

DTC	P0171/25	SYSTEM TOO LEAN (BANK 1)
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DTC	P0172/26	SYSTEM TOO RICH (BANK 1)
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CIRCUIT DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection time. The fuel trim includes the short-term fuel trim and the long-term fuel trim.

The short-term fuel trim is the short-term fuel compensation used to maintain the air-fuel ratio at its ideal theoretical value. The signal from the heated oxygen sensor indicates whether the air-fuel ratio is rich or lean compared to the ideal theoretical value, triggering a reduction in the fuel volume if the air-fuel ratio is rich, and an increase in the fuel volume if it is lean.

The long-term fuel trim is the overall fuel compensation in order to balance the short-term fuel trim for a continual deviation from the central value by individual engine differences, operating environment and age deterioration.

If both the short-term fuel trim and the long-term fuel trim are lean or rich beyond a standard level, it is detected as a malfunction in the SFI system. The ECM illuminates the MIL and the DTC is set.

DTC No.	DTC Detection Condition	Trouble Area
P0171/25	When air-fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on lean side (2 trip detection logic)	<ul style="list-style-type: none"> • Air induction system • Injector blockage • Mass air flow meter • Engine coolant temperature sensor • Fuel pressure • Gas leakage in exhaust system • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater (sensor 1) • A/F sensor heater relay • PCV valve and hose • PCV hose connection
P0172/26	When air-fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on rich side (2 trip detection logic)	<ul style="list-style-type: none"> • Injector leakage or blockage • Mass air flow meter • Engine coolant temperature sensor • Ignition system • Fuel pressure • Gas leakage in exhaust system • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater • A/F sensor heater relay

HINT:

- When DTC P0171/25 is set, the actual air-fuel ratio is lean. When DTC P0172/26 is set, the actual air-fuel ratio is rich.
- If the vehicle runs out of fuel, the air-fuel ratio is lean and DTC P0171/25 may be set. The MIL then illuminates.
- If the total of the short-term fuel trim value and long-term fuel trim value is within $\pm 20\%$, the system is functioning normally.

WIRING DIAGRAM

Refer to DTC P2195 on [page 05-192](#).

INSPECTION PROCEDURE

HINT:

Intelligent tester II only:

Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform Active Test using the intelligent tester II.

HINT:

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

- (1) Connect the intelligent tester II to the DLC3.
- (2) Start the engine and turn the intelligent tester II ON.
- (3) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
- (4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
- (5) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
- (6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

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

+25 % → Rich output: Less than 3.0 V

-12.5 % → Lean output: More than 3.35 V

The heated oxygen sensor reacts in accordance with increase and decrease of the injection volume:

+25 % → Rich output: More than 0.55 V

-12.5 % → Lean output: Less than 0.4 V

NOTICE:

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

	Output Voltage of A/F Sensor (Sensor 1)	Output Voltage of Heated Oxygen Sensor (Sensor 2)	Main Suspect Trouble Area
Case 1	Injection volume +25 % -12.5 % Output voltage More than 3.35 V OK Less than 3.0 V	Injection volume +25 % -12.5 % Output voltage More than 0.55 V OK Less than 0.4V	—
Case 2	Injection volume +25 % -12.5 % Output voltage Almost no reaction NG	Injection volume +25 % -12.5 % Output voltage More than 0.55 V OK Less than 0.4V	A/F sensor (A/F sensor, sensor heater, sensor circuit)
Case 3	Injection volume +25 % -12.5 % Output voltage More than 3.35 V OK Less than 3.0V	Injection volume +25 % -12.5 % Output voltage Almost no reaction NG	Heated oxygen sensor (Heated oxygen sensor, sensor heater, sensor circuit)
Case 4	Injection volume +25 % -12.5 % Output voltage Almost no reaction NG	Injection volume +25 % -12.5 % Output voltage Almost no reaction NG	Extremely rich or lean actual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

