/- 2.25 mmHg-g) or more	Canister pressure sensor noise	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "CONFIRM DTC" procedures above.

B **REPLACE CANISTER ASSEMBLY**

A

5.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 1/5 TO 2/5)



(a) Check the EVAP pressure in steps 1/5 and 2/5.

Result:

DTCS*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	Virtually no variation in EVAP pressure during step 1/5. Then decreases to reference pressure	Not yet determined	A
P2402	Small difference between EVAP pressures during steps 1/5 and 2/5	Leak detection pump stuck ON	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "CONFIRM DTC" procedures above.

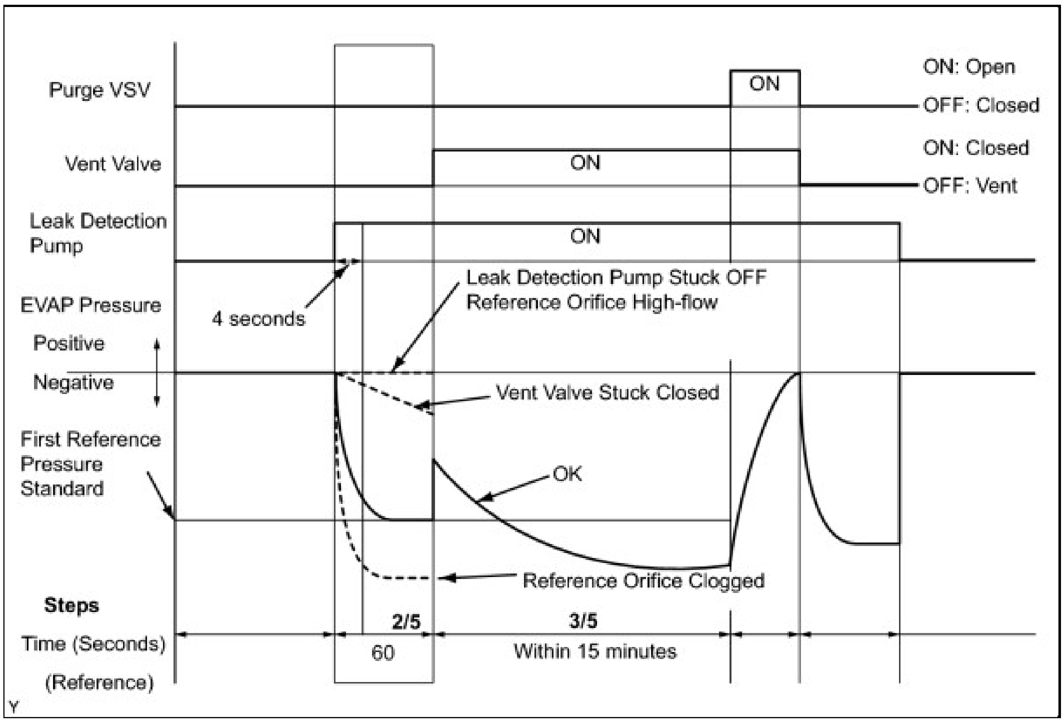
HINT:

The first reference pressure is the value determined in step 2/5.

B **PERFORM ACTIVE TEST USING TECHSTREAM (FOR LEAK DETECTION PUMP)**

A

6.	**PERFORM EVAPORATIVE SYSTEM CHECK (STEP 2/5)**



HINT:

Make a note of the pressures checked in steps (a) and (b) below.

(a) Check the EVAP pressure 4 seconds after the leak detection pump is activated*.

*: The leak detection pump begins to operate as step 1/5 finishes and step 2/5 starts.

(b) Check the EVAP pressure again when it has stabilized. This pressure is the reference pressure.

Result:

DTCS*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	EVAP pressure in step (b) between -4.85 kPa-g and -1.057 kPa-g (-36.4 mmHg-g and -7.93 mmHg-g)	Not yet determined	A
P043F and P2401	EVAP pressure in step (b) -1.057 kPa-g (-7.93 mmHg-g) or more	• Reference orifice high-flow • Leak detection pump stuck OFF	B
P043E	EVAP pressure in step (b) below -4.85 kPa-g (-36.4 mmHg-g)	Reference orifice clogged	C

DTCS*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
P2419	EVAP pressure in step (a) more than -1.057 kPa-g (-7.93 mmHg-g)	Vent valve stuck closed	D

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "CONFIRM DTC" procedures above.

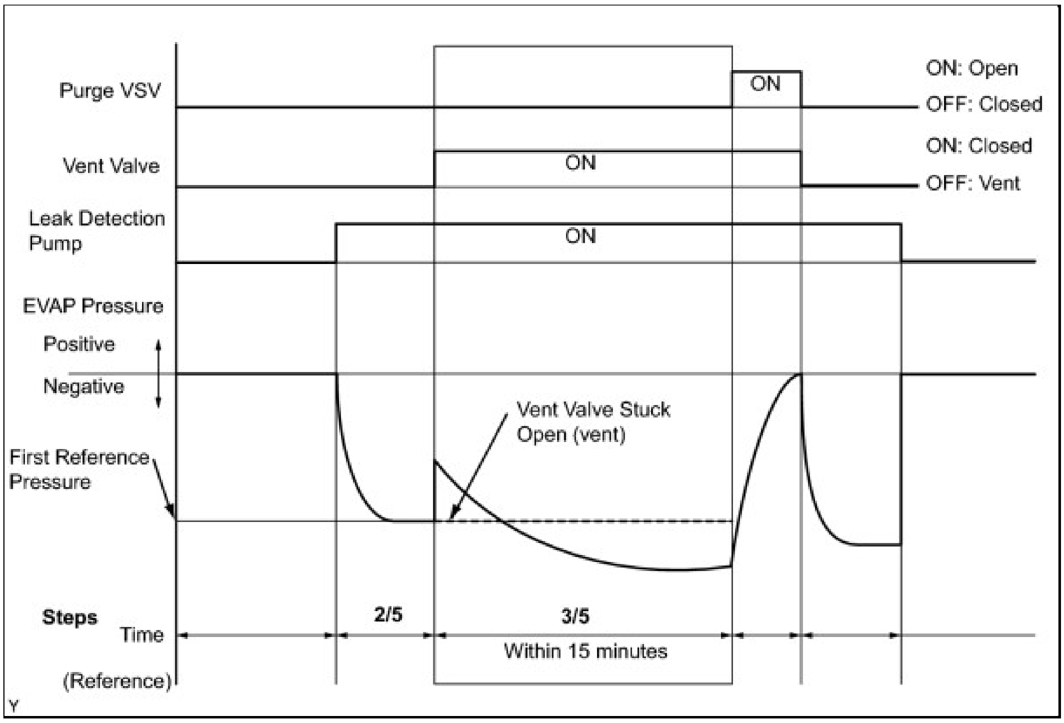
D ▶ INSPECT CANISTER PUMP MODULE (VENT VALVE OPERATION)

C ▶ REPLACE CANISTER ASSEMBLY

B ▶ PERFORM EVAPORATIVE SYSTEM CHECK (STEP 3/5)

A ▼

7.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 2/5 TO 3/5)



(a) Check the EVAP pressure increase in step 3/5.

Result:

DTCS*	RESULT	SUSPECTED TROUBLE	PROCEED

		AREA	TO
-	EVAP pressure increases by 0.3 kPa-g (2.25 mmHg-g) or more within 10 seconds of proceeding from step 2/5 to step 3/5	Not yet determined	A
P2420	No variation in EVAP pressure despite proceeding from step 2/5 to step 3/5	Vent valve stuck open (vent)	B
P0451	No variation in EVAP pressure during steps 1/5 through 3/5	Canister pressure sensor output value stuck	C

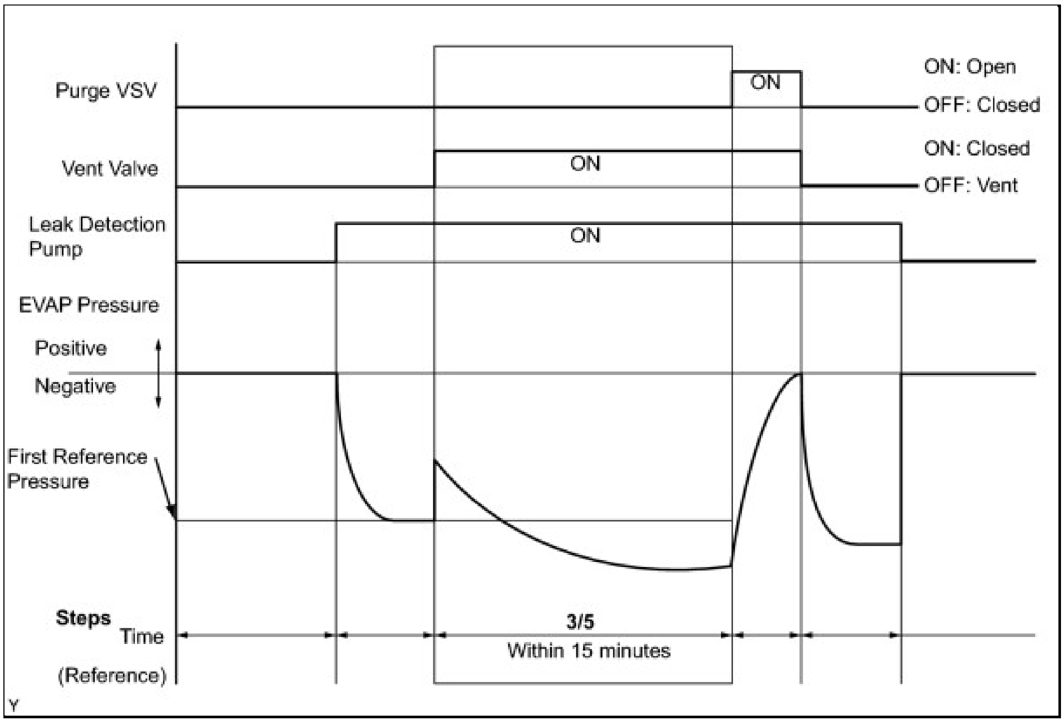
*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "CONFIRM DTC" procedures above.

C REPLACE CANISTER ASSEMBLY

B INSPECT CANISTER PUMP MODULE (POWER SOURCE FOR VENT VALVE)

A

8.	**PERFORM EVAPORATIVE SYSTEM CHECK (STEP 3/5)**



(a) Wait until the EVAP pressure change is less than 0.1 kPa-g (0.75 mmHg-g) for 30 seconds.

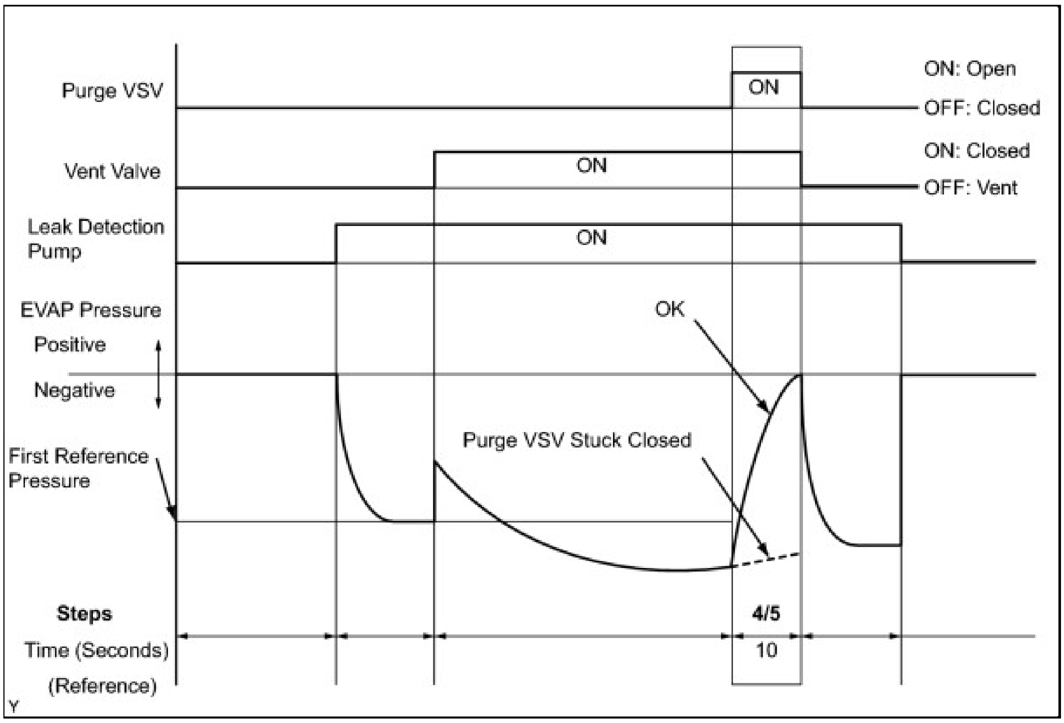
(b) Measure the EVAP pressure and record it.

HINT:

A few minutes are required for the EVAP pressure to become saturated. When there is little fuel in the fuel tank, it takes up to 15 minutes.

NEXT

9.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 4/5)



(a) Check the EVAP pressure in step 4/5.

Result:

DTCS*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	EVAP pressure increases by 0.3 kPa-g (2.25 mmHg-g) or more within 10 seconds of proceeding from step 3/5 to step 4/5	Not yet determined	A
P0441	EVAP pressure increases by 0.3 kPa-g (2.25 mmHg-g) or more within 10 seconds of proceeding from step 3/5 to step 4/5	Problems in EVAP hose between purge VSV and intake manifold	B
P0441	Variation in EVAP pressure less than 0.3 kPa-g (2.25 mmHg-g) for 10 seconds, after proceeding from step 3/5 to step 4/5	Purge VSV stuck closed	C

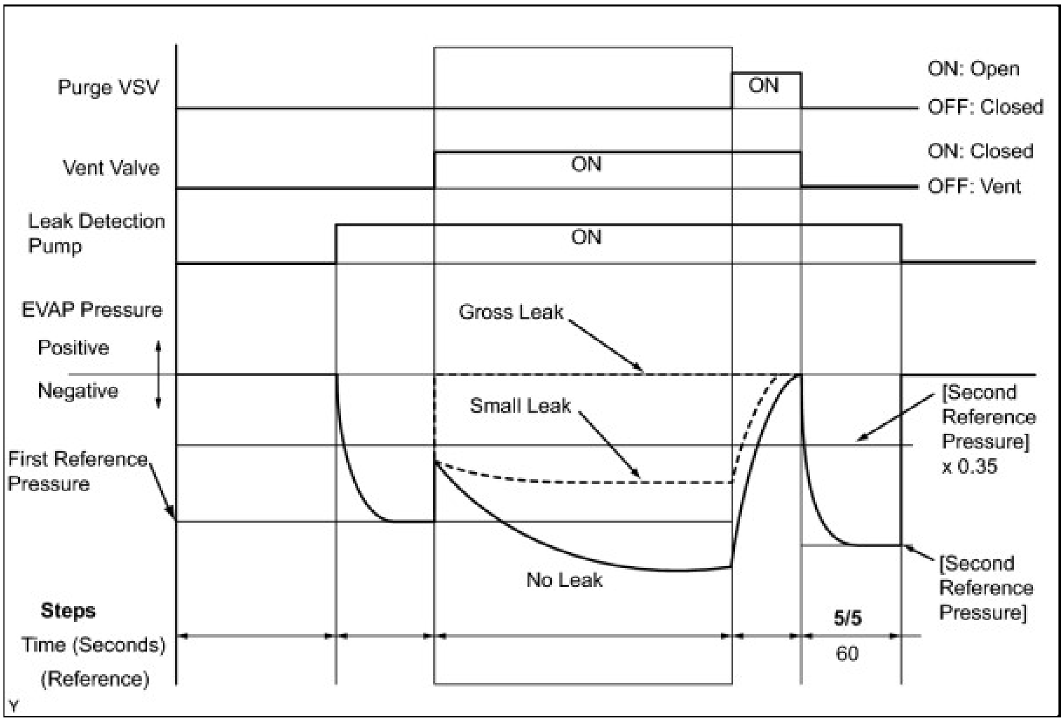
*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "CONFIRM DTC" procedures above.

C ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (PURGE VSV)**

B ▶ **CHECK EVAP HOSE (PURGE VSV - INTAKE MANIFOLD)**

A
▼

10.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 5/5)



(a) Check the EVAP pressure in step 5/5.

(b) Compare the EVAP pressure in step 3/5 and the second reference pressure (step 5/5).

Result:

DTCS*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	EVAP pressure (step 3/5) lower than second reference pressure (step 5/5)	Not yet determined (no leak from EVAP system)	A
P0441 and P0455	EVAP pressure (step 3/5) higher than [second reference pressure (step 5/5) x 0.35]	• Purge VSV stuck open • EVAP gross leak	B

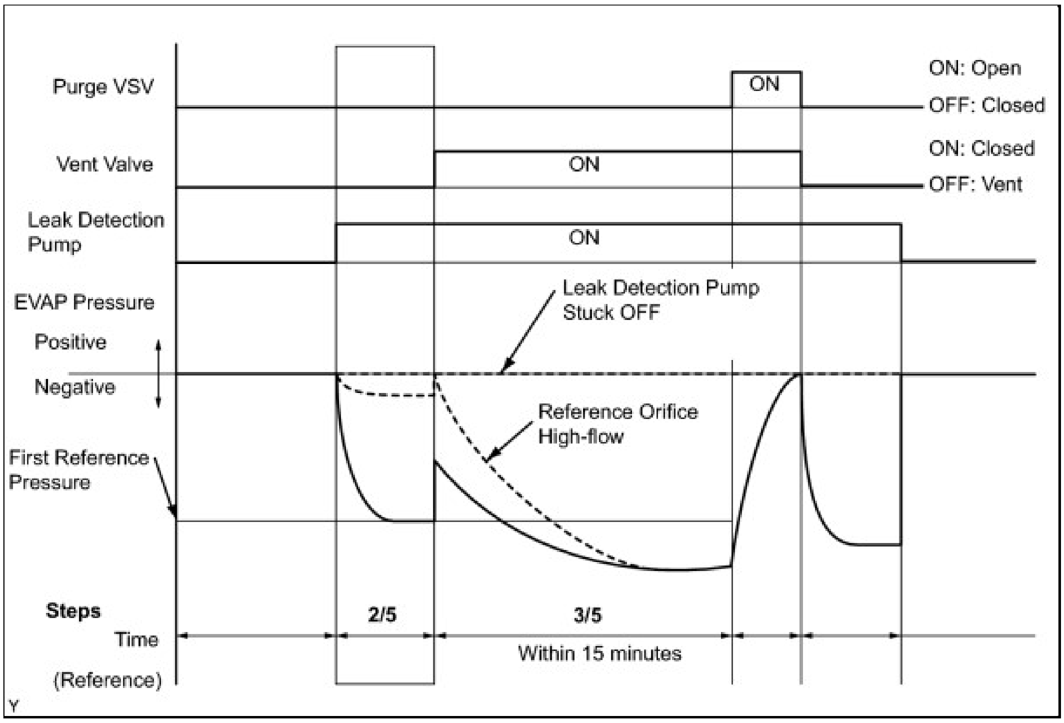
DTCS*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
P0456	EVAP pressure (step 3/5) higher than second reference pressure (step 5/5)	EVAP small leak	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "CONFIRM DTC" procedures above.

B ▶ PERFORM ACTIVE TEST USING TECHSTREAM (PURGE VSV)

A ▶ REPAIR OR REPLACE PARTS AND COMPONENTS INDICATED BY OUTPUT DTCS

11.	**PERFORM EVAPORATIVE SYSTEM CHECK (STEP 3/5)**



(a) Check the EVAP pressure in step 3/5.

Result:

DTCS*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
P043F	EVAP pressure less than [reference pressure] measured at 2/5	Reference orifice high-flow	A
P2401	EVAP pressure almost same as [reference pressure] measured at 2/5	Leak detection pump stuck OFF	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "CONFIRM DTC"

procedures above.

HINT:

The first reference pressure is the value determined in step 2/5.

B ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (FOR LEAK DETECTION PUMP)**

A ▶ **REPLACE CANISTER ASSEMBLY**

12.	PERFORM ACTIVE TEST USING TECHSTREAM (PURGE VSV)

(a) Enter the following menus: Powertrain / Engine and ECT / Active Test / Activate the VSV for EVAP Control.

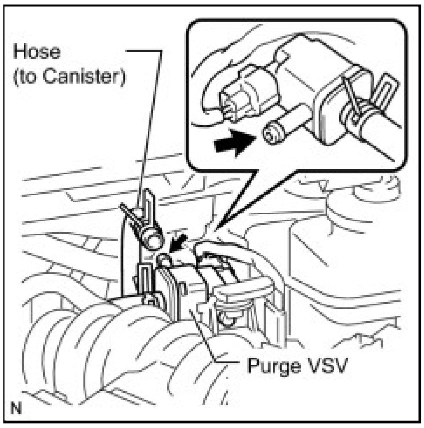
(b) Disconnect the hose (connected to the canister) from the purge VSV.

(c) Start the engine.

(d) Using the Techstream, turn off the purge VSV (Activate the VSV for EVAP Control: OFF).

(e) Use your finger to confirm that the purge VSV has no suction.

(f) Using the Techstream, turn on the purge VSV (Activate the VSV for EVAP Control: ON).



(g) Use your finger to confirm that the purge VSV has suction.

Result:

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
No suction when purge VSV turned OFF, and suction applied when turned ON	Purge VSV normal	A
Suction applied when purge VSV turned OFF	Purge VSV stuck open	B
No suction when purge VSV turned ON	• Purge VSV stuck closed • Problems with EVAP hose between purge VSV and intake manifold	C

(h) Reconnect the hose.

C ▶ **CHECK EVAP HOSE (PURGE VSV - INTAKE MANIFOLD)**

B ▶ **INSPECT PURGE VSV**

A

13.	CHECK FUEL CAP ASSEMBLY

(a) Check that the fuel cap is correctly installed and confirm the fuel cap meets OEM specifications.

(b) Tighten the fuel cap until a few click sounds are heard.

HINT:

If an EVAP tester is available, check the fuel cap using the Techstream.

1. Remove the fuel cap and install it onto a fuel cap adapter.
2. Connect an EVAP tester pump hose to the adapter, and pressurize the cap to 3.2 to 3.7 kPa (24 to 28 mmHg) using an EVAP tester pump.
3. Seal the adapter and wait for 2 minutes.
4. Check the pressure. If the pressure is 2 kPa (15 mmHg) or more, the fuel cap is normal.

Result:

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Fuel cap correctly installed	-	A
Fuel cap loose	• Fuel cap improperly installed • Defective fuel cap • Fuel cap does not meet OEM specifications	B
Defective fuel cap	-	B
No fuel cap	-	C

C **REPLACE FUEL TANK CAP**

B **CORRECTLY REINSTALL OR REPLACE FUEL TANK CAP**

A **LOCATE EVAP LEAK PART**

14.	INSPECT PURGE VSV

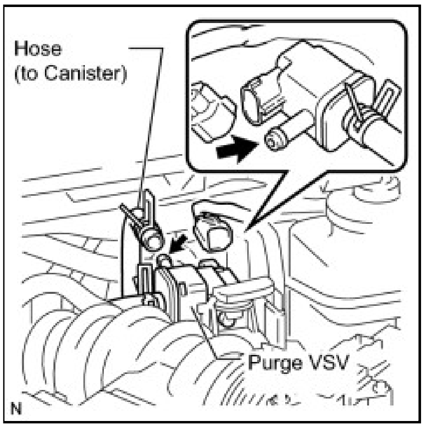
(a) Turn the ignition switch off.

(b) Disconnect the purge VSV connector.

(c) Disconnect the hose (connected to the canister) from the purge VSV.

(d) Start the engine.

(e) Use your finger to confirm that the purge VSV has no suction.



Result:

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
No suction	ECM	A
Suction applied	Purge VSV	B

(f) Reconnect the purge VSV connector.

(g) Reconnect the hose.

B ▶ **REPLACE PURGE VSV**

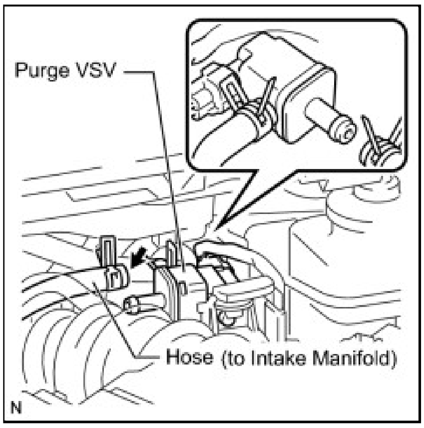
A ▶ **REPLACE ECM**

15.	CHECK EVAP HOSE (PURGE VSV - INTAKE MANIFOLD)

(a) Disconnect the hose (connected to the intake manifold) from the purge VSV.

(b) Start the engine.

(c) Use your finger to confirm that the hose has suction.



Result:

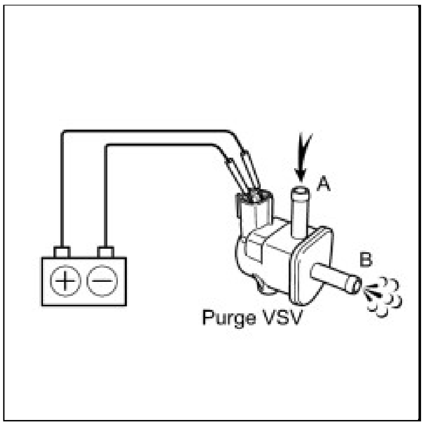
RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Suction applied	EVAP hose between purge VSV and intake manifold normal	A
No suction	• Intake manifold port • EVAP hose between purge VSV and intake manifold	B

(d) Reconnect the hose.

B ▶ **INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)**

A ▼

16.	INSPECT PURGE VSV



(a) Remove the purge VSV.

(b) Apply battery voltage across the terminals of the purge VSV.

(c) Confirm that air flows from port A to port B.

Result:

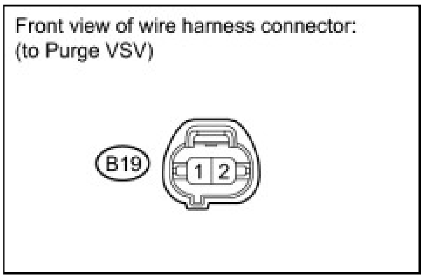
RESULT	CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
Air flows	Battery voltage applied across purge VSV terminals	-	A
No air flow	Battery voltage applied across purge VSV terminals	Purge VSV	B

(d) Reinstall the purge VSV.

B ▶ **REPLACE PURGE VSV**

A ▼

17.	CHECK HARNESS AND CONNECTOR (POWER SOURCE OF PURGE VSV)



(a) Disconnect the purge VSV connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Result:

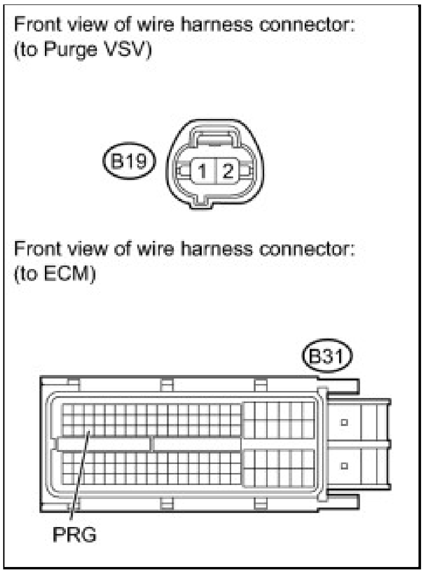
TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
B19-2 - Body ground	Ignition switch ON	11 to 14 V	Normal	A
		Other than result above	Wire harness or connectors between purge VSV and battery	B

(d) Reconnect the purge VSV connector.

B ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

A ▼

18.	CHECK HARNESS AND CONNECTOR (PURGE VSV - ECM)



(a) Disconnect the ECM connector.

(b) Disconnect the purge VSV connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B31-49 (PRG) - B19-1	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B31-49 (PRG) or B19-1 - Body ground	Always	10 kΩ or higher

(d) Reconnect the ECM connector.

(e) Reconnect the purge VSV connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

19.	INSPECT CANISTER PUMP MODULE (POWER SOURCE FOR VENT VALVE)

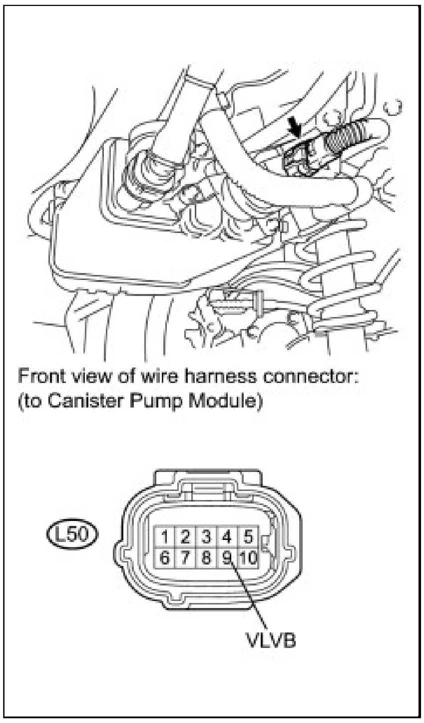
(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

(c) Turn the ignition switch to ON.

(d) Measure the voltage according to the value(s) in the table below.

Result:



TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
L50-9 (VLVB) - Body ground	Ignition switch ON	11 to 14 V	1. Wire harness between vent valve and ECM 2. Vent valve 3. ECM	A
		Below 3 V	Power source wire harness of vent valve	B

(e) Reconnect the canister pump module connector.

B REPAIR OR REPLACE HARNESS OR CONNECTOR

A

20.	INSPECT CANISTER PUMP MODULE (VENT VALVE OPERATION)

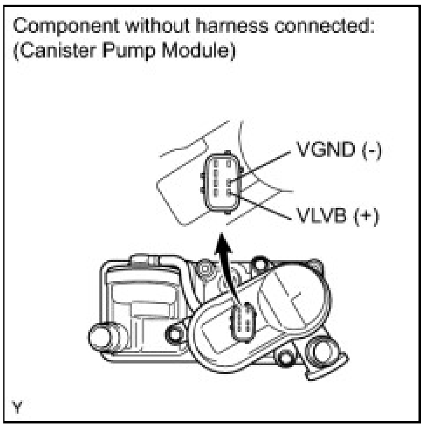
(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

(c) Apply the battery voltage to VLVB and VGND terminals of the canister pump module.

(d) Touch the canister pump module to confirm the vent valve operation.

Result:



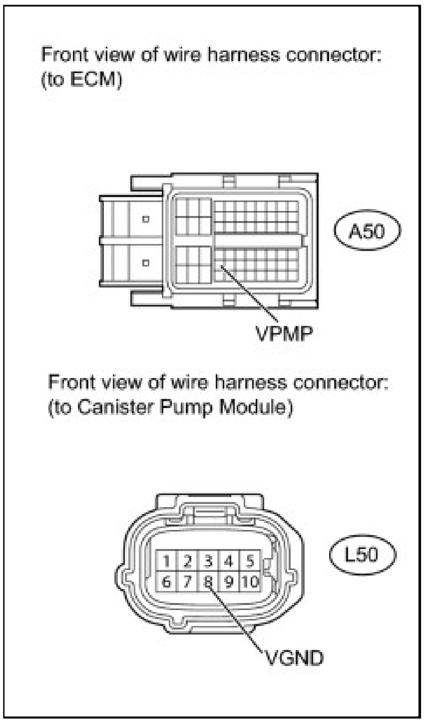
RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Operating	1. Wire harness between vent valve and ECM 2. ECM	A
Not operating	Vent valve	B

(e) Reconnect the canister pump module connector.

B ▶ REPLACE CANISTER ASSEMBLY

A ▼

21.	CHECK HARNESS AND CONNECTOR (ECM - CANISTER PUMP MODULE)



(a) Disconnect the ECM connector.

(b) Disconnect the canister pump module connector.

(c) Measure the resistance according to the value(s) in the table below.

Result:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
A50-42 (VPMP) - L50-8 (VGND)	Always	Below 1 Ω	ECM	A
		10 kΩ or higher	Wire harness between ECM and canister pump module	B

(d) Reconnect the ECM connector.

(e) Reconnect the canister pump module connector.

B ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

A ▶ REPLACE ECM

22.	PERFORM ACTIVE TEST USING TECHSTREAM (FOR LEAK DETECTION PUMP)

(a) Turn the ignition switch off.

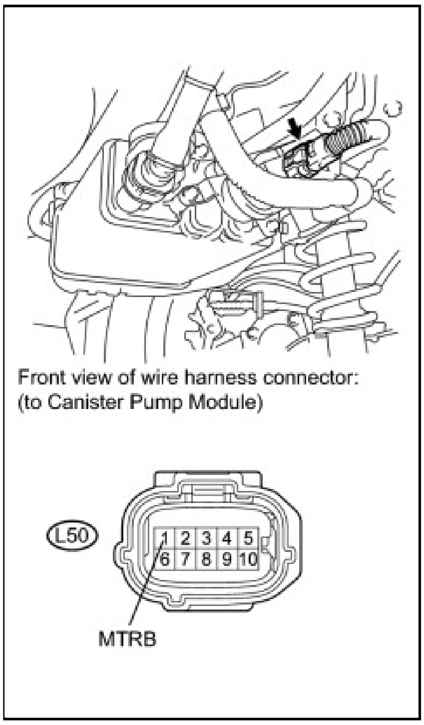
(b) Disconnect the canister pump module connector.

(c) Turn the ignition switch to ON.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Activate the Vacuum Pump.

(e) Measure the voltage according to the value(s) in the table below.

Result:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
L50-1 (MTRB) - Body ground	Leak detection pump ON and OFF (Active Test ON and OFF)	Below 3 V when OFF 11 to 14 V when ON	1. Wire harness between leak detection pump and body ground 2. Leak detection pump	A
		Below 3 V when OFF and ON	1. Wire harness between leak detection pump and ECM 2. ECM	B

(f) Reconnect the canister pump module connector.

B ▶ **CHECK HARNESS AND CONNECTOR (ECM - CANISTER PUMP MODULE)**

A ▼

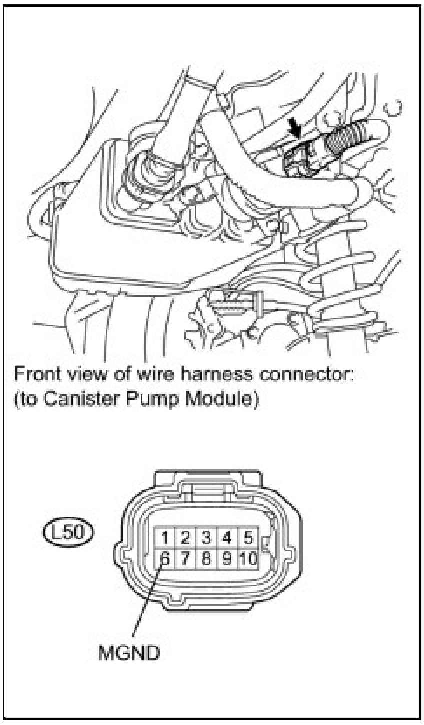
23.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - BODY GROUND)

(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

(c) Measure the resistance according to the value(s) in the table below.

Result:



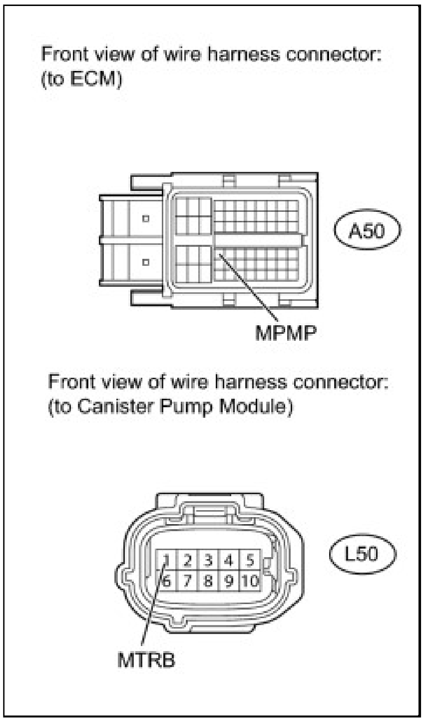
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
L50-6 (MGND) - Body ground	Always	Below 1 Ω	Leak detection pump	A
		10 kΩ or higher	Wire harness between canister pump module and body ground	B

(d) Reconnect the canister pump module connector.

B ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

A ▶ **REPLACE CANISTER ASSEMBLY**

24.	CHECK HARNESS AND CONNECTOR (ECM - CANISTER PUMP MODULE)



(a) Turn the ignition switch off.

(b) Disconnect the ECM connector.

(c) Disconnect the canister pump module connector.

(d) Measure the resistance according to the value(s) in the table below.

Result:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
A50-34 (MPMP) - L50-1 (MTRB)	Always	Below 1 Ω	ECM	A
		10 kΩ or higher	Wire harness between ECM and canister pump module	B

(e) Reconnect the ECM connector.

(f) Reconnect the canister pump module connector.

B ▶ **REPAIR OR REPLACE**

HARNESS OR CONNECTOR

A ▶ REPLACE ECM

25.	INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)

(a) Stop the engine.

(b) Disconnect the EVAP hose from the intake manifold.

(c) Start the engine.

(d) Use your finger to confirm that the port of the intake manifold has suction.

Result:

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Suction applied	EVAP hose between intake manifold and purge VSV	A
No suction	Intake manifold	B

(e) Reconnect the EVAP hose.

B ▶ INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)

A ▶ REPLACE PURGE LINE HOSE (INTAKE MANIFOLD - PURGE VSV)

26.	CORRECTLY REINSTALL OR REPLACE FUEL TANK CAP

HINT:

- When reinstalling the fuel tank cap, tighten it until a few click sounds are heard.
- When replacing the fuel tank cap, use a fuel tank cap that meets OEM specifications, and install it until a few click sounds are heard.

NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

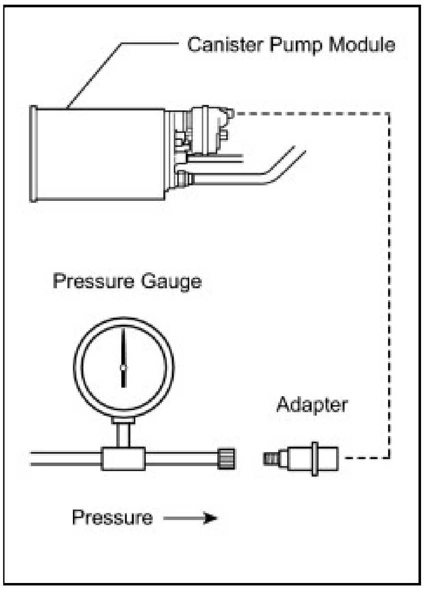
27.	REPLACE FUEL TANK CAP

HINT:

When replacing the fuel cap, use a fuel cap that meets OEM specifications, and install it until a few click sounds are heard.

NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

28.	LOCATE EVAP LEAK PART



(a) Disconnect the vent hose.

(b) Connect an EVAP tester to the canister pump module with the adapter.

(c) Pressurize the EVAP system to 3.2 to 3.7 kPa (24 to 28 mmHg).

(d) Apply soapy water to the piping and connecting parts of the EVAP system.

(e) Look for areas where bubbles appear. This indicates the leak point.

(f) Repair or replace the leak point.

HINT:

Disconnect the hose between the canister and the fuel tank from the canister. Block the canister side and conduct an inspection. In this way, the fuel tank can be excluded as an area suspected of causing fuel leaks.

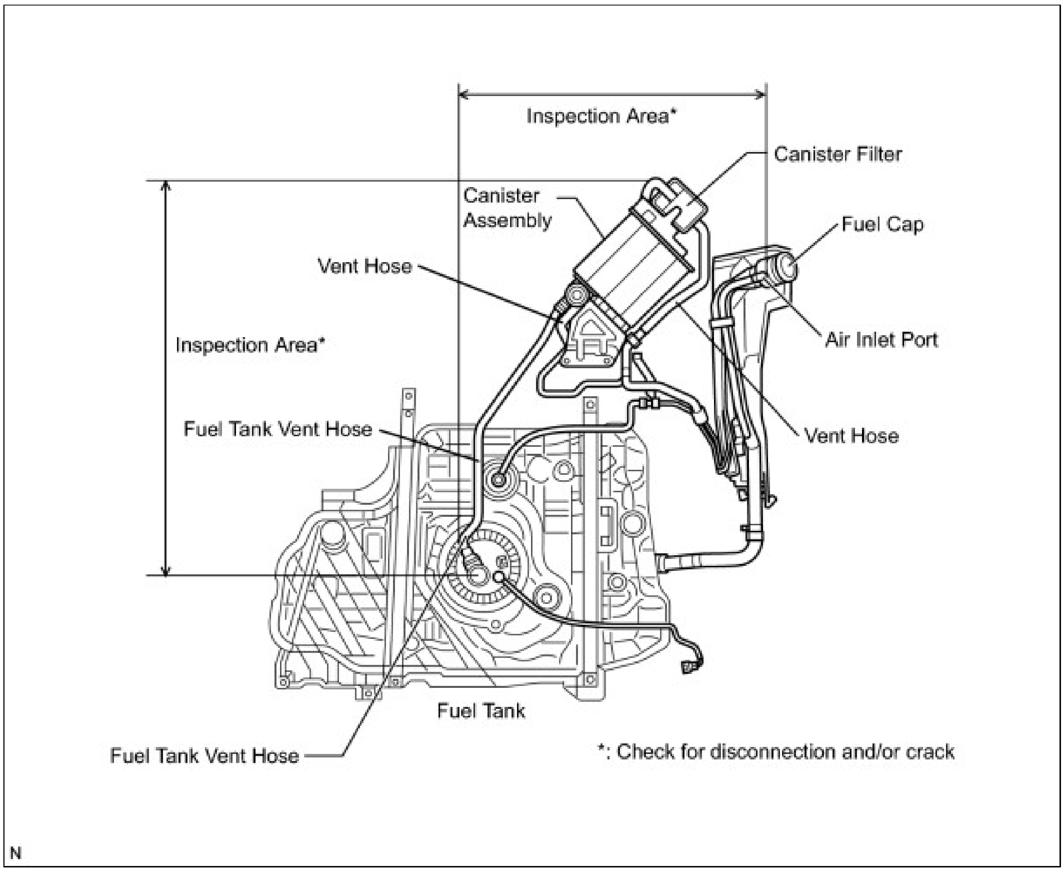
NEXT ▶ **PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)**

29.	REPLACE CANISTER ASSEMBLY

(a) Replace the canister assembly INFO .

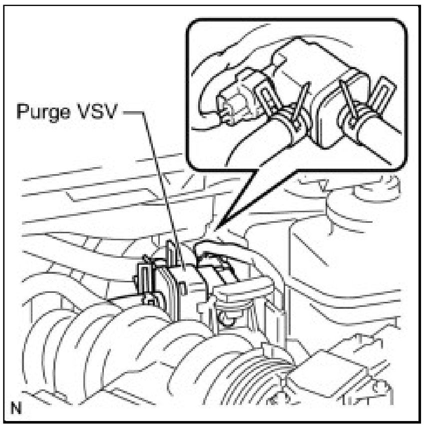
NOTICE:

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



NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

30.	REPLACE PURGE VSV



(a) Disconnect the connector and the hoses from the purge VSV.

(b) Remove the purge VSV.

(c) Install a new purge VSV.

(d) Reconnect the connector and hoses.

NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

31.	REPAIR OR REPLACE HARNESS OR CONNECTOR

NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

32.	REPLACE PURGE LINE HOSE (INTAKE MANIFOLD - PURGE VSV)

NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

33.	INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)

(a) Check that the EVAP purge port of the intake manifold is not clogged. If necessary, replace the intake manifold.

NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

34.	REPLACE ECM

(a) Replace the ECM INFO .

NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

35.	REPAIR OR REPLACE PARTS AND COMPONENTS INDICATED BY OUTPUT DTCS

(a) Repair the malfunctioning areas indicated by the DTCs that had been confirmed when the vehicle was brought in.

NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

36.	PERFORM EVAPORATIVE SYSTEM CHECK (AUTOMATIC MODE)

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of five steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the EVAP SYSTEM CHECK when the fuel tank is more than 90% full because the cut-off valve may be closed. If the cut-off valve is closed, the fuel tank leak check is not possible.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing an Evaporative System Check, keep the temperature below 35°C (95°F).

(a) Clear the DTCs INFO .

(b) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.

(c) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine and ECT / Trouble Codes.

HINT:

If no pending DTCs are found, the repair has been successfully completed.

NEXT ▶ **END**

CONFIRMATION DRIVING PATTERN

HINT:

After a repair, check Monitor Status by performing the Key-Off Monitor Confirmation and Purge Flow Monitor Confirmation described below.

1. Key-off monitor confirmation

(a) Preconditions

The monitor will not run unless:

- The vehicle has been driven for 10 minutes or more (in a city area or on a freeway)
- The fuel tank is less than 90% full
- The altitude is less than 8000 ft. (2432 m)
- The engine coolant temperature is between 4.4°C and 35°C (40°F and 95°F)
- The intake air temperature is between 4.4°C and 35°C (40°F and 95°F)
- The vehicle remains stationary (the vehicle speed is 0 mph [0 km/h])

(b) Monitor Conditions

1. Allow the engine to idle for at least 5 minutes.
2. Turn the ignition switch off and wait for 5 hours (or 7 or 9.5 hours).

HINT:

Do not start the engine until checking Monitor Status. If the engine is started, the steps described above must be repeated.

(c) Monitor Status

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Enter the following menus: Powertrain / Engine and ECT / Monitor / Evaporative System.
4. Check the Monitor Status displayed on the Techstream.

HINT:

If Incomplete is displayed, the monitor did not complete. Make sure that the preconditions have been met, and perform the Monitor Conditions again.

2. Purge flow monitor confirmation (P0441)

HINT:

Perform this monitor confirmation after the Key-Off Monitor Confirmation shows Complete.

(a) Preconditions

The monitor will not run unless:

- The vehicle has been driven for 10 minutes or more (in a city area or on a freeway)
- The engine coolant temperature is between 4.4°C and 35°C (40°F and 95°F)
- The intake air temperature is between 4.4°C and 35°C (40°F and 95°F)

(b) Monitor Conditions

1. Release the pressure from the fuel tank by removing and reinstalling the fuel cap.
2. Warm the engine up until the engine coolant temperature reaches more than 75°C (167°F).

3. Increase the engine speed to 3000 rpm once.
4. Allow the engine to idle and turn A/C on for 1 minute.

(c) Monitor Status

1. Turn the ignition switch off (if ON or the engine is running).
2. Connect the Techstream to the DLC3.
3. Turn the ignition switch to ON.
4. Turn the Techstream on.
5. Enter the following menus: Powertrain / Engine and ECT / Monitor.
6. Check the Monitor Status displayed on the Techstream.

HINT:

If Incomplete is displayed, the monitor did not complete. Make sure that the preconditions have been met, and perform the Monitor Conditions again.

MONITOR RESULT

Refer to Checking Monitor Status INFO .

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PFX0B9X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2119: Throttle Actuator Control Throttle Body Range / Performance (2010 Corolla)		

DTC	**P2119**	**Throttle Actuator Control Throttle Body Range / Performance**

DESCRIPTION

The electronic throttle control system is composed of the throttle actuator, throttle position sensor, accelerator pedal position sensor, and ECM. The ECM operates the throttle actuator to regulate the throttle valve in response to driver inputs. The throttle position sensor detects the opening angle of the throttle valve, and provides the ECM with feedback so that the throttle valve can be appropriately controlled by the ECM.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2119	Throttle valve opening angle continues to vary greatly from target opening angle (1 trip detection logic)	• Electronic throttle control system • ECM

MONITOR DESCRIPTION

The ECM determines the actual opening angle of the throttle valve from the throttle position sensor signal. The actual opening angle is compared to the target opening angle commanded by the ECM. If the difference between these two values is outside the standard range, the ECM interprets this as a malfunction in the electronic throttle control system. The ECM then illuminates the MIL and sets the DTC.

If the malfunction is not repaired successfully, the DTC can be set when the accelerator pedal is quickly released (to close the throttle valve) after the engine speed reaches 5000 rpm by fully depressing the accelerator pedal (fully open the throttle valve).

MONITOR STRATEGY

Related DTCs	P2119: Electronic throttle control system malfunction
Required Sensors/Components (Main)	Throttle actuator (throttle body)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediate

Sequence of Operation	None

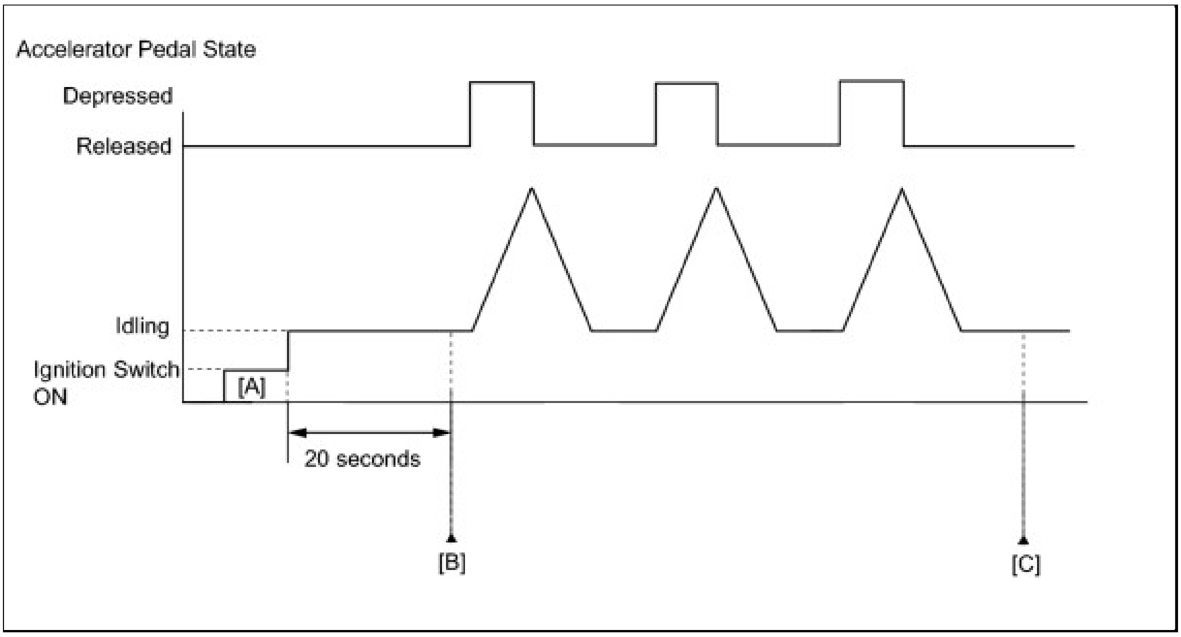
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
System guard* judge condition	ON
*System guard set when following conditions are met:	-
Throttle actuator	ON
Throttle actuator duty calculation	Executing
Throttle position sensor fail	Not detected
Throttle actuator current-cut operation	Not executing
Throttle actuator power supply	4 V or more
Throttle actuator fail	Not detected

TYPICAL MALFUNCTION THRESHOLDS

Either of following conditions A or B is met	-
A. Commanded closed throttle position - current closed throttle position	0.3 V or more for 1 second
B. Commanded open throttle position - current open throttle position	0.3 V or more for 0.6 seconds

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine.
7. Idle the engine for 20 seconds.
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P2119.
10. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.