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

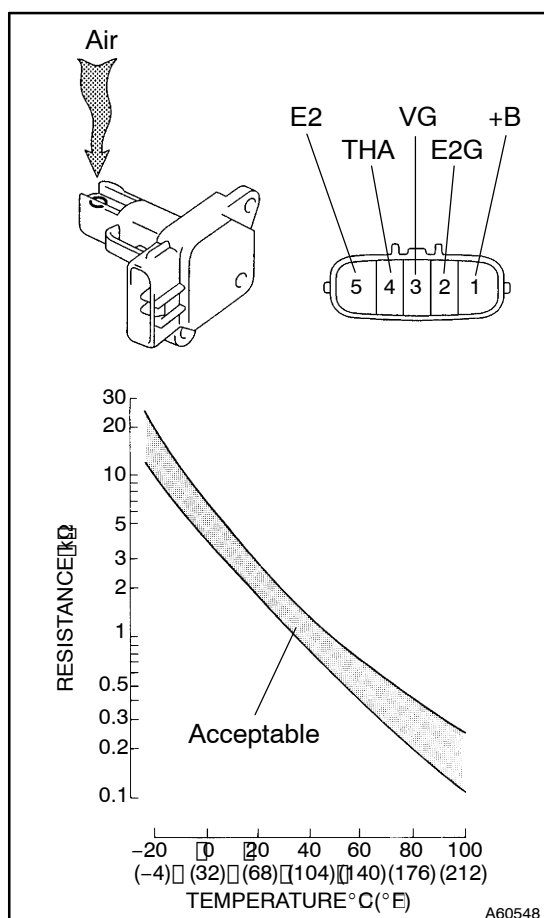
To display the graph, select the following menu items on the tester: View / Line graph.

HINT:

- Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help 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, and other data from the time the malfunction occurred.
- A low A/F sensor voltage could be caused by a rich air-fuel mixture. Check the conditions that would cause the engine to run with the rich air-fuel mixture.
- A high A/F sensor voltage could be caused by a lean air-fuel mixture. Check the conditions that would cause the engine to run with the lean air-fuel mixture.

1 CHECK AIR INDUCTION SYSTEM

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

OK: No vacuum leak.**NG****REPAIR OR REPLACE AIR INDUCTION SYSTEM****OK****2 CHECK CONNECTION OF PCV HOSE****OK:** The PCV hose is connected correctly, and the PCV hose is not damaged.**NG****REPAIR OR REPLACE PCV HOSE****OK****3 INSPECT FUEL INJECTOR ASSY (INJECTION AND VOLUME) (See page 11-8)****NG****REPLACE FUEL INJECTOR ASSY**
(See page 11-11)**OK****4 INSPECT MASS AIR FLOW METER**

- Remove the mass air flow meter.
- Inspect output voltage.
 - Apply the battery voltage across terminals +B and E2G.
 - Connect the positive (+) tester probe to terminal VG, and negative (-) tester probe to terminal E2G.
 - Blow air into the mass air flow meter, and check that the voltage fluctuates.
- Inspect the resistance.
 - Measure the resistance between the terminals of the intake air temperature sensor.

Standard:

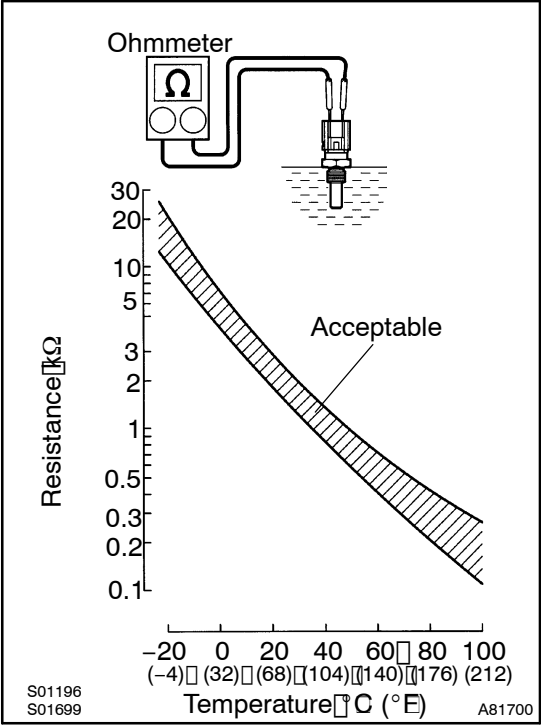
Tester Connection	Specified Condition
THA (4) - E2 (5)	13.6 to 18.4 kΩ at -20°C (-4°F)
THA (4) - E2 (5)	2.21 to 2.69 kΩ at 20°C (68°F)
THA (4) - E2 (5)	0.49 to 0.67 kΩ at 60°C (140°F)

- (d) Reinstall the mass air flow meter.

NG → REPLACE MASS AIR FLOW METER

OK

5 INSPECT ENGINE COOLANT TEMPERATURE SENSOR (RESISTANCE)



- (a) Remove the engine coolant temperature sensor.
- (b) Measure the resistance between the terminals of the engine coolant temperature sensor.

Standard:

Tester Connection	Specified Condition
1 - 2	2.32 to 2.59 kΩ at 20°C (68°F)
1 - 2	0.310 to 0.326 kΩ at 80°C (176°F)

NOTICE:
When checking the engine coolant temperature sensor in water, be careful not to allow water to contact the terminals. After checking, dry the sensor.