- If the judgment result shows INCOMPLETE or UNKNOWN, fully depress and release the accelerator pedal 3 times, and then check the DTC judgment result at step [C].

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
12. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

FAIL-SAFE

When this DTC, as well as other DTCs relating to electronic throttle control system malfunctions, is set, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 6.5° throttle angle by 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 allow the vehicle to continue running at a minimal speed. If the accelerator pedal is depressed gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned to off.

WIRING DIAGRAM

Refer to DTC P2102 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2119)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P2119	A
P2119 and other DTCs	B

HINT:

If any DTCs other than P2119 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A
▼

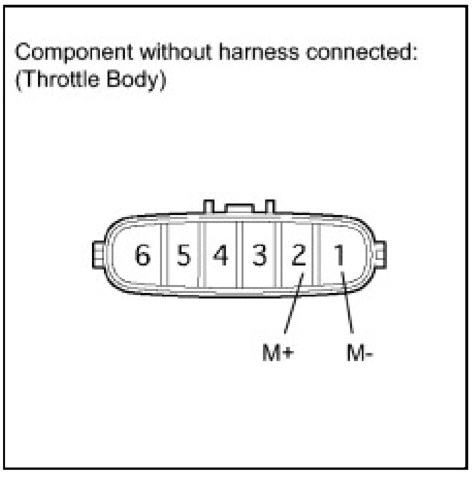
2.	INSPECT THROTTLE BODY (RESISTANCE OF THROTTLE ACTUATOR)

(a) Disconnect the throttle body connector.

(b) Measure the resistance according to the value(s) in the table below

Standard Resistance:

TESTER CONDITION	CONDITION	SPECIFIED CONDITION
2(M+) - 1 (M-)	20°C (68°F)	0.3 to 100 Ω



(c) Reconnect the throttle body connector.

NG ▶ **REPLACE THROTTLE BODY**

OK
▼

3.	REPLACE ECM

NEXT

4.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2119)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Allow the engine to idle for 15 seconds or more.

(f) Fully depress and release the accelerator pedal several times quickly.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read DTCs.

OK:
No DTC output.

HINT:

The output voltage of the throttle position sensor can be checked using the Techstream. Variations in the output voltage indicate that the throttle actuator is operating. To check the output voltage using the Techstream, enter the following menus: Powertrain / Engine and ECT / ETCS / Throttle Position No. 1.

NG REPLACE THROTTLE BODY

OK CHECK FOR INTERMITTENT PROBLEMS

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000WC409EX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2195,P2196: Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1) (2010 Corolla)		

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)**

DESCRIPTION

HINT:

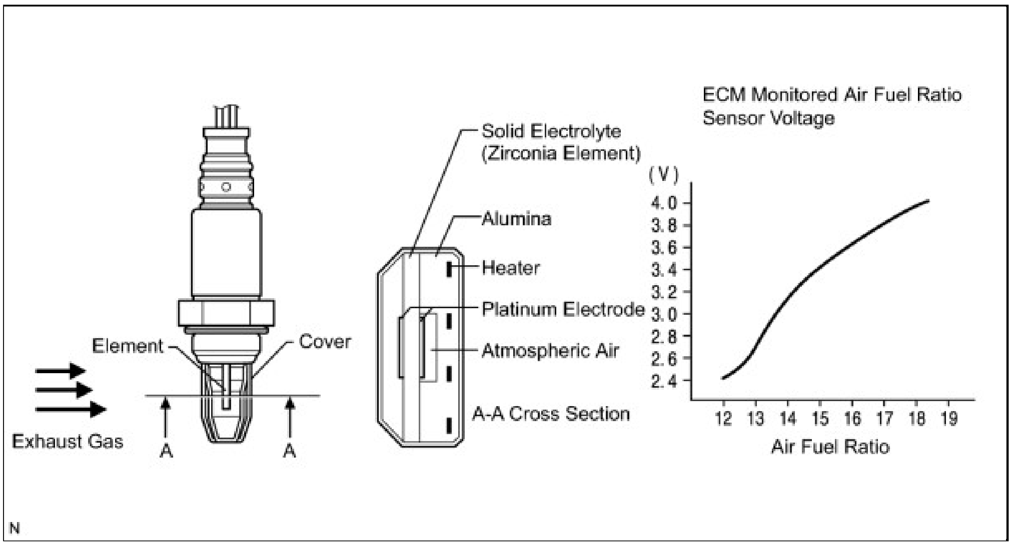
- Although the DTC titles say oxygen sensor, these DTCs relate to the air-fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

The air fuel ratio sensor generates a voltage* that corresponds to the actual air-fuel ratio. This sensor voltage is used to provide the ECM with feedback so that it can control the air-fuel ratio. The ECM determines the deviation from the stoichiometric air-fuel ratio level, and regulates the fuel injection duration. If the air fuel ratio sensor malfunctions, the ECM is unable to control the air-fuel ratio accurately.

The air fuel ratio sensor is a planar type with an integrated heater, which heats the solid electrolyte (zirconia element). This heater is controlled by the ECM. When the intake air volume is low (the exhaust gas temperature is low), current flows to the heater to heat the sensor, in order to facilitate accurate oxygen concentration detection. In addition, the sensor and heater portions are the narrow type. The heat generated by the heater is conducted to the solid electrolyte through the alumina, therefore the sensor activation is accelerated.

In order to obtain a high purification rate of the carbon monoxide (CO), hydrocarbon (HC) and nitrogen oxide (NOx) components in the exhaust gas, a three-way catalytic converter is used. For the most efficient use of the three-way catalytic converter, the air-fuel ratio must be precisely controlled so that it is always close to the stoichiometric level.

*: Value changes inside the ECM. Since the air fuel ratio sensor uses a current output element, the current is converted into a voltage inside the ECM. Any measurements taken at the air fuel ratio sensor or ECM connectors will show a constant voltage.



DTC NO.		DTC DETECTION CONDITION	TROUBLE AREA
P2195	• •	Conditions (a) and (b) continue for 10 seconds or more (2 trip detection logic) (a) Air fuel ratio sensor voltage more than 3.8 V (b) Heated oxygen sensor voltage 0.15 V or more	• Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • Air fuel ratio sensor (sensor 1) heater • Air fuel ratio sensor heater circuit • Intake system • Fuel pressure • Fuel injector • ECM
		While fuel-cut operation performed (during vehicle deceleration), Air fuel ratio sensor current 3.6 mA or more for 3 seconds (2 trip detection logic)	• Air fuel ratio sensor • ECM
P2196	• •	Conditions (a) and (b) continue for 10 seconds or more (2 trip detection logic) (a) Air fuel ratio sensor voltage less than 2.8 V (b) Heated oxygen sensor voltage less than 0.6 V	• Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • Air fuel ratio sensor (sensor 1) heater • Air fuel ratio sensor heater circuit • Intake system • Fuel pressure • Fuel injector • ECM
		While fuel-cut operation performed (during vehicle deceleration), Air fuel ratio sensor current less than 1.0 mA for 3 seconds (2 trip detection logic)	• Air fuel ratio sensor • ECM

HINT:

- When any of these DTCs are set, check the air fuel ratio sensor voltage output by entering the following menus: Powertrain / Engine and ECT / Data List / A/F Control System / AFS Voltage B1 S1.
- Short-term fuel trim values can also be read using the Techstream.
- The ECM regulates the voltages at the A1A+ and A1A- terminals of the ECM to a constant level. Therefore, the air fuel ratio sensor voltage output cannot be confirmed without using the Techstream.
- If a air fuel ratio sensor malfunction is detected, the ECM sets a DTC.

MONITOR DESCRIPTION

Sensor voltage detection monitor

Under the air-fuel ratio feedback control, if the air fuel ratio sensor voltage output indicates rich or lean for a certain period of time, the ECM determines that there is a malfunction in the air fuel ratio sensor. The ECM illuminates the MIL and sets a DTC.

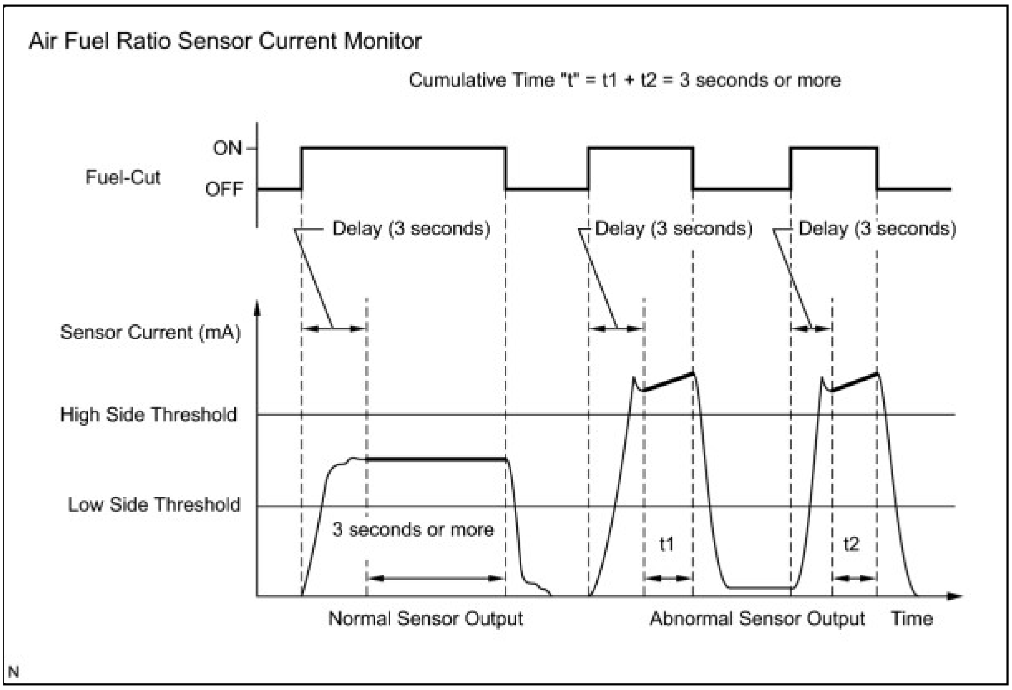
Example:

If the air fuel ratio sensor voltage output is less than 2.8 V (very rich condition) for 10 seconds, despite the heated oxygen sensor voltage output being less than 0.6 V, the ECM sets DTC P2196. Alternatively, if the air fuel ratio sensor voltage output is more than 3.8 V (very lean condition) for 10 seconds, despite the heated oxygen sensor voltage output being 0.15 V or more, DTC P2195 is set.

Sensor current detection monitor

A rich air-fuel mixture causes a low air fuel ratio sensor current, and a lean air-fuel mixture causes a high air fuel ratio sensor current. Therefore, the sensor output becomes low during acceleration, and it becomes high during deceleration with the throttle valve fully closed. The ECM monitors the air fuel ratio sensor current during fuel-cut and detects any abnormal current values.

If the air fuel ratio sensor output is 3.6 mA or more for more than 3 seconds of cumulative time, the ECM interprets this as a malfunction in the air fuel ratio sensor and sets DTC P2195 (high-side stuck). If the air fuel ratio sensor output is less than 1.0 mA for more than 3 seconds of cumulative time, the ECM sets DTC P2196 (low-side stuck).



MONITOR STRATEGY

Related DTCs	P2195: Air fuel ratio sensor (Bank 1) signal stuck lean P2196: Air fuel ratio sensor (Bank 1) signal stuck rich
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Related)	Heated oxygen sensor
Frequency of Operation	Continuous
Duration	10 seconds: Sensor voltage detection monitor 3 seconds: Sensor current detection monitor
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

ALL

Monitor runs whenever following DTCs are not present	P0016 (VVT System Bank 1 - Misalignment) P0031, P0032 (Air Fuel Ratio Sensor Heater - Sensor 1)

	P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0451, P0452, P0453 (EVAP System) P0500 (Vehicle Speed Sensor) P0505 (IAC Valve)

Sensor Voltage Detection Monitor (Lean Side Malfunction P2195)

Time while all of following conditions met	2 seconds or more
Rear heated oxygen sensor voltage	0.15 V or more
Time after engine start	30 seconds or more
Air fuel ratio sensor status	Activated
Fuel system status	Closed-loop
Engine	Running

Sensor Voltage Detection Monitor (Rich Side Malfunction P2196)

Time while all of following conditions met	2 seconds or more
Rear heated oxygen sensor voltage	Below 0.6 V
Time after engine start	30 seconds or more
Air fuel ratio sensor status	Activated
Fuel system status	Closed-loop
Engine	Running

Sensor Current Detection Monitor (P2195, P2196)

Battery voltage	11 V or more
Atmospheric pressure	76 kPa (570 mmHg) or higher
Air-fuel ratio sensor status	Activated
Engine coolant temperature	75°C (167°F) or more
Continuous time of fuel cut	3 to 10 seconds

TYPICAL MALFUNCTION THRESHOLDS

Sensor Voltage Detection Monitor (Lean Side Malfunction P2195)

Air-fuel ratio sensor voltage	More than 3.8 V for 10 seconds

Sensor Voltage Detection Monitor (Rich Side Malfunction P2196)

Air-fuel ratio sensor voltage	Less than 2.8 V for 10 seconds

Sensor Current Detection Monitor (High Side Malfunction P2195)

Air-fuel ratio sensor current during fuel cut	3.6 mA or more

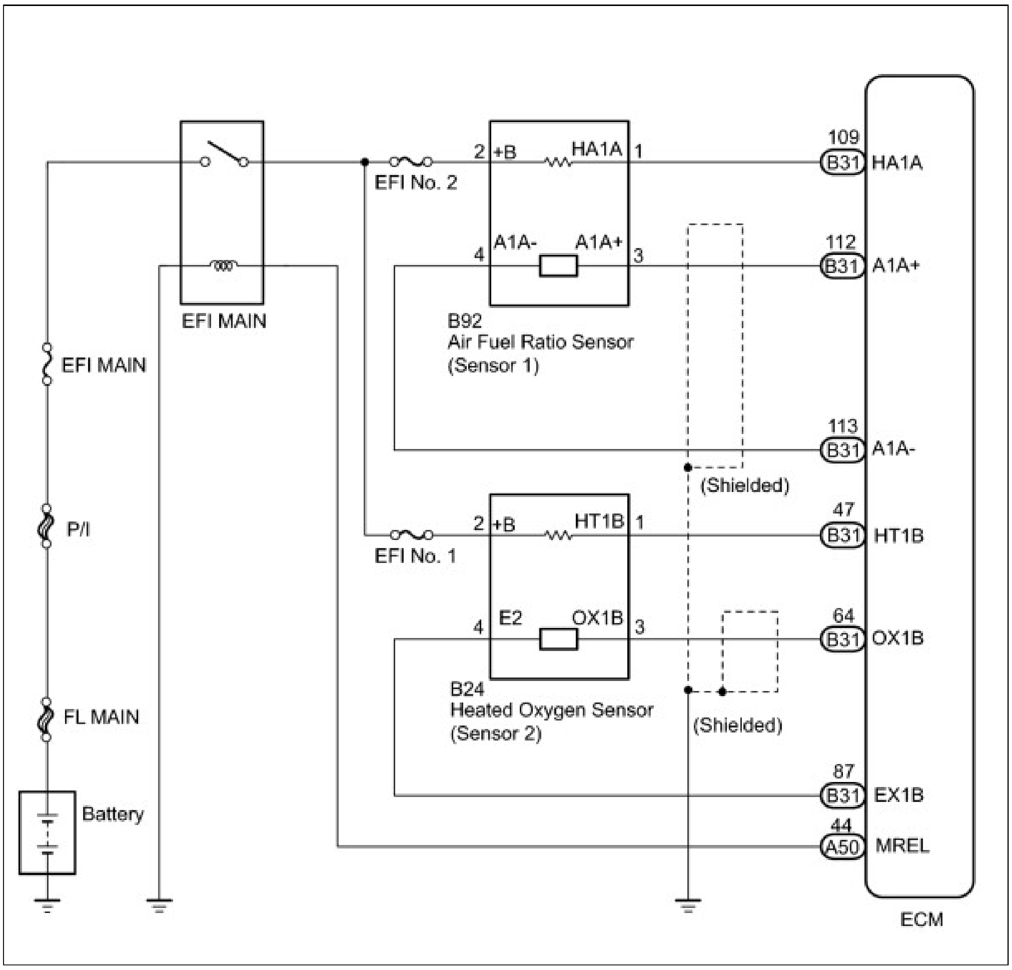
Sensor Current Detection Monitor (Low Side Malfunction P2196)

Air-fuel ratio sensor current during fuel cut	Less than 1.0 mA

MONITOR RESULT

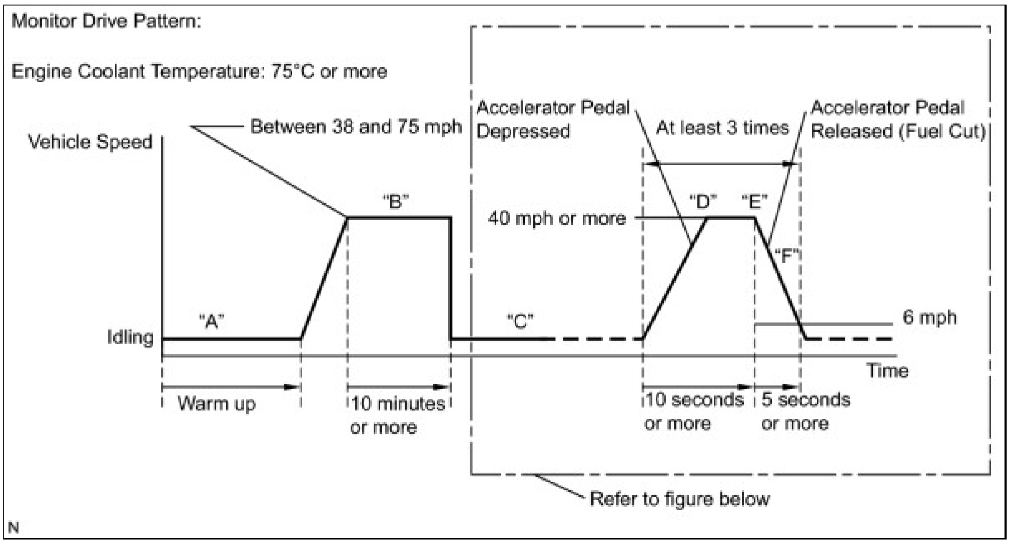
Refer to Checking Monitor Status INFO .

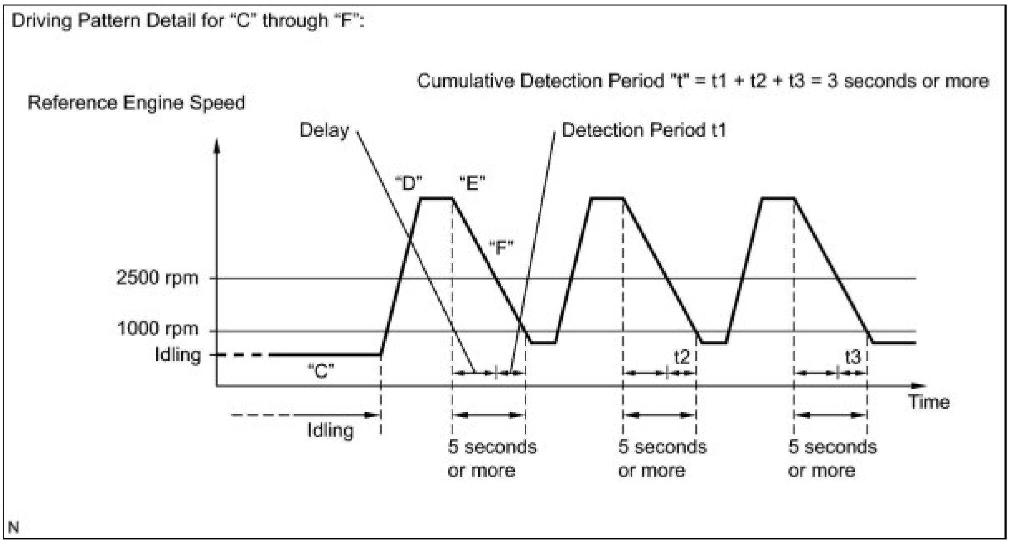
WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN

This confirmation driving pattern is used in the "Perform Confirmation Driving Pattern" procedure of the following diagnostic troubleshooting procedure.





1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
5. Turn the ignition switch off.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Start the engine, and warm it up until the ECT reaches 75°C (167°F) or more (Step "A").
8. On Techstream, enter the following menus to check the fuel-cut status: Powertrain / Engine and ECT / Data List / Idle Fuel Cut.
9. Drive the vehicle at between 38 and 75 mph (60 and 120 km/h) for at least 10 minutes (Step "B").

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

10. Shift the transmission to 2nd gear (Step "C").
11. Accelerate the vehicle to 40 mph (64 km/h) or more by depressing the accelerator pedal for at least 10 seconds (Step "D").
12. Soon after performing step "D" above, release the accelerator pedal for at least 4 seconds without depressing the brake pedal in order to execute fuel-cut control (Step "E").

HINT:

Fuel-cut is performed when the following conditions are met:

- Accelerator pedal is fully released.

- Engine speed is 2500 rpm or more (fuel injection returns at 1000 rpm).

13. Allow the vehicle to decelerate until the vehicle speed decreases to less than 6 mph (10 km/h).
14. Repeat steps "C" through "E" above at least 3 times in one driving cycle.
15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Input the DTC: P2195 or P2196.
17. Check the DTC judgment result [F].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps "B" through "F".

18. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
19. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

20. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F sensor function provided in the Active Test. The Control the Injection Volume for A/F sensor function can help to determine whether the Air Fuel Ratio sensor, Heated Oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
5. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.
6. Perform the Active Test operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume.)
7. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1 S1 and O2S B1 S2)

displayed on the Techstream.

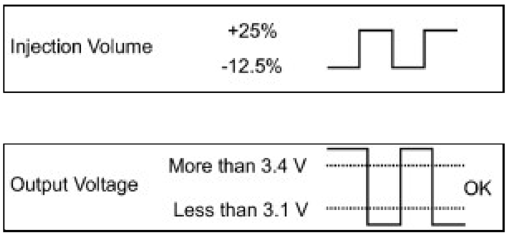
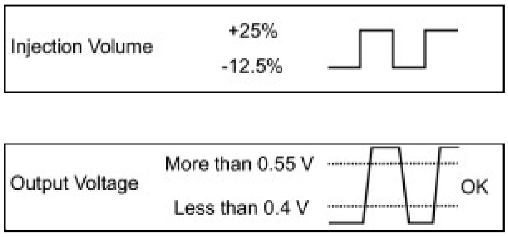
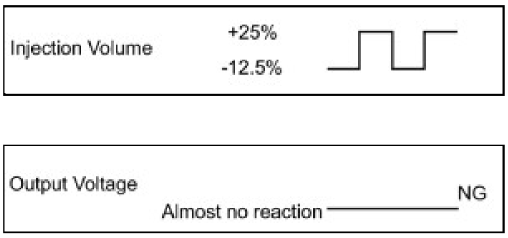
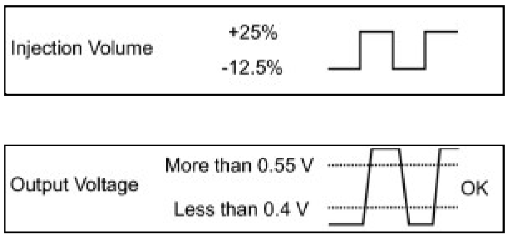
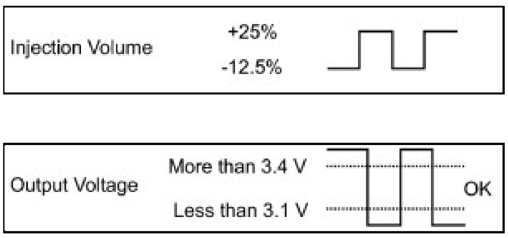
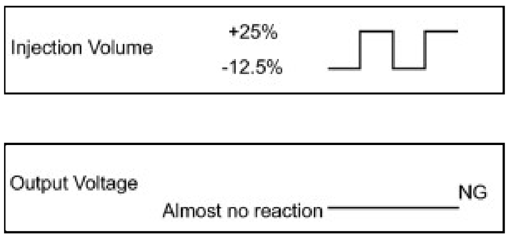
HINT:

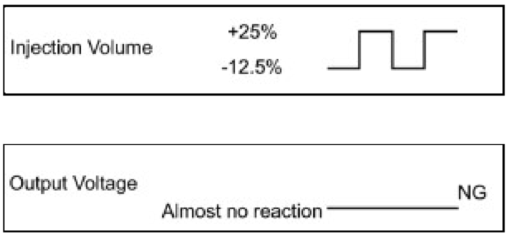
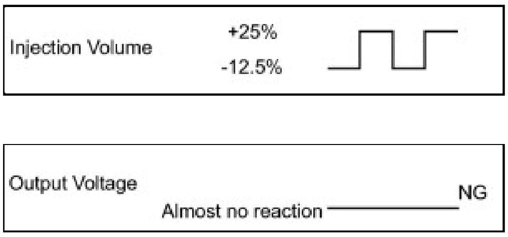
- The Control the Injection Volume for A/F sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1 S1 (Air fuel ratio sensor)	+25%	Rich	Less than 3.1 V
	-12.5%	Lean	More than 3.4 V
O2S B1 S2 (Heated oxygen sensor)	+25%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
1			-
2			• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3			• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
4			• Injector • Fuel pressure • Gas leak from exhaust system (Air fuel ratio extremely rich or lean)

- Following the Control the Injection Volume for air fuel ratio sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1 S1 and O2S B1 S2; then press the graph button on the Data List view.

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P2195 or P2196	A
P2195 or P2196 and other DTCs	B

HINT:

If any DTCs other than P2195 and P2196 are output, troubleshoot those DTCs first.

B GO TO DTC CHART

A

2.	READ VALUE USING TECHSTREAM (TEST VALUE OF AIR FUEL RATIO SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Allow the vehicle to drive in accordance with the drive pattern described in the Confirmation Driving Pattern.

(f) Enter the following menus: Powertrain / Engine and ECT / Monitor / O2 Sensor.

(g) Check that the status of O2 Sensor is Complete.

If the status is still Incomplete, perform the drive pattern increasing the vehicle speed and using the second gear to decelerate the vehicle.

(h) Enter the following menus: Powertrain / Engine and ECT / Monitor / O2 Sensor / Details / RANGE B1 S1.

(i) Check the test value of the air fuel ratio sensor output current during fuel-cut.

Result:

RESULT	PROCEED TO
Within normal range (1.0 mA or more, and less than 3.6 mA)	A
Outside normal range (Less than 1.0 mA, or 3.6 mA or more)	B

B REPLACE AIR FUEL RATIO SENSOR

A

3.	READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF AIR FUEL RATIO SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the air-fuel ratio sensor at an engine speed of 2500 rpm for 90 seconds.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / A/F Control System / AFS Voltage B1 S1 and Engine Speed, then press the Record button.

(f) Check the air fuel ratio sensor voltage three times, when the engine is in each of the following conditions:

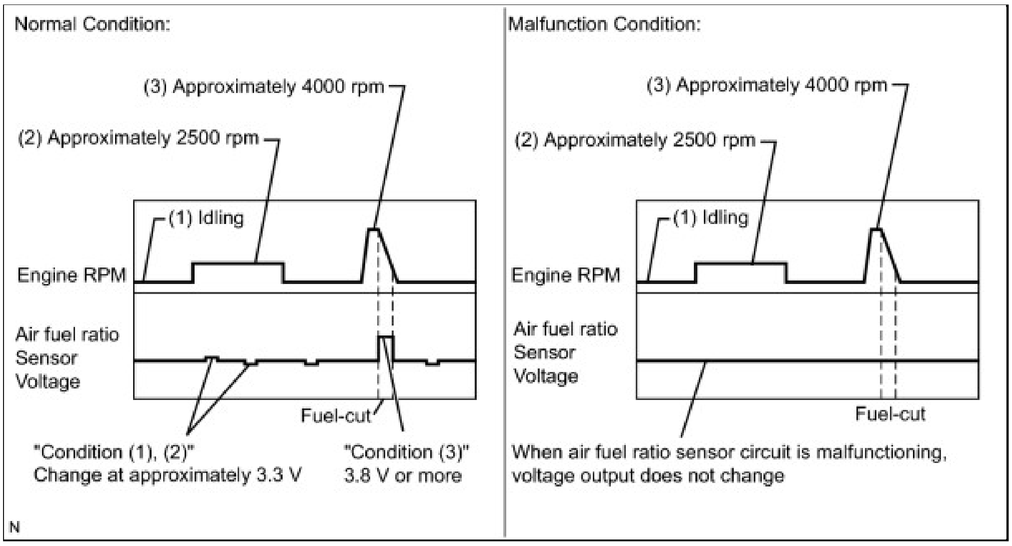
(1) While idling (check for at least 30 seconds)
(2) At an engine speed of approximately 2500 rpm (without any sudden changes in engine speed)
(3) Raise the engine speed to 4000 rpm and then quickly release the accelerator pedal so that the throttle valve is fully closed.

Standard:

CONDITION	AIR FUEL RATIO SENSOR VOLTAGE VARIATION	REFERENCE
(1) and (2)	Changes at approximately 3.3 V	Between 3.1 V and 3.5 V
(3)	Increases to 3.8 V or more	This occurs during engine deceleration (when fuel-cut performed)

HINT:

For more information, see the diagrams below.



HINT:

- If the output voltage of the air fuel ratio sensor remains at approximately 3.3 V (see Malfunction Condition diagram) under any conditions, including those above, the air fuel ratio sensor may have an open circuit. (This will also happen if the air fuel ratio sensor heater has an open circuit.)
- If the output voltage of the air fuel ratio sensor remains at either approximately 3.8 V or more, or 2.8 V or less (see Malfunction Condition diagram) under any conditions, including those above, the air fuel ratio sensor may have a short circuit.
- The ECM stops fuel injection (fuel cut) during engine deceleration. This causes a lean condition and results in a momentary increase in the air fuel ratio sensor output voltage.
- The ECM must establish a closed throttle valve position learning value to perform fuel cut. If the battery terminal has been reconnected, the vehicle must be driven over 10 mph (16 km/h) to allow the ECM to learn the closed throttle valve position.
- When the vehicle is driven:

  The output voltage of the air fuel ratio sensor may be below 2.8 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 air fuel ratio sensor is functioning normally.
- The air fuel ratio sensor is a current output element; therefore, the current is converted into a voltage inside the ECM. Measuring the voltage at the connectors of the air fuel ratio sensor or ECM will show a constant voltage result.

NG ▶ **INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)**

OK

4.	**PERFORM CONFIRMATION DRIVING PATTERN**

NEXT

5.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P2195 or P2196	A
No output	B

B **CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST**

A

6.	**REPLACE AIR FUEL RATIO SENSOR**

(a) Replace the air fuel ratio sensor INFO .

NEXT

7.	**PERFORM CONFIRMATION DRIVING PATTERN**

NEXT

8.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P2195 or P2196	B

B ▶ **REPLACE ECM**

A

9.	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO ▶ **CHECK FOR INTERMITTENT PROBLEMS**

YES ▶ **DTC CAUSED BY RUNNING OUT OF FUEL**

10.	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE) INFO

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK

11.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

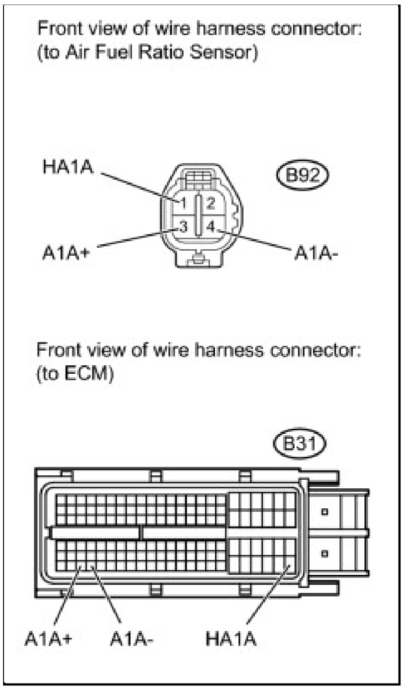
(a) Disconnect the air fuel ratio sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B92-1 (HA1A) - B31-109 (HA1A)	Always	Below 1 Ω
B92-3 (A1A+) - B31-112 (A1A+)		
B92-4 (A1A-) - B31-113 (A1A-)		



Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B92-1 (HA1A) or B31-109 (HA1A) - Body ground	Always	10 kΩ or higher
B92-3 (A1A+) or B31-112 (A1A+) - Body ground		
B92-4 (A1A-) or B31-113 (A1A-) - Body ground		

(d) Reconnect the air fuel ratio sensor connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)**

OK ▼

12.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks in intake system.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK ▼

13.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO .

NG ▶ **REPAIR OR REPLACE FUEL SYSTEM**

OK
▼

14.	INSPECT FUEL INJECTOR

(a) Check the injector injection (whether fuel volume is high or low, and whether injection pattern is poor) INFO .

NG ▶ **REPLACE FUEL INJECTOR**

OK
▼

15.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

NEXT
▼

16.	PERFORM CONFIRMATION DRIVING PATTERN

NEXT
▼

17.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P2195 or P2196	B

B ▶ **REPLACE ECM**

A
▼

18.	**CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST**

NO ▶ **CHECK FOR INTERMITTENT PROBLEMS**

YES ▶ **DTC CAUSED BY RUNNING OUT OF FUEL**

19.	**REPLACE AIR FUEL RATIO SENSOR**

(a) Replace the air fuel ratio sensor INFO .

NEXT
▼

20.	**PERFORM CONFIRMATION DRIVING PATTERN**

NEXT
▼

21.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P2195 or P2196 (Air fuel ratio sensor pending DTCs)	B

B ▶ **REPLACE ECM**

A ▶ **END**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000PFZ0ALX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2121: Throttle / Pedal Position Sensor / Switch "D" Circuit Range / Performance (2010 Corolla)		

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

DESCRIPTION

HINT:

- This DTC relates to the Accelerator Pedal Position (APP) sensor.

Refer to DTC P2120 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2121	Difference between VPA and VPA2 less than 0.4 V, or more than 1.2 V for 0.5 seconds (1 trip detection logic)	• Accelerator pedal position sensor • ECM

MONITOR DESCRIPTION

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

MONITOR STRATEGY

Related DTCs	P2121: Accelerator pedal position sensor rationality
Required Sensors/Components (Main)	Accelerator pedal position sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

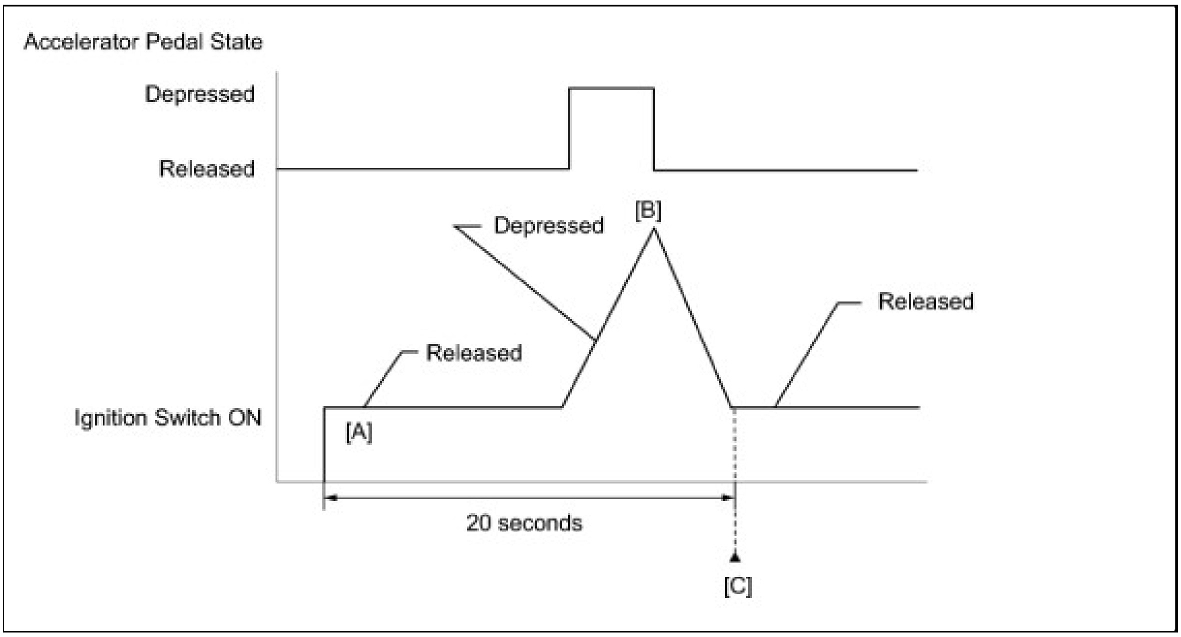
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Either of following conditions 1 or 2 met:	-
1. Time after Ignition switch OFF to ON	0.012 seconds or more
2. Electronic throttle actuator power	ON

TYPICAL MALFUNCTION THRESHOLDS

Difference between VPA voltage (learned value) and VPA2 voltage (learned value)	Less than 0.4 V, or more than 1.2 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream ON.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Fully depress and release the accelerator pedal [B].
7. Check that 20 seconds or more have elapsed since the DTCs were cleared.
8. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
9. Input the DTC: P2121.
10. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal
ABNORMAL	- DTC judgment completed - System abnormal
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C] again.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
12. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

The accelerator pedal position sensor has two (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 limp mode. In limp 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 as being fully closed. In this case, the throttle valve remains closed as if the engine is idling.

If a pass condition is detected and then the ignition switch is turned to off, the fail-safe operation stops and the system returns to a normal condition.

WIRING DIAGRAM

Refer to DTC P2120 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2121)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P2121	A
P2121 and other DTCs	B

HINT:

If any DTCs other than P2121 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	**READ VALUE USING TECHSTREAM (ACCELERATOR POSITION SENSOR)** INFO

NG ▶ **REPLACE ACCELERATOR PEDAL ROD ASSEMBLY**

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

3.	REPLACE ACCELERATOR PEDAL ROD ASSEMBLY

(a) Replace the accelerator pedal rod assembly INFO .

NEXT

4.	CHECK WHETHER DTC OUTPUT RECURS (ACCELERATOR PEDAL POSITION SENSOR DTCS)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Start the engine.

(f) Allow the engine to idle for 15 seconds.

(g) Fully depress and release the accelerator pedal several times quickly.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(i) Read DTCs.

Result:

RESULT	PROCEED TO
P2121	A
No output	B

B ▶ **END**

A ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM0000028K604GX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2237-P2239,P2252,P2253: Oxygen (A/F) Sensor Pumping Current Circuit / Open (Bank 1 Sensor 1) (2010 Corolla)		

DTC	**P2237**	**Oxygen (A/F) Sensor Pumping Current Circuit / Open (Bank 1 Sensor 1)**

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	**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)**

DESCRIPTION

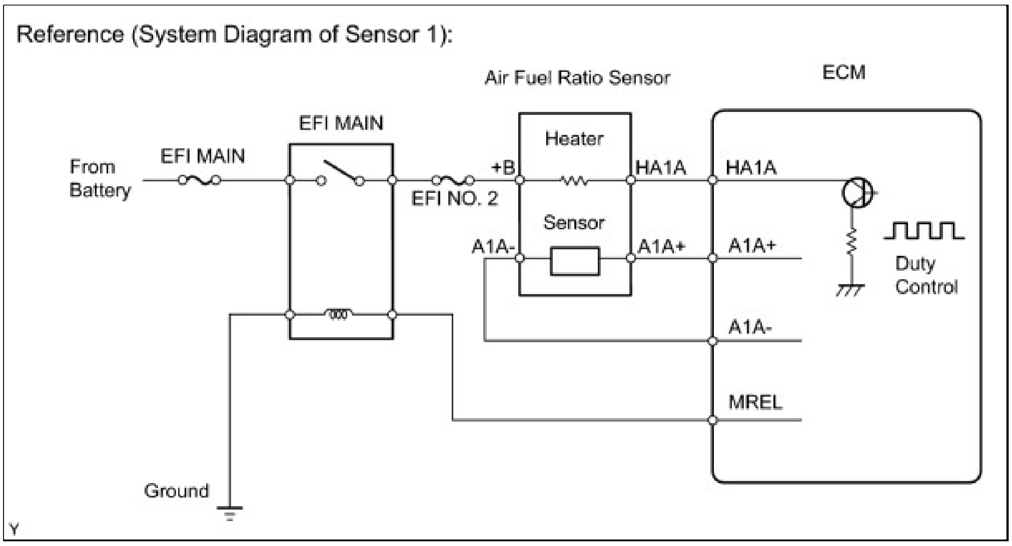
HINT:

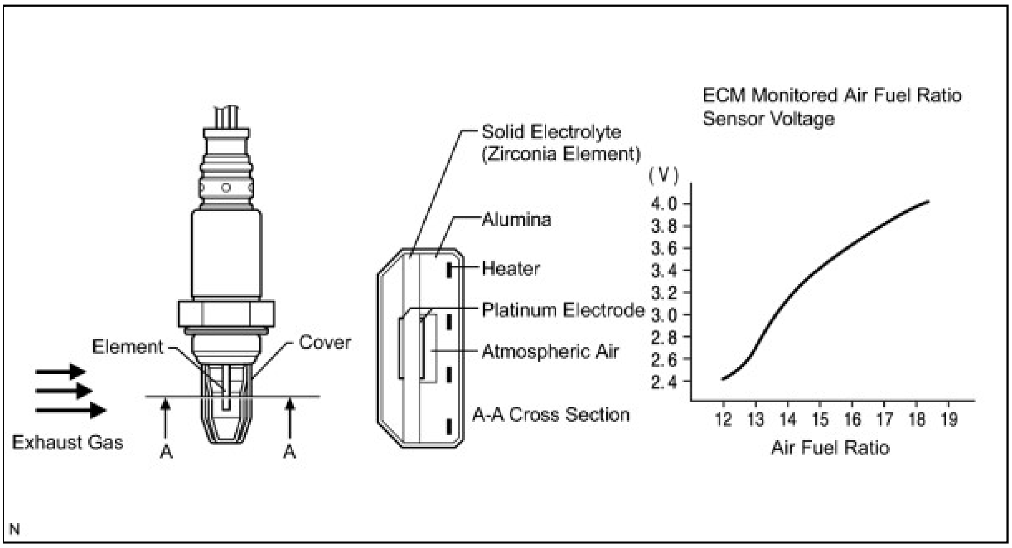
- Although the DTC titles say oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

The air fuel ratio sensor, which is located between the exhaust manifold and catalyst, consists of alloyed metal elements and a heater.

Depending on the engine operating conditions, the heater heats the sensor elements to activate them. Battery voltage is applied to the heater, the sensor ground is controlled by the ECM using a duty ratio.

The sensor elements convert the oxygen concentration in the exhaust gas into voltage values to output. Based on the voltage, the ECM determines the air-fuel ratio and regulates the fuel injection volume depending on the air-fuel ratio and engine operating conditions. The voltage changes between 0.6 V and 4.5 V while the engine is running. If the air-fuel ratio is lean, which means the oxygen concentration in the exhaust gas is high, the voltage is high. If the air-fuel ratio is rich, which means the oxygen concentration in the exhaust gas is low, the voltage is low.





DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2237	Open in the circuit between terminals A1A+ and A1A- of the air fuel ratio sensor while engine is running (2 trip detection logic)	• Open in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • ECM
P2238	Any of the following conditions are met (2 trip detection logic) • Air fuel ratio sensor output drops while engine is running. • Voltage at terminal A1A+ is 0.5 V or less. • Voltage difference between terminals A1A+ and A1A- is 0.1 V or less.	• Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • ECM
P2239	A1A+ voltage more than 4.5 V (2 trip detection logic)	• Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • ECM

MONITOR DESCRIPTION

These DTCs are output when there is an open or short in the air fuel ratio sensor circuit, or if air fuel ratio sensor output drops. To detect these problems, the voltage of the air fuel ratio sensor is monitored when turning the ignition switch to the

ON position, and the admittance (admittance is an electrical term that indicates the ease of flow of current) is checked while driving. If the voltage of the air fuel ratio sensor is between 0.6 V and 4.5 V, it is considered normal. If the voltage is out of the specified range, or the admittance is less than the standard value, the ECM will determine that there is a malfunction in the air fuel ratio sensor. If the same malfunction is detected in next driving cycle, the MIL will be illuminated and a DTC will be stored.

MONITOR STRATEGY

Related DTCs	P2237: Air fuel ratio sensor open circuit between A1A+ and A1A- P2238: Air fuel ratio sensor short circuit between A1A+ and A1A- P2238: Air fuel ratio sensor short circuit between A1A+ and GND P2238: Air fuel ratio sensor low impedance P2239: Air fuel ratio sensor short circuit between A1A+ and +B P2252: Air fuel ratio sensor short circuit between A1A- and GND P2253: Air fuel ratio sensor short circuit between A1A- and +B
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Related)	Engine coolant temperature sensor Crankshaft position sensor
Frequency of Operation	Continuous
Duration	10 seconds: P2237 (Open circuit) and P2238 (Low Impedance) 5 seconds: Other
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0016 (VVT System Bank 1 - Misalignment) P0031, P0032 (Air Fuel Ratio Sensor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0451, P0452, P0453 (EVAP System) P0500 (Vehicle Speed Sensor) P0505 (IAC Valve)

P2237 (Air Fuel Ratio Sensor Open Circuit Between A1A+ and A1A-)

Estimated sensor temperature	450 to 550°C (842 to 1022°F)
Engine	Running
Battery voltage	11 V or more

P2238 (Air Fuel Ratio Sensor Low Impedance)

Estimated sensor temperature	700 to 800°C (1292 to 1472°F)
Engine coolant temperature	10°C (50°F) or higher
Fuel cut	No executed

Other

Battery voltage	11 V or more
Ignition switch	ON
Time after ignition switch is OFF to ON	5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P2237 (Air Fuel Ratio Sensor Open Circuit Between A1A+ and A1A-)

Air fuel ratio sensor admittance	Below 0.002 1/Ω

P2238 (Air Fuel Ratio Sensor Low Impedance)

Air fuel ratio sensor admittance	Below 0.022 1/Ω

P2238 (Air Fuel Ratio Sensor Short Circuit Between A1A+ and GND)

A/F+ terminal voltage	0.5 V or less

P2239 (Air Fuel Ratio Sensor Short Circuit Between A1A+ and +B)

A/F+ terminal voltage	More than 4.5 V

P2252 (Air Fuel Ratio Sensor Short Circuit Between A1A- and GND)

A/F- terminal voltage	0.5 V or less

P2253 (Air Fuel Ratio Sensor Short Circuit Between A1A- and +B)

A/F- terminal voltage	More than 4.5 V

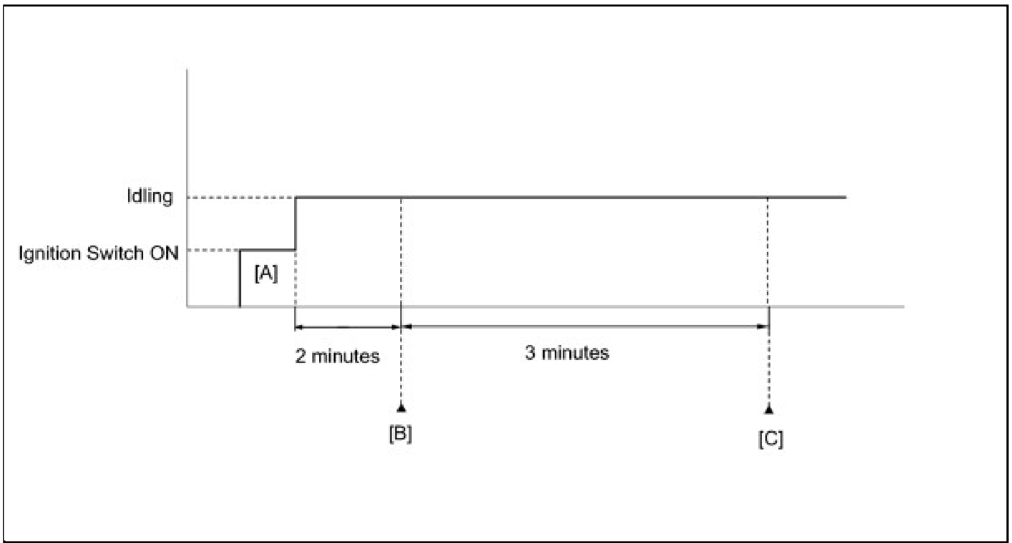
P2238 (Air Fuel Ratio Sensor Short Circuit Between A1A+ and A1A-)

Difference between A/F+ terminal and A/F- terminal voltage	0.1 V or less

COMPONENT OPERATING RANGE

Air fuel ratio sensor admittance	0.002 1/Ω or more
A1A+ terminal voltage	0.5 to 4.5 V
A1A- terminal voltage	0.5 to 4.5 V
Difference between A1A+ and A1A- terminal voltages	0.1 to 0.8 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Start the engine and wait 2 minutes.
7. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P2237, P2238, P2239, P2252 or P2253.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal
ABNORMAL	- DTC judgment completed - System abnormal
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or UNKNOWN, idle the engine for 3 minutes and check the DTC judgment result again [C].