HINT:
Alternate procedure: Connect an ohmmeter to the installed engine coolant temperature sensor and read the resistance. Use an infrared thermometer to measure the engine temperature in the immediate vicinity of the sensor. Compare these values to the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

NG → REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK

6 CHECK FOR SPARK AND IGNITION (See page 18-3)

OK: The spark occurs.

NG → REPAIR OR REPLACE

OK

7 CHECK FUEL PRESSURE (See page 11-5)

- (a) Check the fuel pressure (high or low pressure).

NG → CHECK AND REPLACE FUEL SYSTEM

OK

8	CHECK FOR EXHAUST GAS LEAKAGE
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OK: No gas leak.

NG

REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

OK

9	READ VALUE OF INTELLIGENT TESTER II(OUTPUT VOLTAGE OF AIR FUEL RATIO SENSOR)
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- (a) Connect the intelligent tester II to the DLC 3.
- (b) Start the engine and turn the intelligent tester II ON.
- (c) Warm up the A/F sensor with the engine at 2,500 rpm for approximately 90 seconds.
- (d) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Data List.
- (e) Select the following monitor items: AFS B1 S1 and Engine Speed.
- (f) Monitor the A/F sensor voltage carefully.
- (g) Check the A/F sensor voltage under the following conditions.
 - (1) Allow the engine to idle for 30 seconds.
 - (2) Run the engine at approximately 2,500 rpm (where the engine RPM is not suddenly changed).
 - (3) Raise the engine speed to 4,000 rpm and quickly release the accelerator pedal so that the throttle valve is fully closed.

Standard:

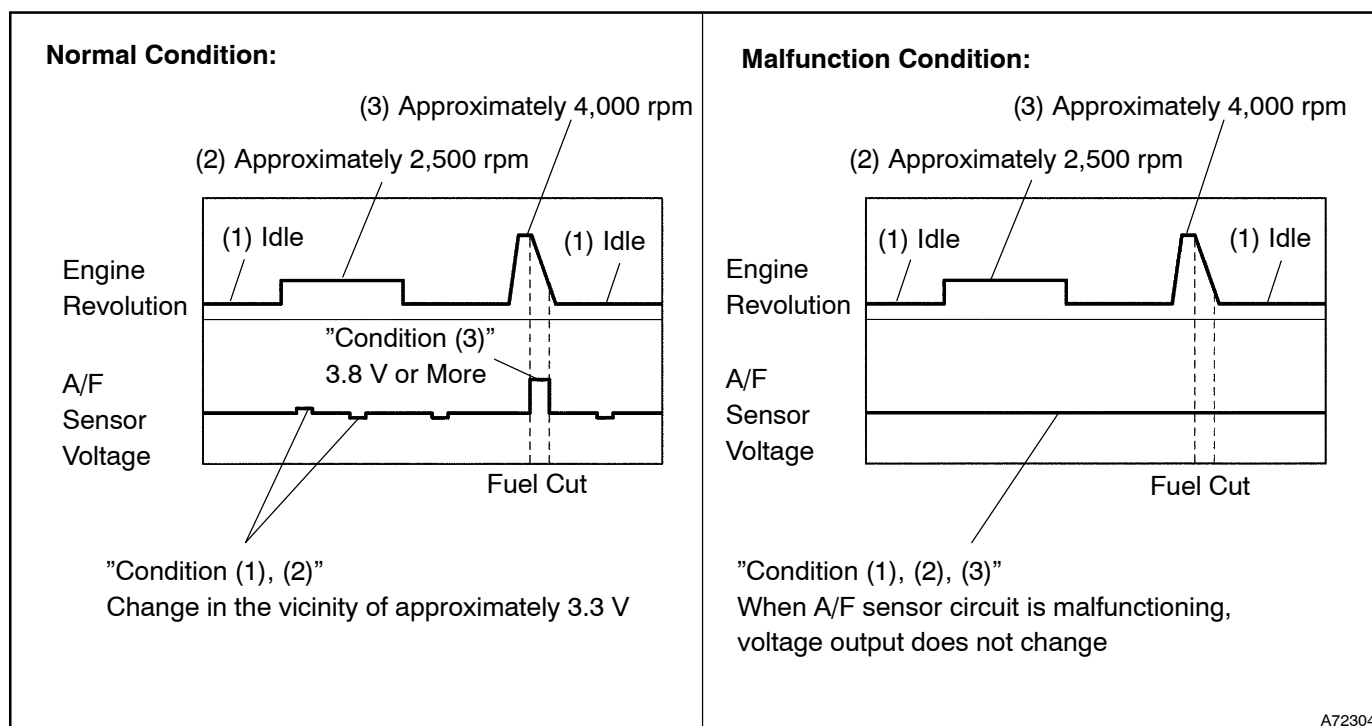
Condition (1) and (2)

The voltage changes in the vicinity of 3.3 V (0.66 V*) (between approximately 3.1 to 3.5 V) as shown in the illustration on the next page.