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check

for permanent DTCs .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P2195 .

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F sensor Active Test. The Control the Injection Volume for A/F sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at 2500 rpm for approximately 90 seconds.
5. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.
6. Perform the Active Test operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume.)
7. Monitor the output voltages of the air fuel and heated oxygen sensors (AFS Voltage B1 S1 and O2S B1 S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F sensor active test lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1 S1 (Air Fuel Ratio)	+25%	Rich	Less than 3.1 V
	-12.5%	Lean	More than 3.4 V
O2S B1 S2 (Heated Oxygen)	+25%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
1			-

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
	Output Voltage More than 3.4 V Less than 3.1 V OK	Output Voltage More than 0.55 V Less than 0.4 V OK	
2	Injection Volume +25% -12.5% Output Voltage Almost no reaction NG	Injection Volume +25% -12.5% Output Voltage More than 0.55 V Less than 0.4 V OK	• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3	Injection Volume +25% -12.5% Output Voltage More than 3.4 V Less than 3.1 V OK	Injection Volume +25% -12.5% Output Voltage Almost no reaction NG	• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit
4	Injection Volume +25% -12.5% Output Voltage Almost no reaction NG	Injection Volume +25% -12.5% Output Voltage Almost no reaction NG	• Injector • Fuel pressure • Gas leak from exhaust system (Air fuel ratio extremely rich or lean)

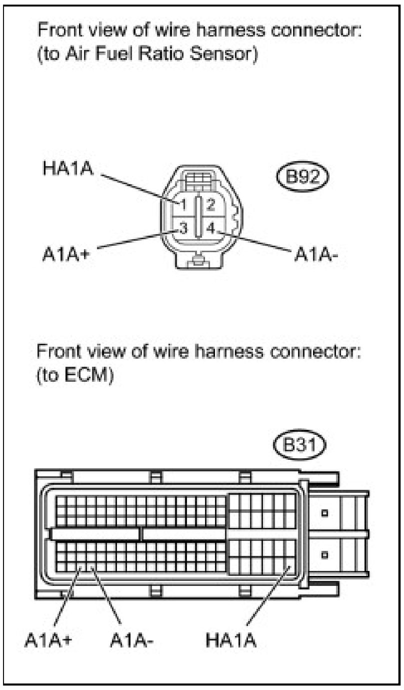
- Following the Control the Injection Volume for A/F sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1 S1 and O2S B1 S2; then press the graph button on the Data List view.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)



(a) Disconnect the air fuel ratio sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B92-1 (HA1A) - B31-109 (HA1A)	Always	Below 1 Ω
B92-3 (A1A+) - B31-112 (A1A+)		
B92-4 (A1A-) - B31-113 (A1A-)		

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B92-1 (HA1A) or B31-109 (HA1A) - Body ground	Always	10 kΩ or higher
B92-3 (A1A+) or B31-112 (A1A+) - Body ground		
B92-4 (A1A-) or B31-113 (A1A-) - Body ground		

(d) Reconnect the air fuel ratio sensor connector.

(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)**

OK ▼

2.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO.

NEXT ▼

3.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Drive the vehicle referring to the Confirmation Driving Pattern on DTC P2195 INFO .

NEXT

4.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read pending DTCs.

Result:

RESULT	PROCEED TO
No output	A
P2237, P2238, P2239, P2252 or P2253	B

B ▶ **REPLACE ECM**

A ▶ **END**

Last Modified: 3-10-2010	6.4 C	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000002BHC020X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2420: Evaporative Emission System Switching Valve Control Circuit High (2010 Corolla)		

DTC	**P2420**	**Evaporative Emission System Switching Valve Control Circuit High**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P2420	Vent valve stuck open (vent)	Following condition met during key-off EVAP monitor: • EVAP pressure change when vent valve closed (ON) less than 0.3 kPa-g (2.25 mmHg-g)	• Canister pump module (Reference orifice, leak detection pump, vent valve) • Connector/wire harness (Canister pump module - ECM) • ECM	While ignition switch OFF	2 trip

HINT:

The vent valve is built into the canister pump module.

DESCRIPTION

The description can be found in the EVAP (Evaporative Emission) System INFO .

INSPECTION PROCEDURE

Refer to the EVAP System INFO .

HINT:

Unit expressions

- [kPa-a (mmHg-a)] denotes absolute pressure.
- [kPa-g (mmHg-g)] denotes gauge pressure (relative pressure).
- On the Techstream, choose the unit of measurement according to the inspection procedure.

MONITOR DESCRIPTION

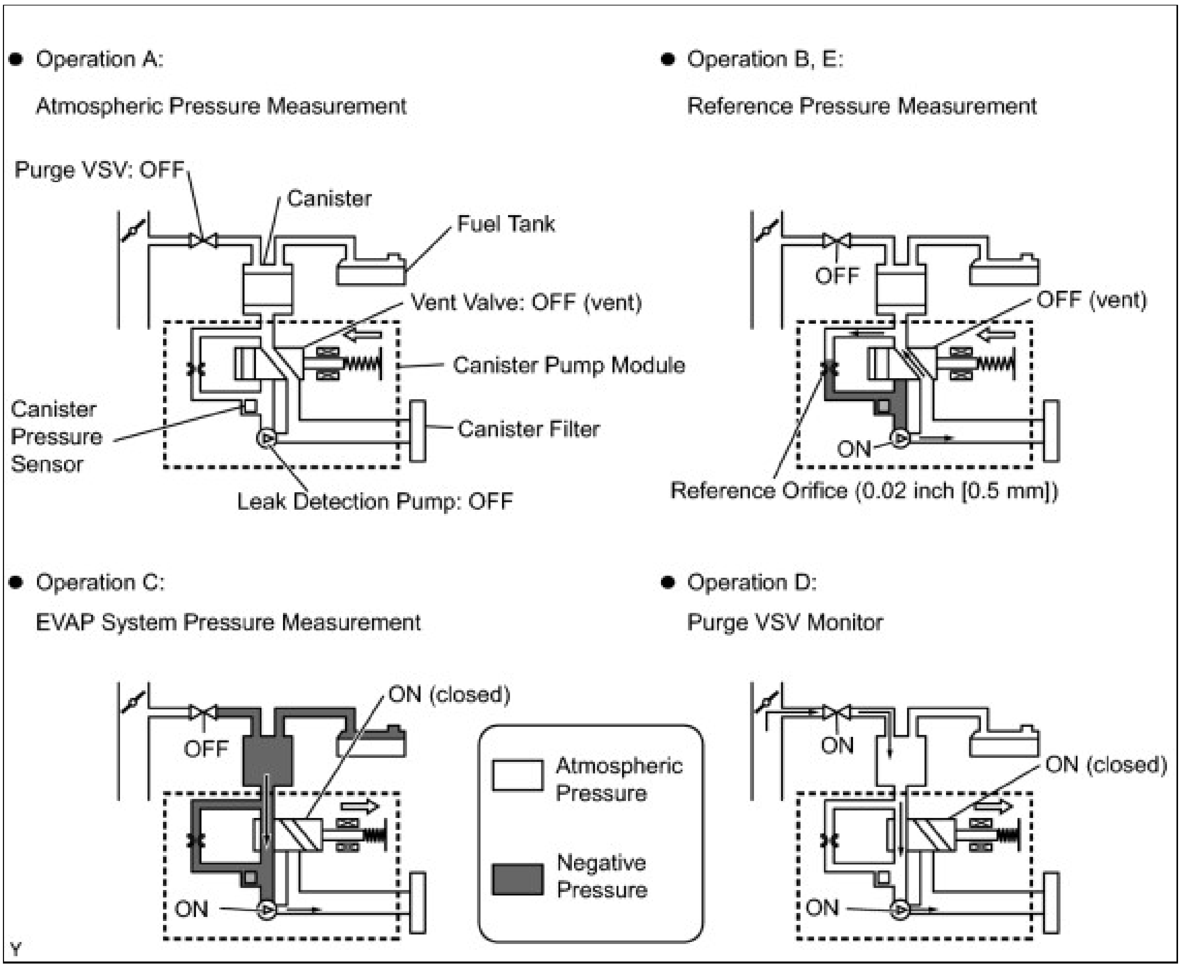
5 hours* after the ignition switch is turned off, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

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

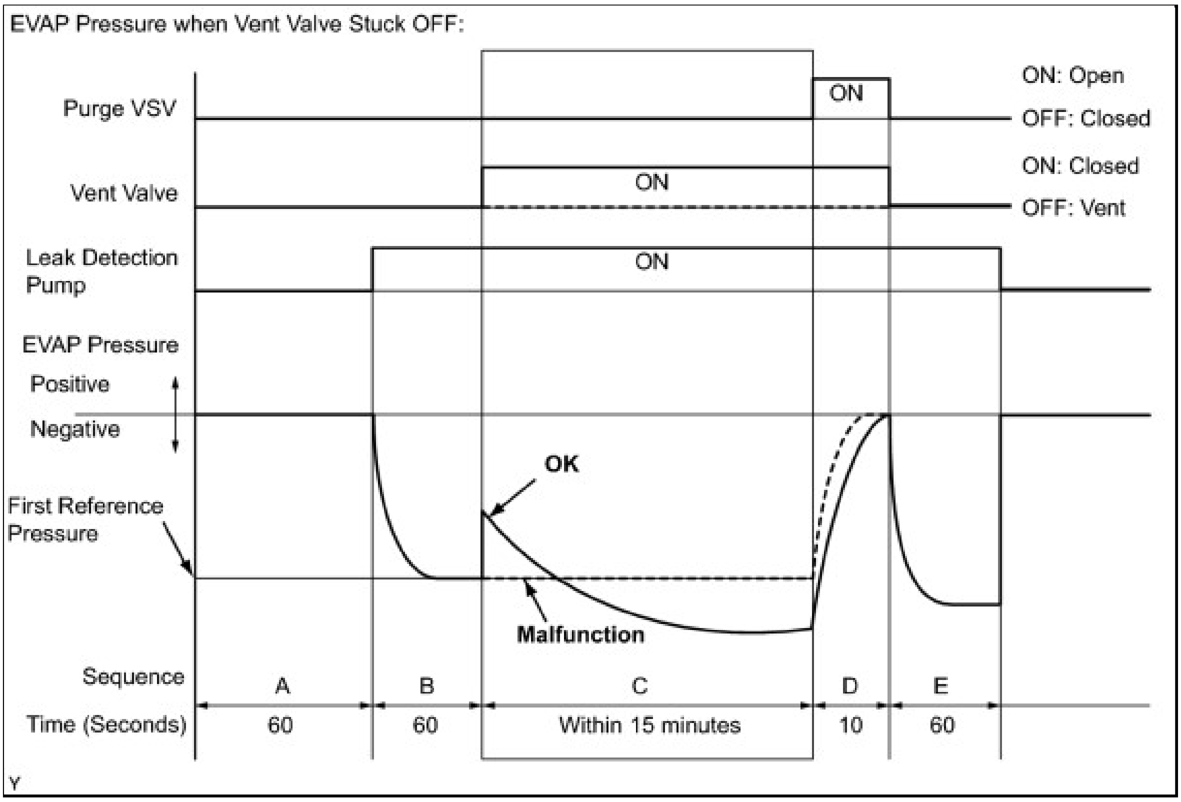
SEQUENCE	OPERATION	DESCRIPTION	DURATION
-	ECM activation	The key-off monitor is activated by soak timer 5, 7 or 9.5 hours after ignition switch turned OFF.	-
A	Atmospheric pressure measurement	Vent valve is turned OFF (vent) and the EVAP system pressure is measured by the ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa-a and 110 kPa-a (525 mmHg-a and 825 mmHg-a), the ECM cancels EVAP system monitor.	60 seconds
B	First reference pressure measurement	In order to determine the reference pressure, the leak detection pump creates negative pressure (vacuum) through the reference orifice and then the ECM checks if the leak detection pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut the EVAP system. Negative pressure (vacuum) created in the EVAP system, and the EVAP system pressure then measured. The measured value is memorized as it will be used in the leak check. If the EVAP pressure does not stabilize within 15 minutes, the ECM cancels the EVAP system monitor.	15 minutes*
D	Purge VSV monitor	Purge VSV is opened and then the EVAP system pressure is measured by the ECM. A large increase indicates normality.	10 seconds
E	Second reference pressure measurement	After a second reference pressure measurement, the leak check is performed by comparing the first and second reference pressure. If stabilized system pressure is higher than the second reference pressure, the ECM determines that the EVAP system is leaking.	60 seconds
-	Final check	Atmospheric pressure is measured and then the monitor result is recorded by the ECM.	-

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



P2420: Vent valve stuck open (vent)

In operation C, the vent valve turns ON (closes) and the EVAP system pressure is then measured by the ECM using the canister pressure sensor to conduct an EVAP leak check. If the pressure does not increase when the vent valve is open, the ECM interprets this as the vent valve being stuck open. The ECM illuminates the MIL and sets the DTC.



MONITOR STRATEGY

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

TYPICAL ENABLING CONDITIONS

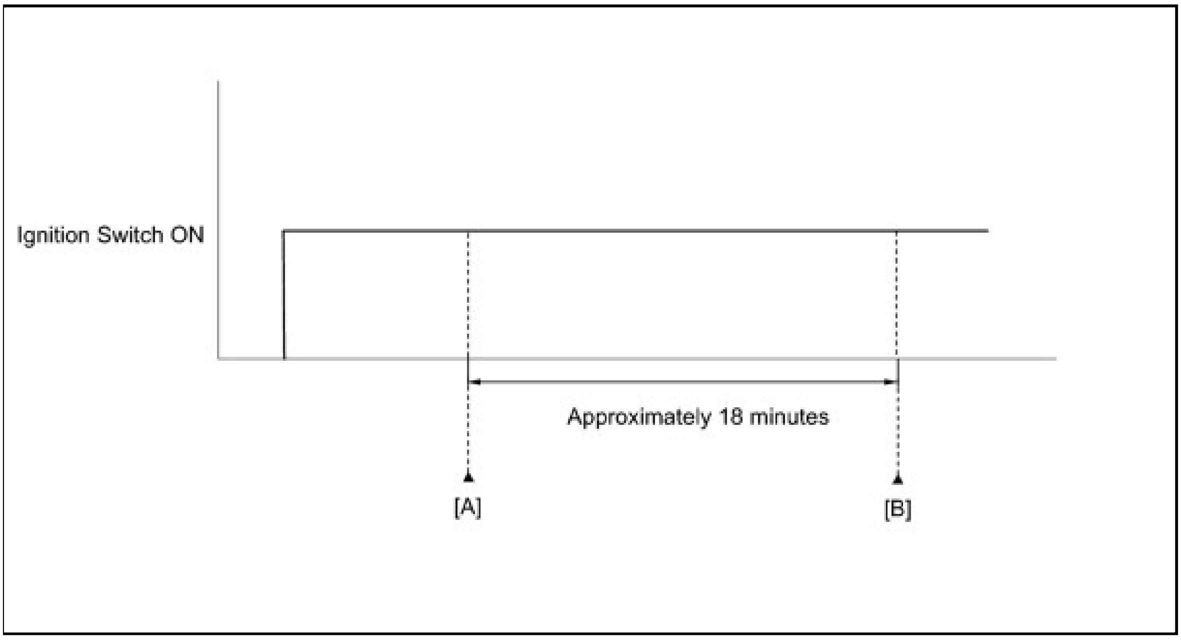
Monitor runs whenever following DTCs are not present	None
EVAP key-off monitor runs when all of following conditions are met	-
Atmospheric pressure	70 to 110 kPa-a (525 to 825 mmHg-a)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Ignition switch	OFF
Time after key off	5 or 7 or 9.5 hours

Canister pressure sensor malfunction (P0451, P0452 and P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of following conditions are met before key off	Conditions 1 and 2
1. Duration that vehicle driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4 to 35°C (40 to 95°F)
Intake air temperature	4.4 to 35°C (40 to 95°F)

TYPICAL MALFUNCTION THRESHOLDS

EVAP pressure change after EVAP canister vent valve ON	Less than 0.3 kPa-g (2.25 mmHg-g)

CONFIRMATION DRIVING PATTERN



NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.

- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off.
5. Turn the ignition switch to ON and turn the Techstream on [A].
6. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.
7. After the "Evaporative System Check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
8. Input the DTC: P2420.
9. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	- DTC judgment completed - System normal
ABNORMAL	- DTC judgment completed - System abnormal
INCOMPLETE	- DTC judgment not completed - Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	- Unable to perform DTC judgment - Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
11. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

12. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

MONITOR RESULT

Refer to Checking Monitor Status INFO .

Last Modified: 3-10-2010	6.4 C	From: 200901
Model Year: 2010	Model: Corolla	Doc ID: RM000000WC205SX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2A00: A/F Sensor Circuit Slow Response (Bank 1 Sensor 1) (2010 Corolla)		

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

DESCRIPTION

HINT:

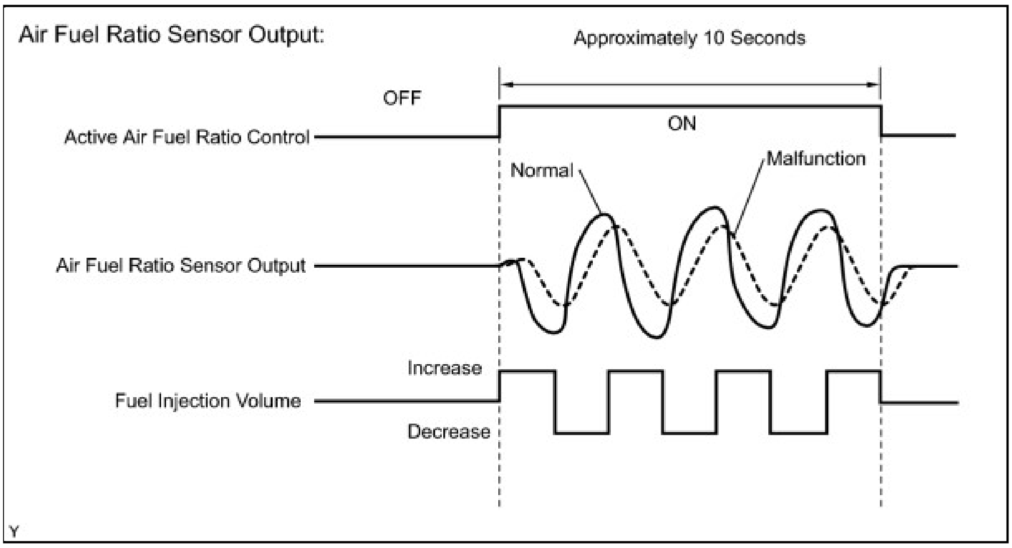
- Refer to DTC P2195 INFO .
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2A00	Calculated value for Air Fuel Ratio (A/F) sensor response rate deterioration level is less than threshold	• Air fuel ratio sensor (bank 1 sensor 1) • Air fuel ratio sensor heater (bank 1 sensor 1) • ECM

MONITOR DESCRIPTION

After engine is warmed up, the ECM performs air-fuel ratio feedback control to maintain the air-fuel ratio at the stoichiometric level. In addition, active air fuel ratio control is performed for approximately 10 seconds after preconditions are met in order to measure the air fuel ratio sensor response rate. During active air fuel ratio control, the ECM forcibly increases and decreases the injection volume a certain amount, based on the stoichiometric air-fuel ratio learned during normal air-fuel ratio control, and measures the air fuel ratio sensor response rate. The ECM receives a signal from the air fuel ratio sensor while performing active air fuel ratio control and uses it to calculate the air fuel ratio sensor response rate deterioration level.

If the value for air fuel ratio sensor response rate deterioration level is beyond the threshold, the ECM interprets this as a malfunction and sets the DTC.



MONITOR STRATEGY

Related DTCs	P2A00: Air fuel ratio sensor (bank 1) slow response
Required Sensors/Components (Main)	Air fuel sensor
Required Sensors/Components (Related)	Vehicle speed sensor, Crankshaft position sensor
Frequency of Operation	Once per driving cycle
Duration	10 to 15 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0016 (VVT System Bank 1 - Misalignment) P0031, P0032 (Air Fuel Ratio Sensor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340 (Camshaft Position Sensor) P0451, P0452, P0453 (EVAP System) P0500 (Vehicle Speed Sensor) P0505 (IAC Valve)
Active A/F control	Performing
Active A/F control performed when following conditions are met	-
Battery voltage	11 V or more
Engine coolant temperature	75°C (167°F) or more
Idling	OFF
Engine RPM	Less than 4000 rpm
Air fuel ratio sensor status	Activated
Fuel-cut	OFF
Engine load	10 to 70%
Shift position	2 or more
Catalyst monitor	Not yet
Intake air amount	4 to 16 g/sec

TYPICAL MALFUNCTION THRESHOLDS

Response rate deterioration level	Less than 0.12 V

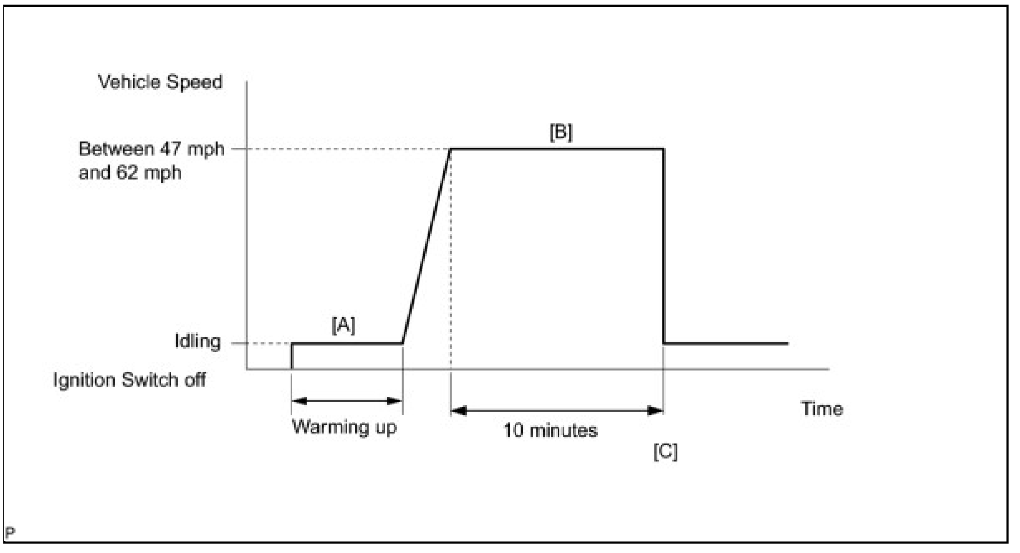
MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

HINT:

Performing this confirmation pattern will activate the air fuel ratio sensor response monitor.



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
5. Turn the ignition switch off.
6. Turn the ignition switch to ON and turn the Techstream on [A].
7. Enter the following menus: Powertrain / Engine and ECT / Monitor / O2 Sensor / Details.
8. Check that RES RATE B1S1 and RES RATE B2S1 are Incomplete.
9. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or more) [A].
10. Drive the vehicle at a constant speed of between 47 and 62 mph (75 and 100 km/h) for 10 minutes [B].
11. Check the monitor result values on the Techstream by entering the following menus: Powertrain / Engine / Monitor / O2 Sensor / Details / RES RATE B1S1 and B2S1.
12. If the values indicated on the Techstream do not change, perform Readiness Monitor Drive Pattern for the air fuel ratio sensor and heated oxygen sensor INFO .
13. Note the value of the Monitor Result.
14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P2A00.
16. Check the DTC judgment result [C].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	DTC judgment completed System normal

TECHSTREAM DISPLAY	DESCRIPTION
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
18. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

19. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P2195 INFO .

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F sensor function provided in the Active Test. The Control the Injection Volume for A/F sensor function can help to determine whether the Air Fuel Ratio sensor, Heated Oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
5. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.
6. Perform the Active Test operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume.)
7. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1 S1 and O2S B1 S2) displayed on the Techstream.

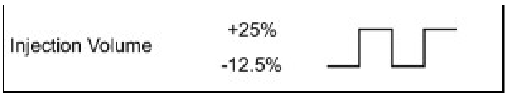
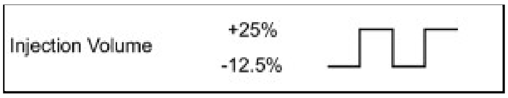
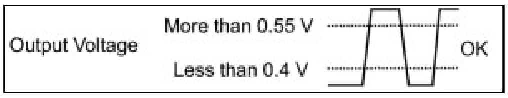
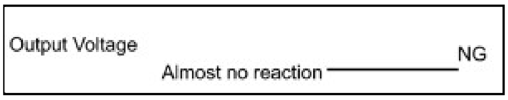
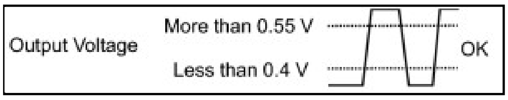
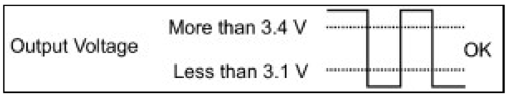
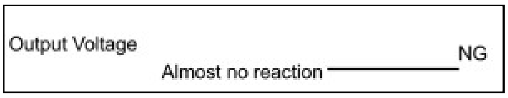
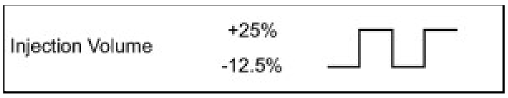
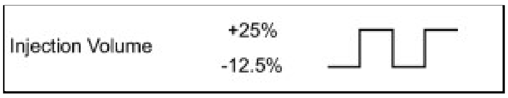
HINT:

- The Control the Injection Volume for A/F sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1 S1 (Air fuel ratio sensor)	+25%	Rich	Less than 3.1 V
	-12.5%	Lean	More than 3.4 V
O2S B1 S2 (Heated oxygen sensor)	+25%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
1	 	 	-
2	 	 	• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3	 	 	• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit
4			• Injector • Fuel pressure • Gas leak from exhaust system (Air fuel

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
	Output Voltage Almost no reaction NG	Output Voltage Almost no reaction NG	ratio extremely rich or lean)

- Following the Control the Injection Volume for A/F sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1 S1 and O2S B1 S2; then press the graph button on the Data List view.

HINT:

- DTC P2A00 may be also set when the air-fuel ratio is stuck rich or lean.
- A low air fuel ratio sensor voltage could be caused by a rich air-fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air-fuel mixture. Check for conditions that would cause the engine to run lean.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2A00)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
P2A00	A
P2A00 and other DTCs	B

HINT:

If any DTCs other than P2A00 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A

2.	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE) INFO

NG ▶ REPLACE AIR FUEL RATIO SENSOR

OK

3.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM) INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)**

OK

4.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Drive the vehicle referring the Confirmation Driving Pattern.

NEXT

5.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2A00)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read DTCs.

Result:

RESULT	PROCEED TO

RESULT	PROCEED TO
P2A00	A
No output	B

B ▶ CHECK FOR INTERMITTENT PROBLEMS

A
▼

6.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

NEXT
▼

7.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Drive the vehicle referring to the Confirmation Driving Pattern.

NEXT
▼

8.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2A00)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read DTCs.

Result:

RESULT	PROCEED TO
No output	A
P2A00	B

B CHECK ENGINE TO DETERMINE CAUSE OF EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO

A END

Last Modified: 3-10-2010	6.4 C	From: 200901
Model Year: 2010	Model: Corolla	Doc ID: RM000000T6X054X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: P2610: ECM / PCM Internal Engine Off Timer Performance (2010 Corolla)		

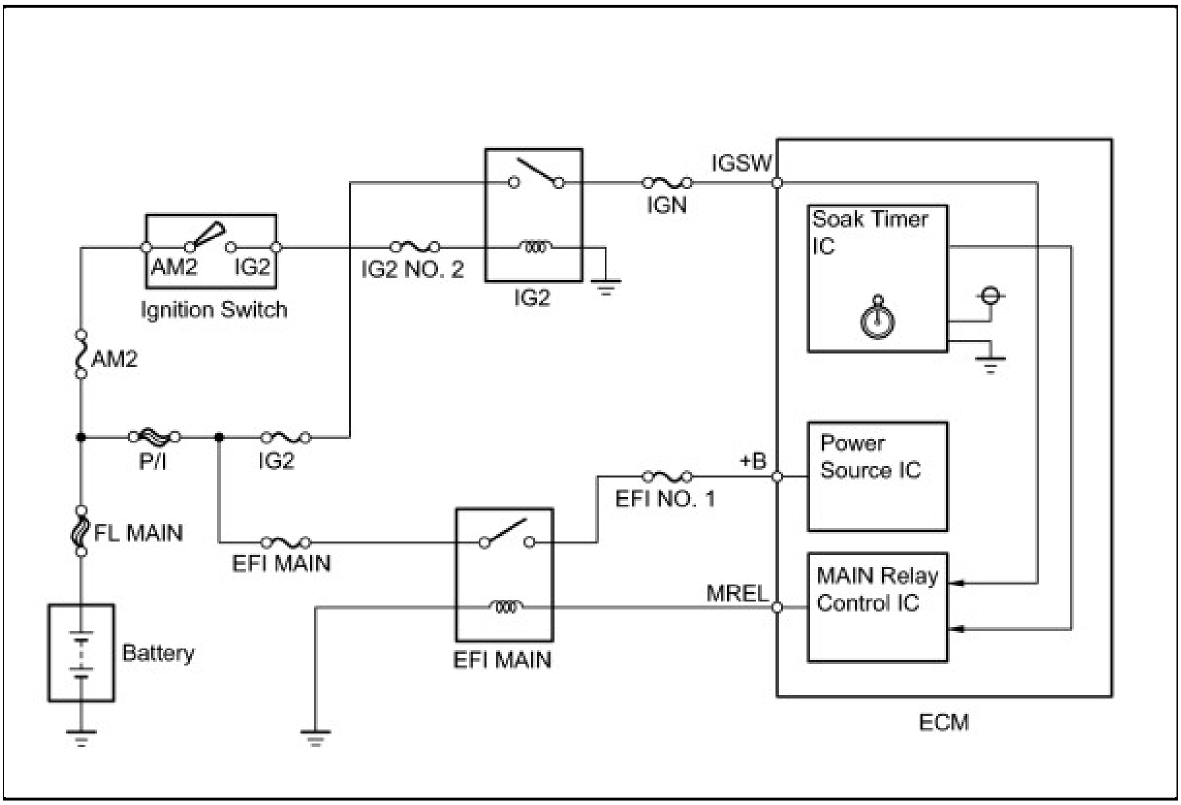
DTC	P2610	ECM / PCM Internal Engine Off Timer Performance

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P2610	Soak timer (built into ECM)	ECM internal malfunction	ECM	Engine running	2 trip

DESCRIPTION

To ensure the accuracy of the EVAP (Evaporative Emission) monitor values, the soak timer, which is built into the ECM, measures 5 hours (+/-15 minutes) from when the ignition switch is turned off, before the monitor is run. This allows the fuel to cool down, which stabilizes the EVAP pressure. When 5 hours have elapsed, the ECM turns on the EVAP system monitor.



MONITOR DESCRIPTION

5 hours after the ignition switch is turned off, the soak timer activates the ECM to begin the EVAP system monitor. While the engine is running, the ECM monitors the synchronization of the soak timer and the CPU clock. If these two are not synchronized, the ECM interprets this as a malfunction, illuminates the MIL and sets the DTC (2 trip detection logic).

MONITOR STRATEGY

Required Sensors/Components	ECM
Frequency of Operation	Once per driving cycle
Duration	10 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

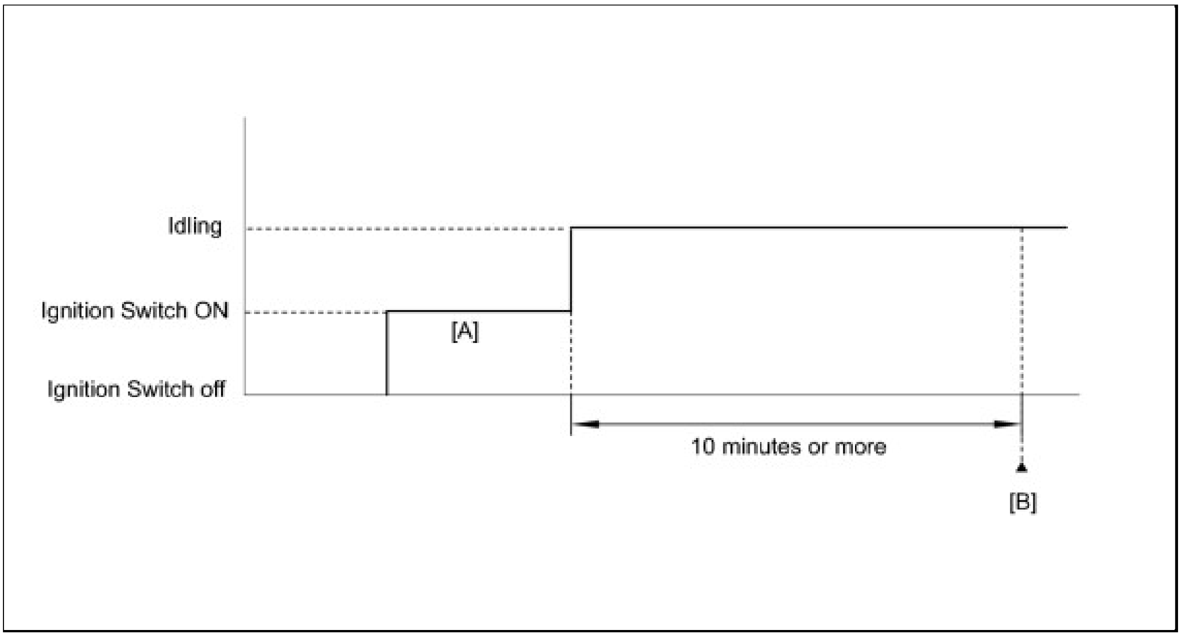
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTC are not present	None
Ignition switch	ON
Engine	Running
Battery voltage	8 V or more
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

Soak timer measurement when ECM CPU clock counts 10 minutes	Less than 7 minutes, or more than 13 minutes

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Turn the ignition switch off.
4. Turn the ignition switch to ON and turn the Techstream on [A].
5. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
6. Start the engine.
7. Idle the engine for 10 minutes or more.
8. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
9. Input the DTC: P2610.
10. Check the DTC judgment result [B].

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

11. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
12. Read Pending DTCs.

    HINT:

    If a pending DTC is output, the system is malfunctioning.

13. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- DTC P2610 is set if an internal ECM problem is detected. Diagnostic procedures are not required. ECM replacement is necessary.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	REPLACE ECM

(a) Replace the ECM INFO .

NEXT

2.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2610)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Start the engine and wait for 10 minutes or more.

(f) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(g) If no pending DTC is displayed, the repair has been successfully completed.

NEXT ▶ **END**

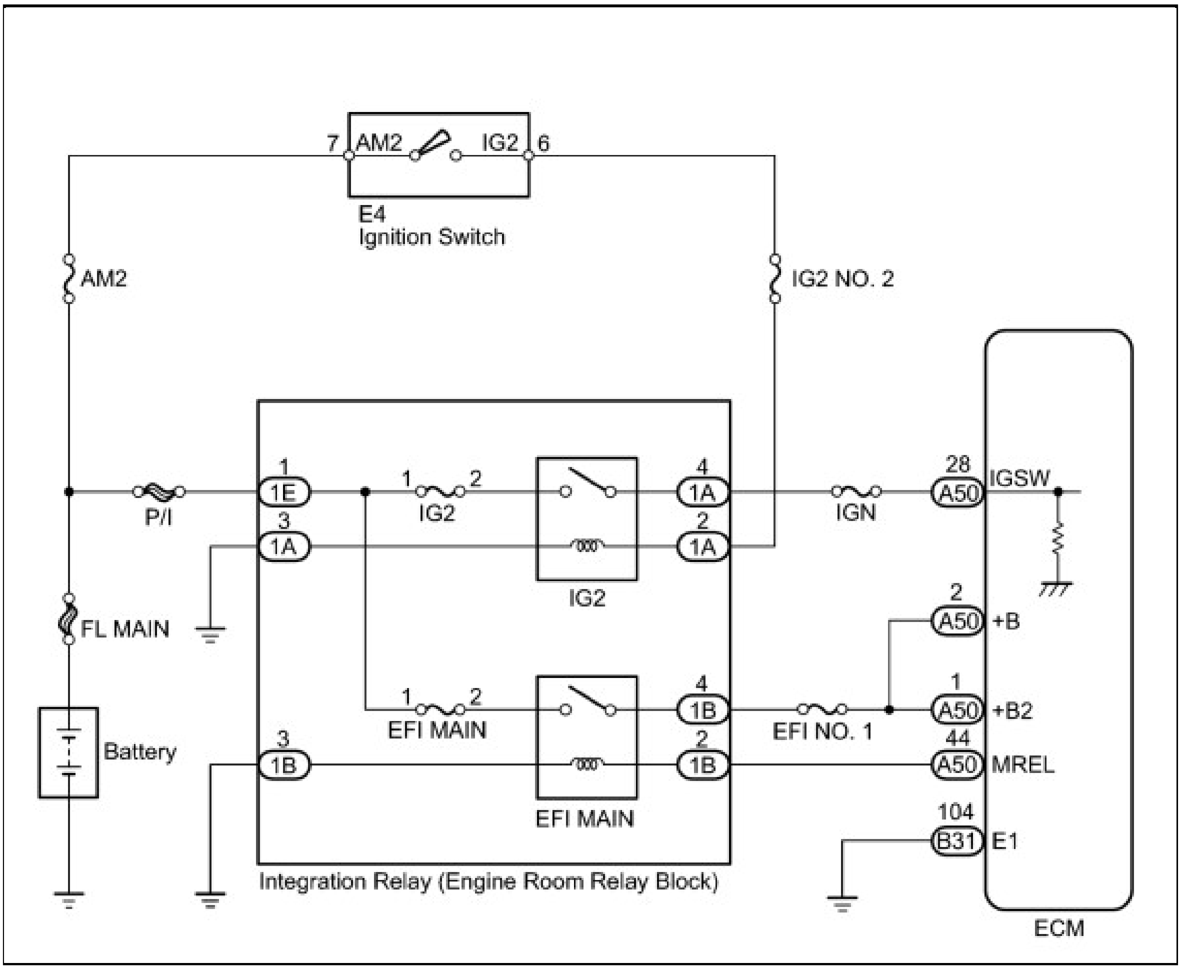
Last Modified: 3-10-2010	6.4 J	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000001F7101CX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: ECM Power Source Circuit (2010 Corolla)		

ECM Power Source Circuit

DESCRIPTION

When the ignition switch is turned to ON, the battery voltage is applied to the IGSW terminal of the ECM. The output signal from the MREL terminal of the ECM causes a current to flow to the EFI MAIN relay coil, closing the EFI relay contacts and supplying power to terminal +B of the ECM.

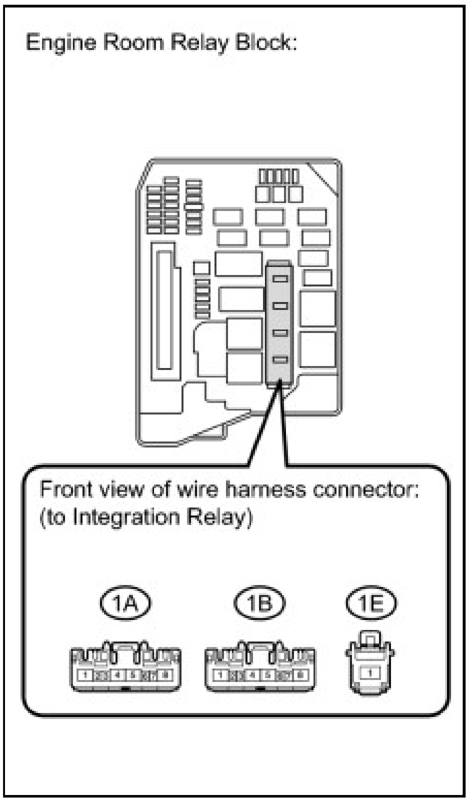
WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	INSPECT INTEGRATION NO.1 RELAY (POWER SOURCE)



(a) Remove the integration relay from the engine room relay block.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1E-1 - Body ground	Always	11 to 14 V

(c) Reinstall the integration relay.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY - BATTERY)**

OK ▼

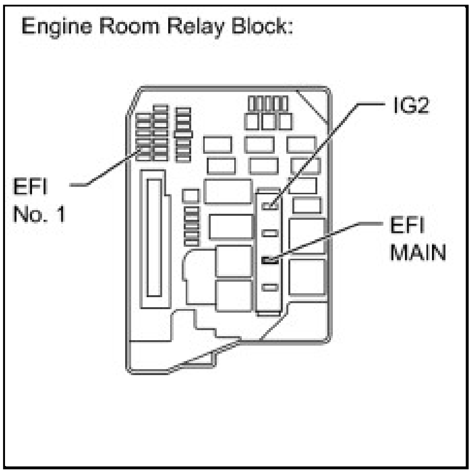
2.	INSPECT FUSES (EFI MAIN, IG2, AND EFI NO. 1 FUSES)

(a) Remove the EFI MAIN fuse, IG2 fuse and EFI No. 1 fuse from the engine room relay block.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN fuse	Always	Below 1 Ω



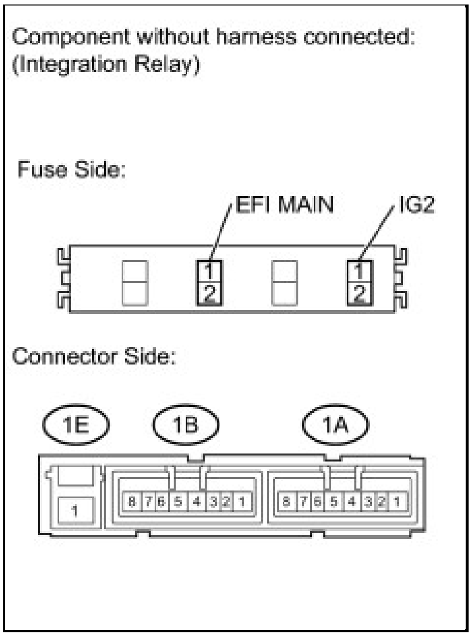
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
IG2 fuse		
EFI No. 1 fuse		

(c) Reinstall the fuses.

NG ▶ **REPLACE FUSE (EFI MAIN, IG2 OR EFI NO. 1 FUSE)**

OK

3.	**INSPECT INTEGRATION NO.1 RELAY (EFI MAIN RELAY AND IG2 RELAY)**



(a) Remove the integration relay from the engine room relay block.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

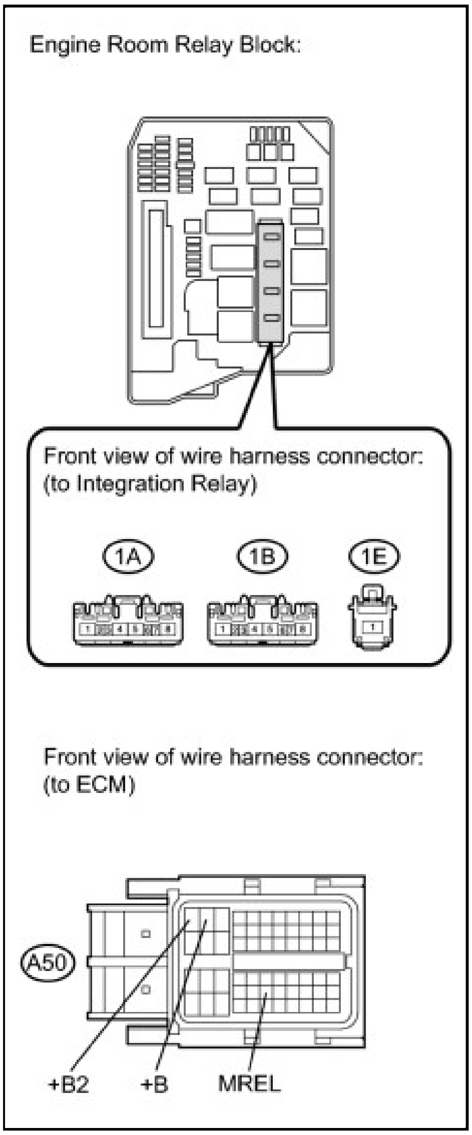
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1E-1 - 1B-4	When battery voltage absent	10 kΩ or higher
	When battery voltage applied to terminals 1B-2 and 1B-3	Below 1 Ω
1E-1 - 1A-4	When battery voltage absent	10 kΩ or higher
	When battery voltage applied to terminals 1A-2 and 1A-3	Below 1 Ω

(c) Reinstall the integration relay.

NG ▶ REPLACE INTEGRATION NO.1 RELAY

OK ▼

4.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY - ECM)



(a) Remove the integration relay from the engine room relay block.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-44 (MREL) - 1B-2	Always	Below 1 Ω
A50-2 (+B) - 1B-4	Always	Below 1 Ω
A50-1 (+B2) - 1B-4	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-44 (MREL) - Body ground	Always	10 kΩ or higher
A50-2 (+B) - Body ground	Always	10 kΩ or higher
A50-1 (+B2) - Body ground	Always	10 kΩ or higher

(d) Reinstall the integration relay.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR

REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY - ECM)

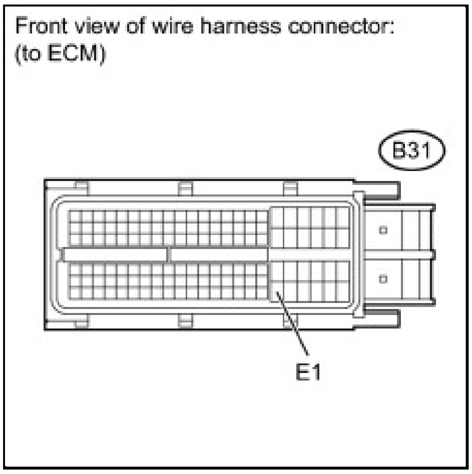
OK

5.	**CHECK HARNESS AND CONNECTOR (ECM - BODY GROUND)**

(a) Disconnect the ECM connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B31-104 (E1) - Body ground	Always	Below 1 Ω

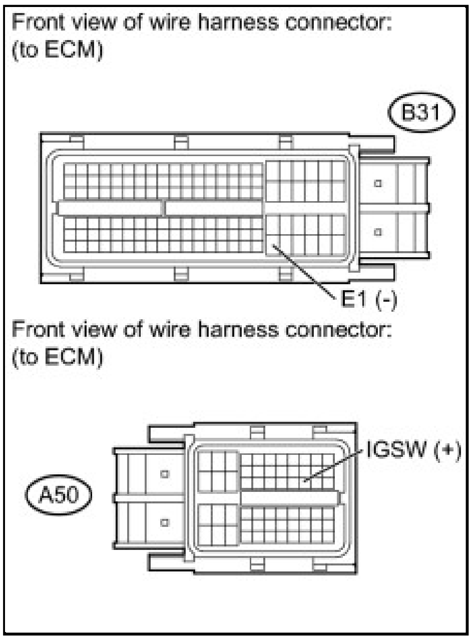
(c) Reconnect the ECM connector.

NG REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - BODY GROUND)

OK

6.	**INSPECT ECM (IGSW TERMINAL VOLTAGE)**

(a) Disconnect the ECM connectors.



(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

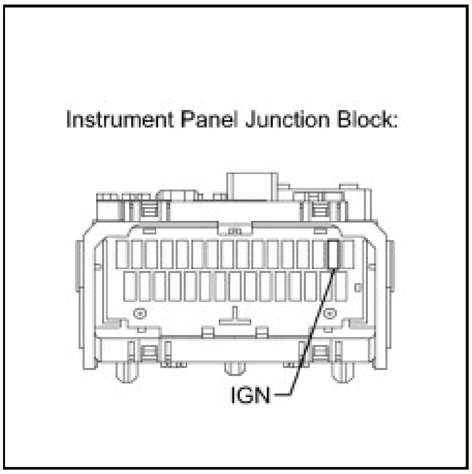
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-28 (IGSW) - B31-104 (E1)	Ignition switch ON	11 to 14 V

(d) Reconnect the ECM connectors.

NG ▶ **INSPECT FUSE (IGN FUSE)**

OK ▶ **REPLACE ECM**

7.	**INSPECT FUSE (IGN FUSE)**



(a) Remove the IGN fuse from the instrument panel junction block.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

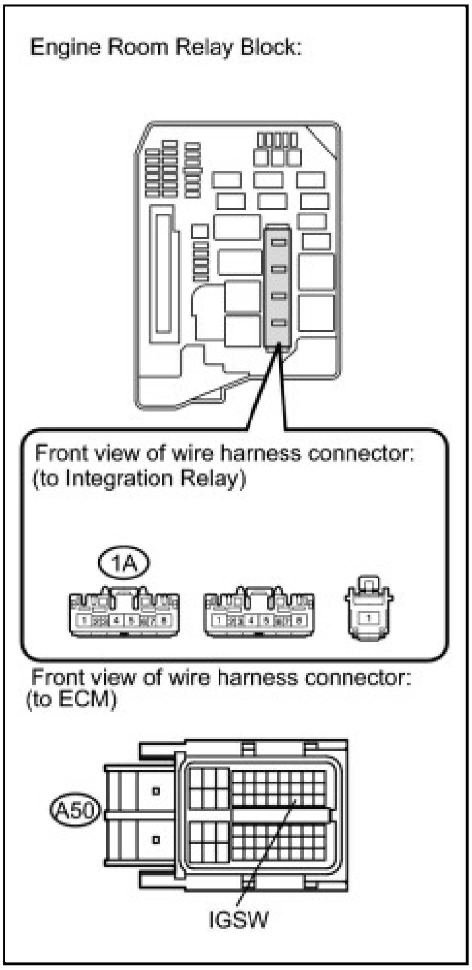
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
IGN fuse	Always	Below 1 Ω

(c) Reinstall the IGN fuse.

NG ▶ **REPLACE FUSE (IGN FUSE)**

OK
▼

8.	CHECK HARNESS AND CONNECTOR (ECM - INTEGRATION RELAY)



(a) Remove the integration relay from the engine room relay block.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-28 (IGSW) - 1A-4	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A50-28 (IGSW) - Body ground	Always	10 kΩ or higher

(d) Reinstall the integration relay.

(e) Reconnect the ECM connector.

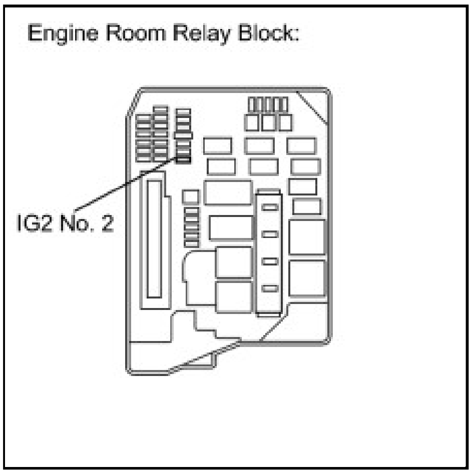
NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - INTEGRATION RELAY)**

OK ▼

9.	INSPECT FUSE (IG2 NO. 2 FUSE)

(a) Remove the IG2 No. 2 fuse from the engine room relay block.

(b) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
IG2 No. 2 fuse	Always	Below 1 Ω

(c) Reinstall the fuse.

NG **REPLACE FUSE (IG2 NO. 2 FUSE)**

OK

10.	**CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY - IGNITION SWITCH)**

(a) Remove the integration relay from the engine room relay block.

(b) Disconnect the ignition switch connector.

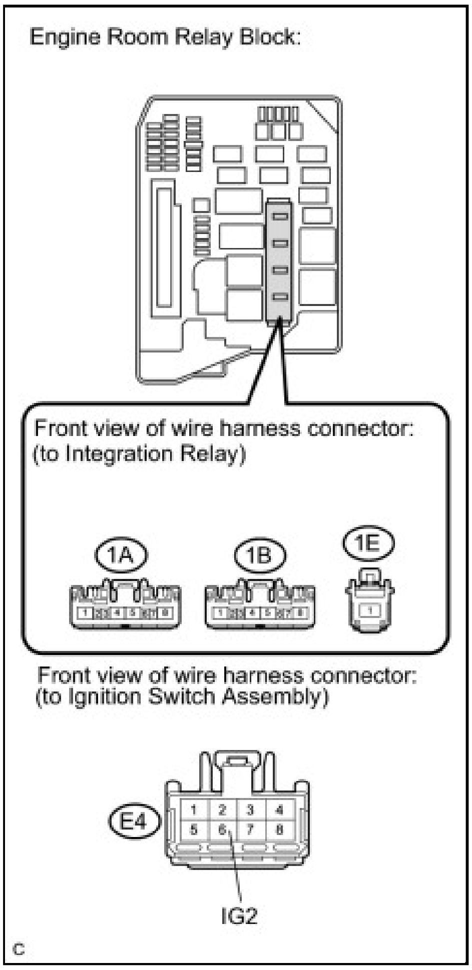
(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1A-2 - E4-6 (IG2)	Always	Below 1 Ω
1A-3 - Body ground	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
E4-6 (IG2) - Body ground	Always	10 kΩ or higher

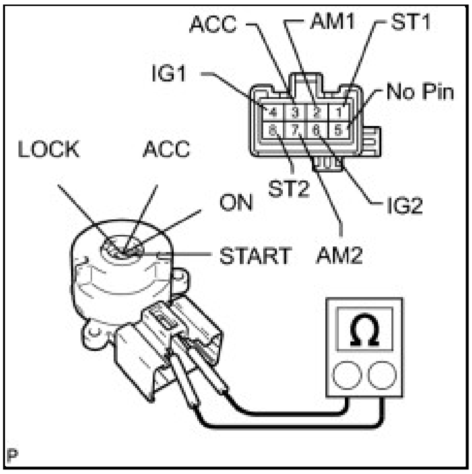
(d) Reinstall the integration relay.

(e) Reconnect the ignition switch connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY - ECM)**

OK ▼

11.	**INSPECT IGNITION SWITCH**



(a) Remove the ignition switch.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
All Terminals	LOCK	10 kΩ or higher
2 (AM1) - 3 (ACC)	ACC	Below 1 Ω
2 (AM1) - 3 (ACC) - 4 (IG1)	ON	

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
7 (AM2) - 6 (IG2)		
2 (AM1) - 4 (IG1) - 1 (ST1)	START	
7 (AM2) - 6 (IG2) - 8 (ST2)		

(c) Reinstall the ignition switch.

NG ▶ **REPLACE IGNITION SWITCH**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION SWITCH - BATTERY)**

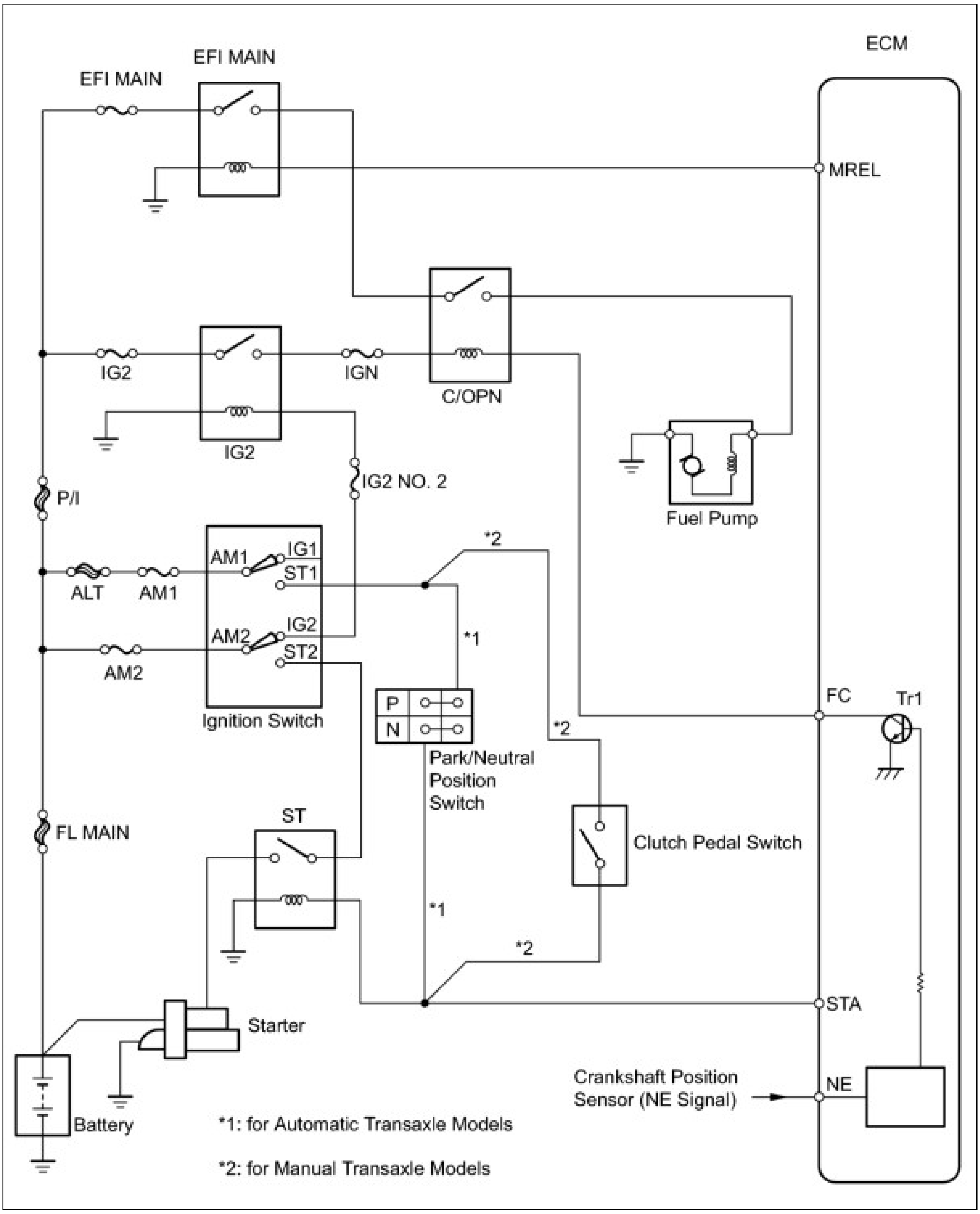
Last Modified: 3-10-2010	6.4 J	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000001DN7022X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: Fuel Pump Control Circuit (2010 Corolla)		

Fuel Pump Control Circuit

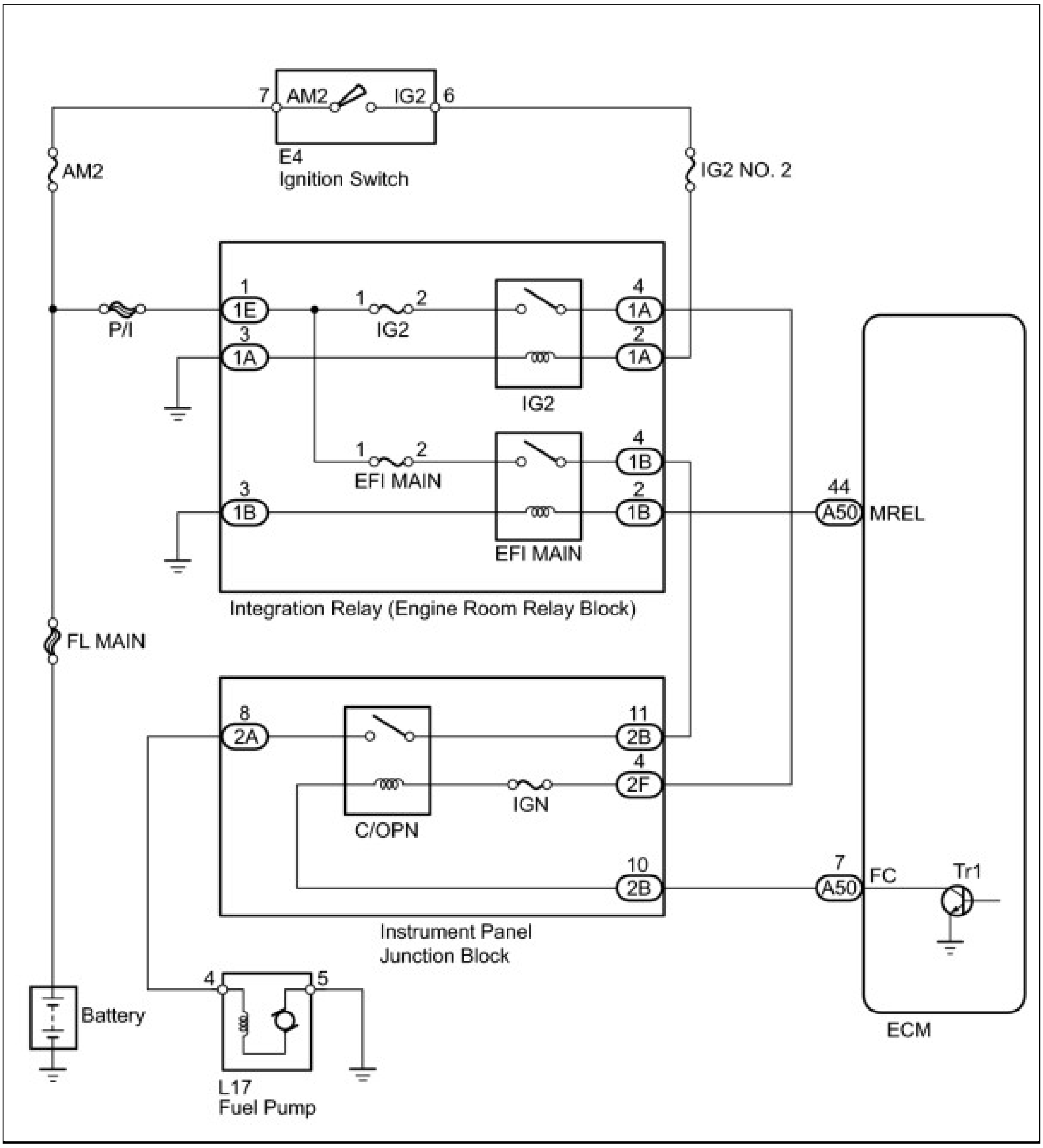
DESCRIPTION

When the engine is cranked, the starter relay drive signal from the ignition switch is input into the STA terminal of the ECM, and the NE signal generated by the crankshaft position sensor is also input into the NE+ terminal. Thus, the ECM interprets that the engine is being cranked, and turns transistor Tr1 in the ECM internal circuit ON. The current flows to the C/OPN (Circuit Opening) relay by turning Tr1 ON. Then, the fuel pump operates.

While the NE signal is input into the ECM, and the engine is running, the ECM turns Tr1 on continuously.



WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	**PERFORM ACTIVE TEST USING TECHSTREAM (FUEL PUMP/SPD)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump/Speed.

(e) Check whether the fuel pump operating sound occurs when performing the Active Test using the Techstream.

Result:

RESULT	PROCEED TO
Fuel pump operating sound does not occur	A
Fuel pump operating sound occurs	B

B ▶ **READ VALUE USING TECHSTREAM (STARTER SIG)**

A
▼

2.	INSPECT MAIN BODY ECU (C/OPN RELAY INPUT VOLTAGE)

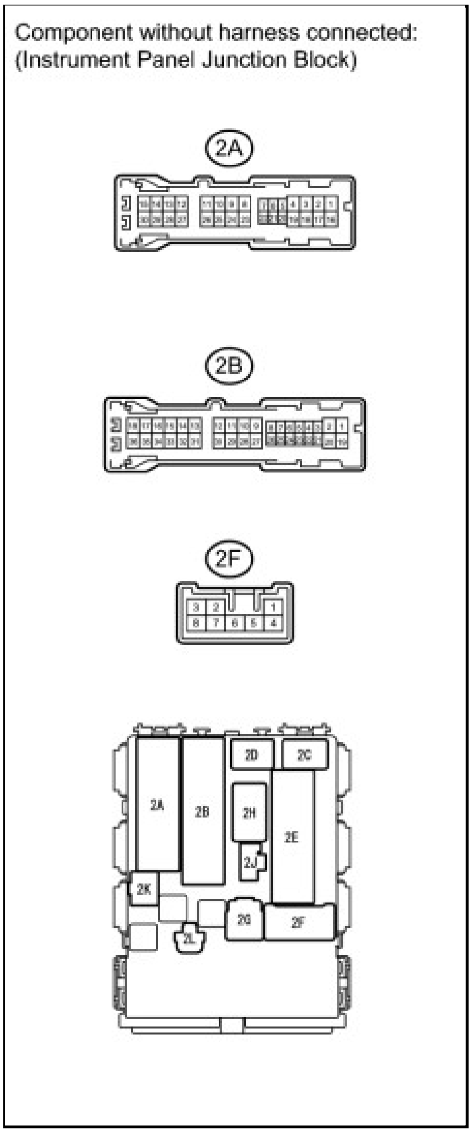
(a) Measure the voltage between the terminal of the instrument panel junction block and the body ground when the ignition switch is turned to ON and OFF.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
2B-11 - Body ground	Ignition switch OFF	Below 1 V
2F-4 - Body ground		
2B-11 - Body ground	Ignition switch ON	11 to 14 V
2F-4 - Body ground		

Result:

RESULT	PROCEED TO
Outside standard range	A
Within standard range	B

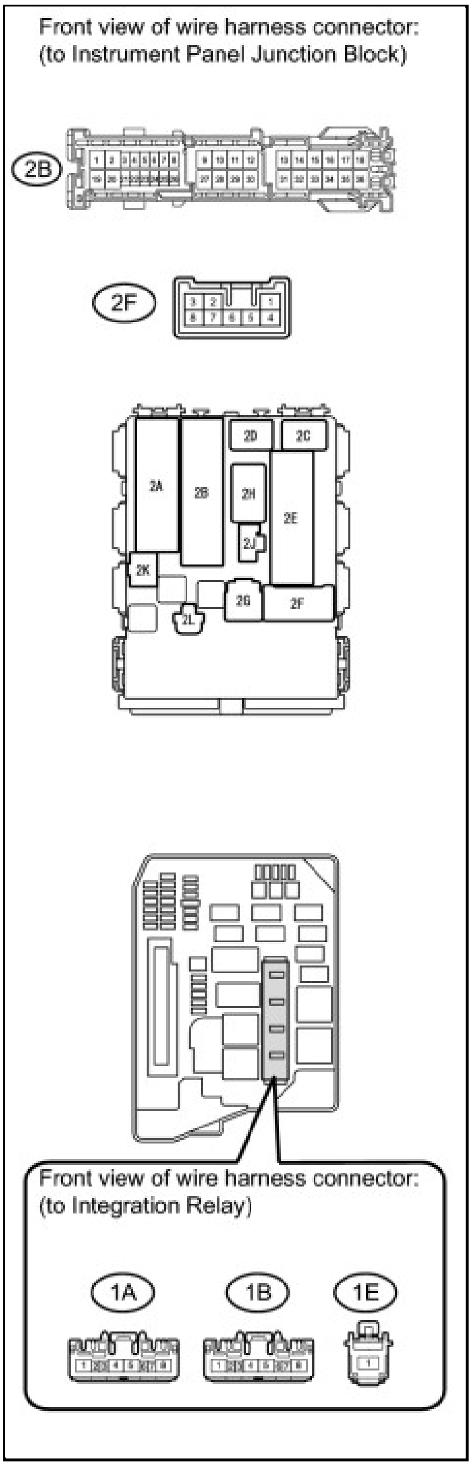


B ▶ **INSPECT INSTRUMENT PANEL JUNCTION BLOCK (C/OPN RELAY)**

A ▼

3.	**CHECK HARNESS AND CONNECTOR (INSTRUMENT PANEL JUNCTION BLOCK - INTEGRATION RELAY)**

(a) Remove the integration relay from the engine room relay block.



(b) Disconnect the instrument panel junction block connectors.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1A-4 - 2F-4	Always	Below 1 Ω
1B-4 - 2B-11	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2F-4 - Body ground	Always	10 kΩ or higher
2B-11 - Body ground	Always	10 kΩ or higher

(d) Reinstall the integration relay.

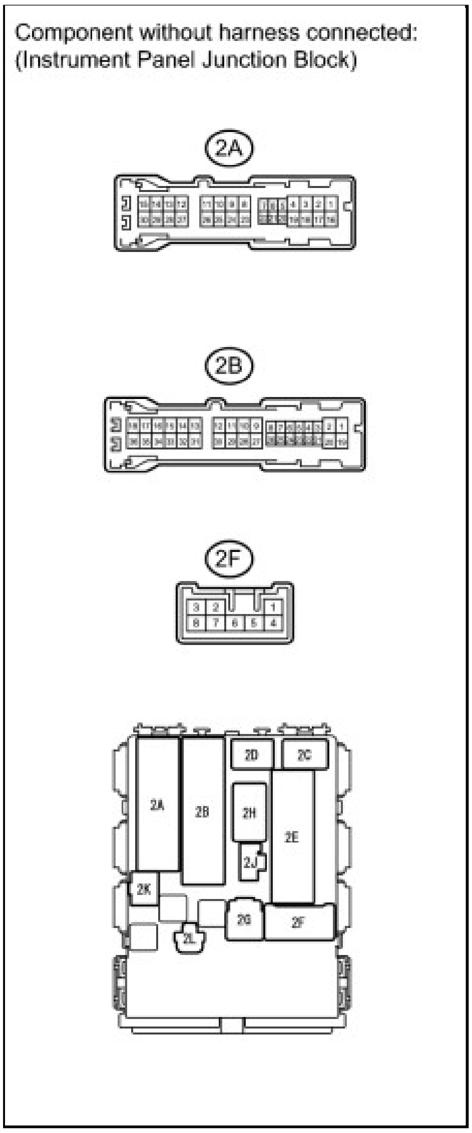
(e) Reconnect the instrument panel junction block connectors.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (INSTRUMENT PANEL JUNCTION BLOCK - INTEGRATION RELAY)**

OK ▶ **GO TO ECM POWER SOURCE CIRCUIT**

4.	**INSPECT INSTRUMENT PANEL JUNCTION BLOCK (C/OPN RELAY)**

(a) Remove the instrument panel junction block.



(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

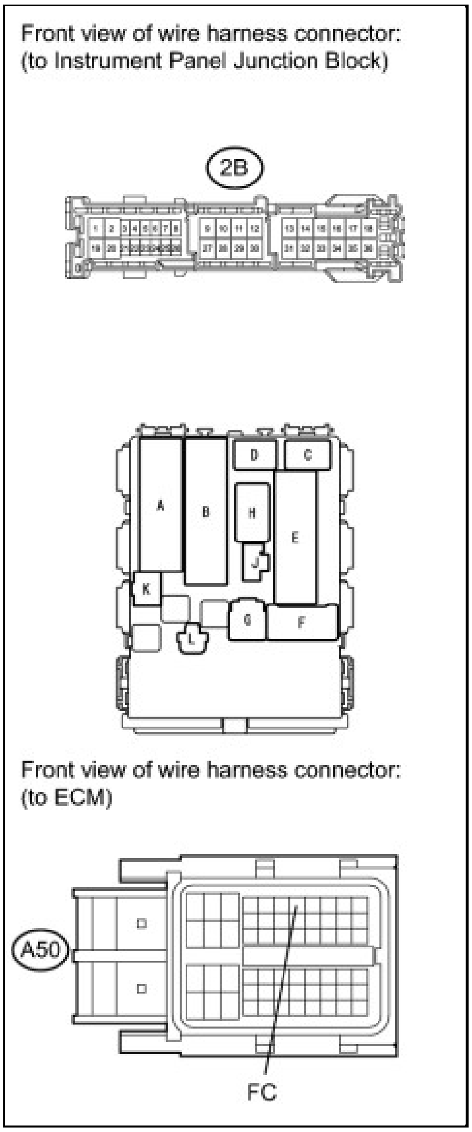
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2B-11 - 2A-8	When battery voltage absent	10 kΩ or higher
	When battery voltage applied to terminals 2F-4 and 2B-10	Below 1 Ω

(c) Reinstall the instrument panel junction block.

NG ▶ **REPLACE INSTRUMENT PANEL JUNCTION BLOCK**

OK

5.	CHECK HARNESS AND CONNECTOR (C/OPN RELAY - ECM)



(a) Disconnect the ECM connector.

(b) Disconnect the instrument panel junction block connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2B-10 - A50-7 (FC)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
2B-10 or A50-7 (FC) - Body ground	Always	10 kΩ or higher

(d) Reconnect the instrument panel junction block connector.

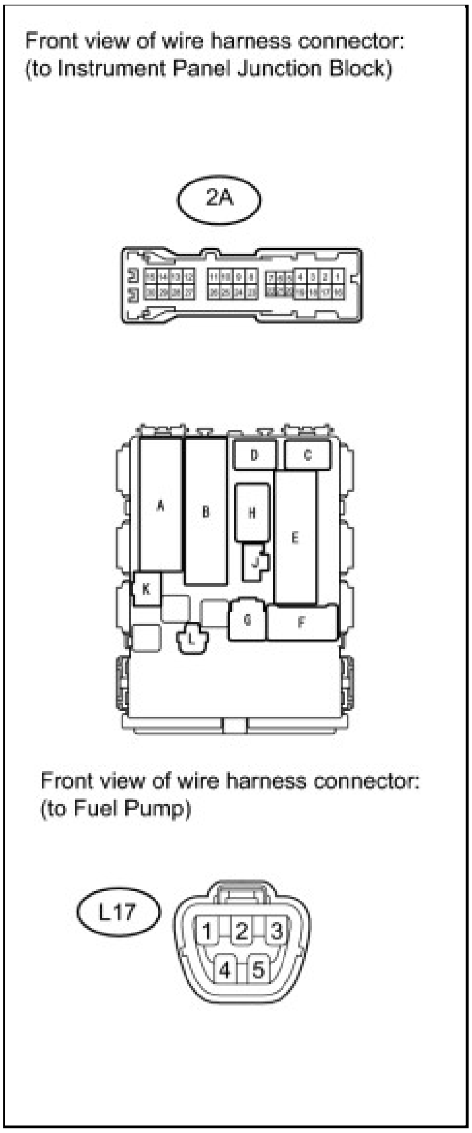
(e) Reconnect the ECM connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (C/OPN RELAY - ECM)**

OK
▼

6.	CHECK HARNESS AND CONNECTOR (INSTRUMENT PANEL JUNCTION BLOCK - FUEL PUMP)

(a) Disconnect the instrument panel junction block connector.



(b) Disconnect the fuel pump connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTIONS	CONDITION	SPECIFIED CONDITIONS
2A-8 - L17-4	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTIONS	CONDITION	SPECIFIED CONDITIONS
2A-8 or L17-4 - Body ground	Always	10 kΩ or higher

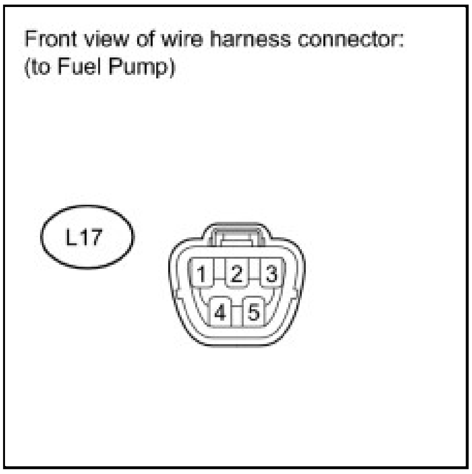
(d) Reconnect the fuel pump connector.

(e) Reconnect the instrument panel junction block connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (INSTRUMENT PANEL JUNCTION BLOCK - FUEL PUMP)**

OK ▼

7.	CHECK HARNESS AND CONNECTOR (FUEL PUMP GROUND CIRCUIT)



(a) Disconnect the fuel pump connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTIONS	CONDITION	SPECIFIED CONDITIONS
L17-5 - Body ground	Always	Below 1 Ω

(c) Reconnect the fuel pump connector.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (FUEL PUMP GROUND CIRCUIT)**

OK ▼

8.	READ VALUE USING TECHSTREAM (STARTER SIG)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / All Data / Starter Signal.

(e) Check the result when the ignition switch is turned to ON and START.

Result:

IGNITION SWITCH POSITION	STARTER SIGNAL
ON	OFF
START	ON

NG ▶ **REPAIR OR REPLACE STARTING SYSTEM**

OK ▼

9.	READ VALUE USING TECHSTREAM (ENGINE SPD)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / All Data / Engine Speed.

(e) Read the values displayed on the Techstream while cranking.

OK:
Values are displayed continuously.

NG ▶ **REPAIR OR REPLACE CRANKSHAFT POSITION SENSOR CIRCUIT**

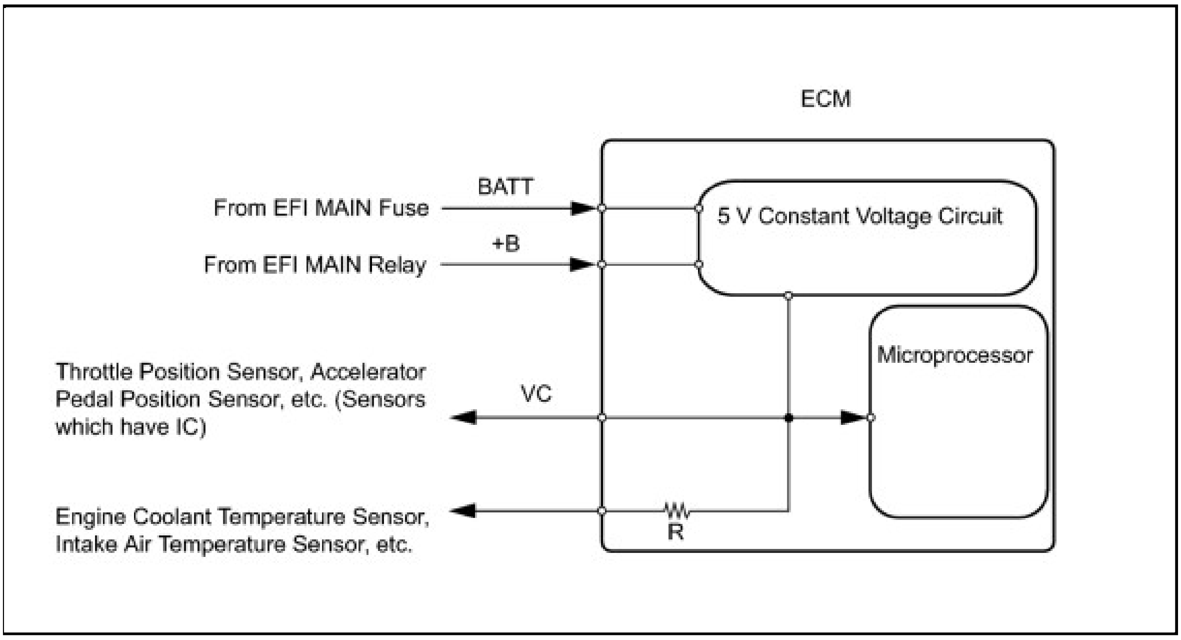
OK ▶ **REPLACE ECM**

Last Modified: 3-10-2010	6.4 J	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000001D6V08HX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: VC Output Circuit (2010 Corolla)		

VC Output Circuit

DESCRIPTION

The ECM constantly generates 5 V power from the battery voltage supplied to the +B (BATT) terminal to operate the microprocessor. The ECM also provides this power to the sensors through the VC output circuit.

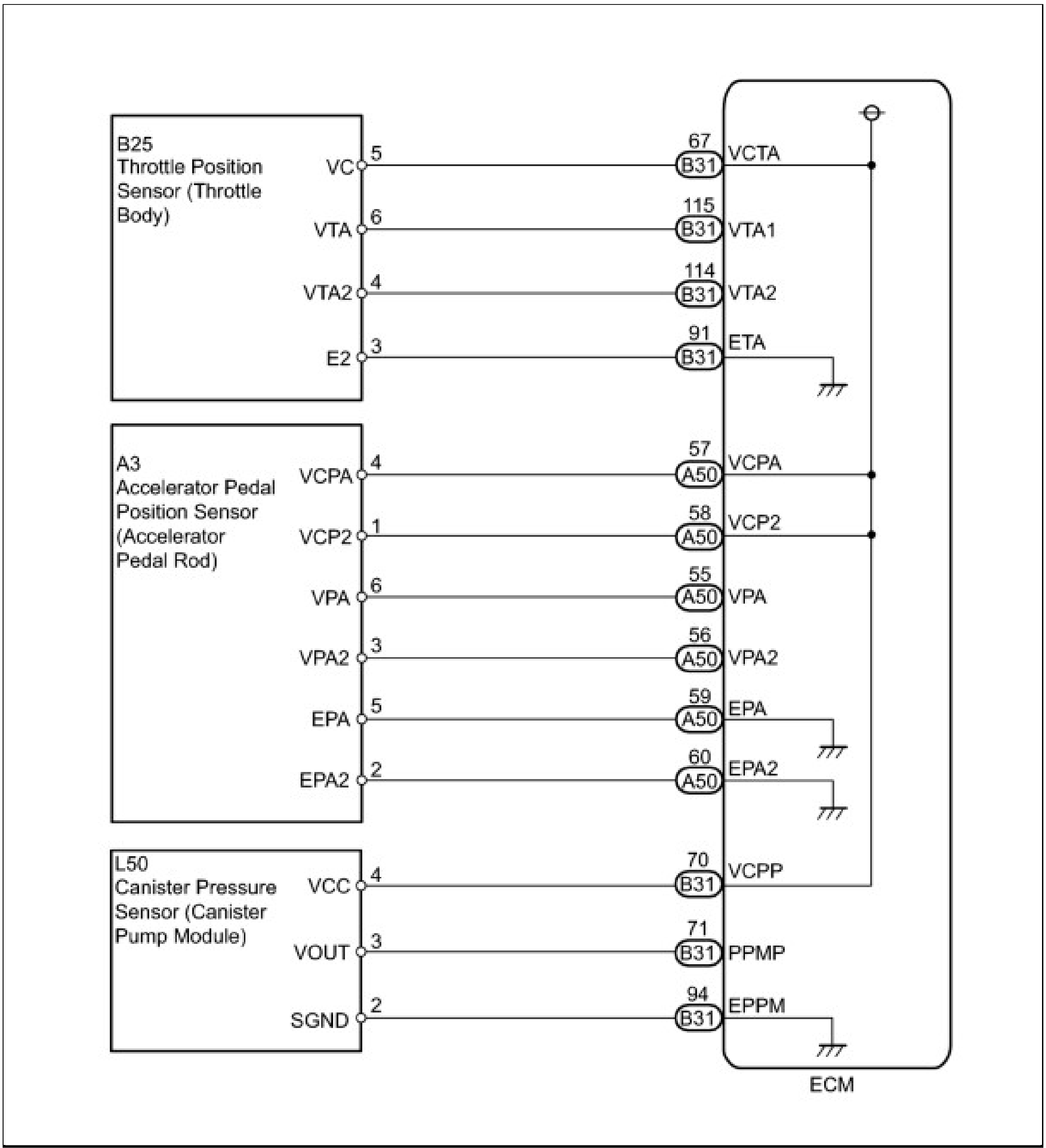


When the VC circuit is short-circuited, the microprocessor in the ECM and sensors that are supplied with power through the VC circuit are inactivated because the power is not supplied from the VC circuit. Under this condition, the system does not start up and the MIL does not illuminate even if the system malfunctions.

HINT:

Under normal conditions, the MIL is illuminated for several seconds when the ignition switch is first turned ON. The MIL goes off when the engine is started.

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	**CHECK MIL**

(a) Check that the Malfunction Indicator Lamp (MIL) lights up when turning the ignition switch to ON.

OK:

MIL lights up

NG ▶ CHECK COMMUNICATION BETWEEN TECHSTREAM AND ECM

OK ▶ SYSTEM OK

2.	CHECK COMMUNICATION BETWEEN TECHSTREAM AND ECM

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

Result:

RESULT	PROCEED TO
Communication is possible	A
Communication is not possible	B

A ▶ GO TO MIL CIRCUIT

B ▼

3.	CHECK MIL (THROTTLE POSITION SENSOR)

(a) Disconnect the throttle body connector.

(b) Turn the ignition switch to ON.

(c) Check the MIL.

Result:

RESULT	PROCEED TO
MIL illuminates	A
MIL does not illuminate	B

(d) Reconnect the throttle body connector.

A ▶ **REPLACE THROTTLE BODY**

B ▼

4.	CHECK MIL (ACCELERATOR PEDAL POSITION SENSOR)

(a) Disconnect the accelerator pedal position sensor connector.

(b) Turn the ignition switch to ON.

(c) Check the MIL.

Result:

RESULT	PROCEED TO
MIL illuminates	A
MIL does not illuminate	B

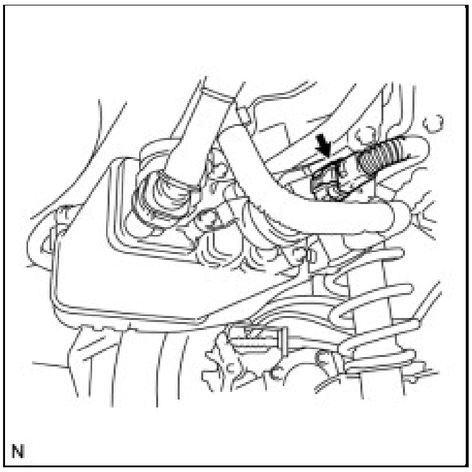
(d) Reconnect the accelerator pedal position sensor connector.

A ▶ **REPLACE ACCELERATOR PEDAL ROD ASSEMBLY**

B ▼

5.	CHECK MIL (CANISTER PUMP MODULE)

(a) Disconnect the canister pump module connector.



(b) Turn the ignition switch to ON.

(c) Check the MIL.

Result:

RESULT	PROCEED TO
MIL illuminates	A
MIL does not illuminate	B

(d) Reconnect the canister pump module connector.

A ▶ REPLACE CANISTER

B ▼

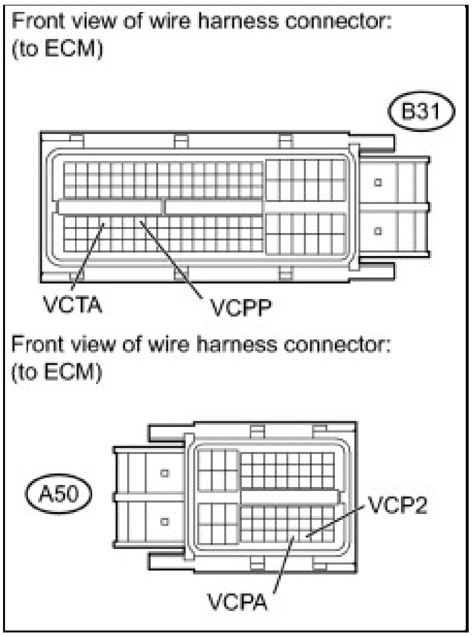
6.	CHECK HARNESS AND CONNECTOR (VC CIRCUIT)

(a) Disconnect the throttle body connector.

(b) Disconnect the accelerator pedal position sensor connector.

(c) Disconnect the canister pump module connector.

(d) Disconnect the ECM connectors.



(e) Measure the resistance.

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B31-67 (VCTA) - Body ground	Always	10 kΩ or higher
A50-57 (VCPA) - Body ground	Always	10 kΩ or higher
A50-58 (VCP2) - Body ground	Always	10 kΩ or higher
B31-70 (VCPP) - Body ground	Always	10 kΩ or higher

(f) Reconnect the throttle body connector.

(g) Reconnect the accelerator pedal position sensor connector.

(h) Reconnect the canister pump module connector.

(i) Reconnect the ECM connectors.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

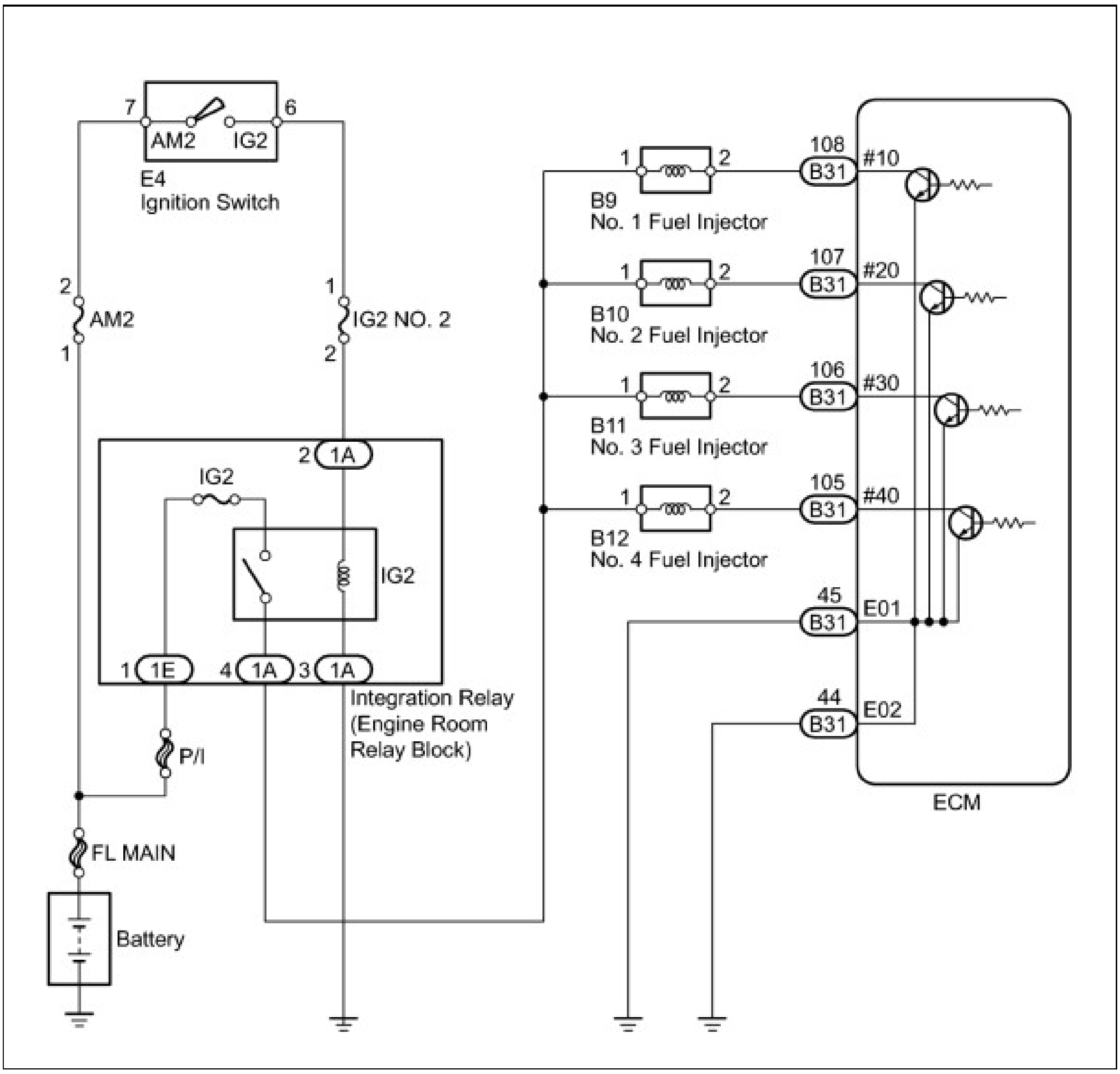
Last Modified: 3-10-2010	6.4 J	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000ZRM04AX
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: Fuel Injector Circuit (2010 Corolla)		

Fuel Injector Circuit

DESCRIPTION

The fuel injectors are located on the intake manifold. They inject fuel into the cylinders based on the signals from the ECM.

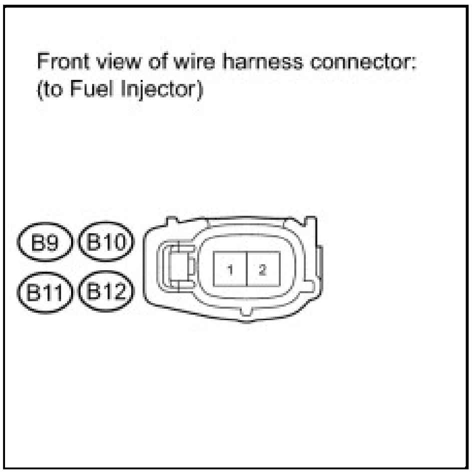
WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	INSPECT FUEL INJECTOR (POWER SOURCE)



(a) Disconnect the fuel injector connectors.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
B9-1 - Body ground	Ignition switch ON	11 to 14 V
B10-1 - Body ground	Ignition switch ON	11 to 14 V
B11-1 - Body ground	Ignition switch ON	11 to 14 V
B12-1 - Body ground	Ignition switch ON	11 to 14 V

(d) Reconnect the fuel injector connectors.

NG ▶ **CHECK HARNESS AND CONNECTOR (FUEL INJECTOR - INTEGRATION RELAY)**

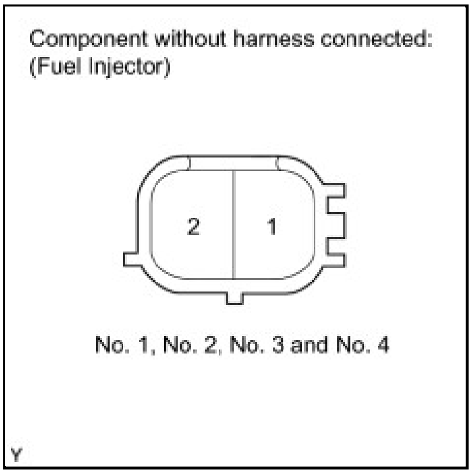
OK ▼

2.	INSPECT FUEL INJECTOR (INJECTOR RESISTANCE)

(a) Disconnect the fuel injector connectors.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	11.6 to 12.4 Ω

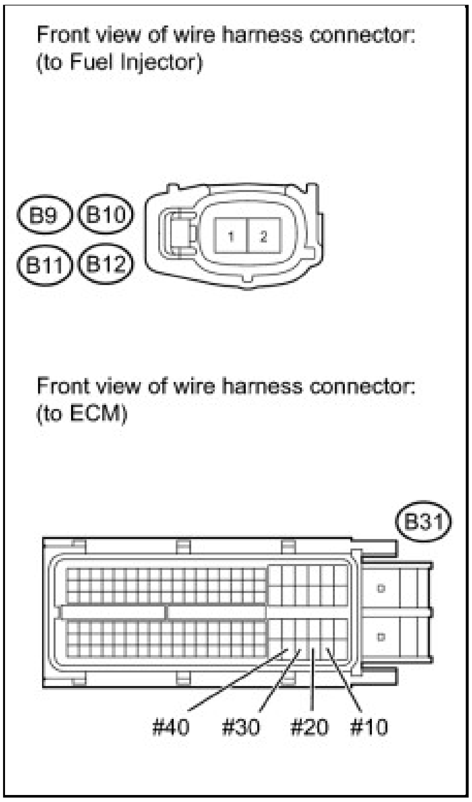
(c) Reconnect the fuel injector connectors.

NG ▶ **REPLACE FUEL INJECTOR**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (FUEL INJECTOR - ECM)**

(a) Disconnect the ECM connector.



(b) Disconnect the fuel injector connectors.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B9-2 - B31-108 (#10)	Always	Below 1 Ω
B10-2 - B31-107 (#20)	Always	Below 1 Ω
B11-2 - B31-106 (#30)	Always	Below 1 Ω
B12-2 - B31-105 (#40)	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B9-2 or B31-108 (#10) - Body ground	Always	10 kΩ or higher
B10-2 or B31-107 (#20) - Body ground	Always	10 kΩ or higher
B11-2 or B31-106 (#30) - Body ground	Always	10 kΩ or higher
B12-2 or B31-105 (#40) - Body ground	Always	10 kΩ or higher

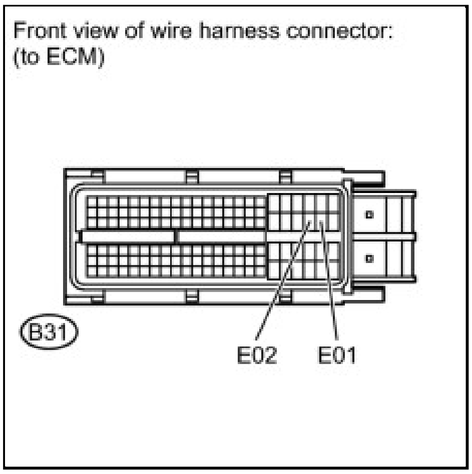
(d) Reconnect the fuel injector connectors.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (FUEL INJECTOR - ECM)

OK ▼

4.	CHECK HARNESS AND CONNECTOR (ECM - BODY GROUND)



(a) Disconnect the ECM connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B31-45 (E01) - Body ground	Always	Below 1 Ω
B31-44 (E02) - Body ground	Always	Below 1 Ω

(c) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - BODY GROUND)

OK ▼

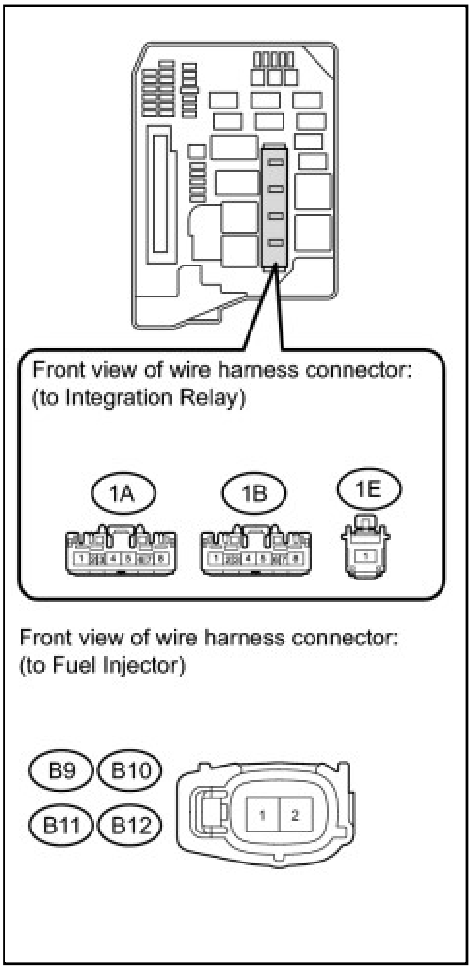
5.	INSPECT FUEL INJECTOR (INJECTION AND VOLUME)

(a) Check the fuel injector injection and volume INFO .

NG ▶ REPLACE FUEL INJECTOR

OK ▶ **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE**

6.	CHECK HARNESS AND CONNECTOR (FUEL INJECTOR - INTEGRATION RELAY)



(a) Disconnect the fuel injector connectors.

(b) Remove the integration relay from the engine room relay block.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B9-1 - 1A-4	Always	Below 1 Ω
B10-1 - 1A-4	Always	Below 1 Ω
B11-1 - 1A-4	Always	Below 1 Ω
B12-1 - 1A-4	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B9-1 or 1A-4 - Body ground	Always	10 kΩ or higher
B10-1 or 1A-4 - Body ground	Always	10 kΩ or higher
B11-1 or 1A-4 - Body ground	Always	10 kΩ or higher
B12-1 or 1A-4 - Body ground	Always	10 kΩ or higher

(d) Reconnect the fuel injector connectors.

(e) Reinstall the integration relay.

NG ▶ **REPAIR OR REPLACE HARNESS OR**

CONNECTOR (FUEL INJECTOR - INTEGRATION RELAY)

REPAIR OR REPLACE ECM

OK ▶ POWER SOURCE CIRCUIT

Last Modified: 3-10-2010	6.4 J	**From:** 200901
Model Year: 2010	**Model:** Corolla	**Doc ID:** RM000000WZ10B4X
Title: 2AZ-FE ENGINE CONTROL: SFI SYSTEM: MIL Circuit (2010 Corolla)		

MIL Circuit

DESCRIPTION

The MIL (Malfunction Indicator Lamp) is used to indicate vehicle malfunction detections by the ECM. When the ignition switch is turned to ON, power is supplied to the MIL circuit, and the ECM provides the circuit ground which illuminates the MIL.

The MIL operation can be checked visually: When the ignition switch is first turned to ON, the MIL should illuminate and should then turn off. If the MIL remains illuminated or does not illuminate, conduct the following troubleshooting procedure using the Techstream.

WIRING DIAGRAM