Condition (3)

The voltage increases to 3.8 V (0.76 V*) or more during engine deceleration (when fuel is cut) as shown in the illustration on the next page.

*: The voltage when not using intelligent tester II.

**HINT:**

- Whenever the output voltage of the A/F sensor remains at approximately 3.3 V (0.660 V*) (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have an open circuit. (This will happen also when the A/F sensor heater has an open circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approximately 3.8 V (0.76 V*) or more, or 2.8 V (0.56 V*) or less (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have a short circuit.
- The ECM will stop fuel injection (fuel cut) during engine deceleration. This will cause lean condition and should result in a momentary increase in the A/F sensor voltage output.
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal was reconnected, the vehicle must be driven over 16 km (10 mph) to allow the ECM to learn the closed throttle position.
- When the vehicle is driven:
The output voltage of the A/F sensor may be below 2.8 V (0.76 V*) during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.
- The A/F sensor is a current output element, therefore the current is converted into voltage inside the ECM. If measuring voltage at the connectors of the A/F sensor or ECM, you will obtain a constant voltage.

*: When not using the intelligent tester II.

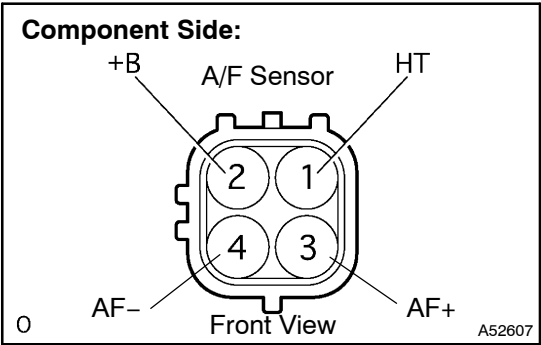
OK

Go to step 17

NG

10

INSPECT AIR FUEL RATIO SENSOR(HEATER RESISTANCE)



- (a) Disconnect the A4 A/F sensor connector.
- (b) Measure the resistance between the terminals of the A/F sensor.

Resistance:

Tester Connection	Specified Condition
HT (1) - +B (2)	1.8 to 3.4 Ω at 20°C (68°F)

- (c) Reconnect the A/F sensor connector.

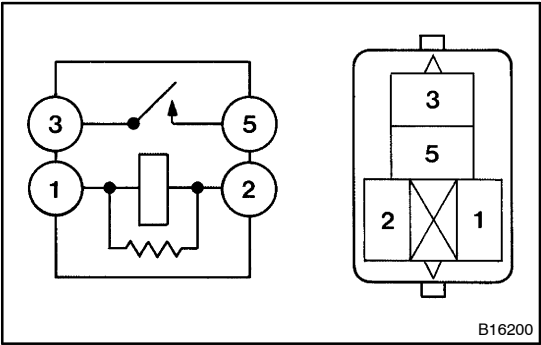
NG

REPLACE AIR FUEL RATIO SENSOR

OK

11

INSPECT EFI RELAY



- (a) Remove the EFI relay from the engine room R/B.
- (b) Check the EFI relay resistance.

Standard:

Tester Connection	Specified Condition
3 - 5	10 k Ω or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

- (c) Reinstall the EFI relay.

NG

REPLACE EFI RELAY

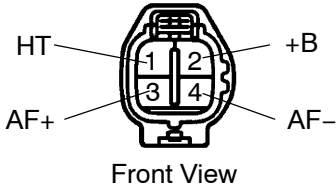
OK

12

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

Wire Harness Side:

A4 A/F Sensor Connector



A76787

- (a) Disconnect the A4 A/F sensor connector.
- (b) Disconnect the E10 ECM connector.
- (c) Check the resistance.

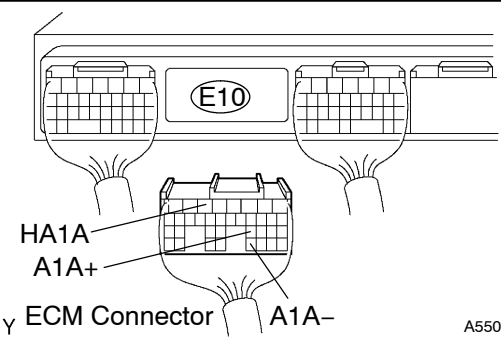
Standard (Check for open):

Tester Connection	Specified Condition
HT (A4-1) - HA1A (E10-5)	Below 1 Ω
AF+ (A4-3) - A1A+ (E10-23)	Below 1 Ω
AF- (A4-4) - A1A- (E10-31)	Below 1 Ω

Standard (Check for short):

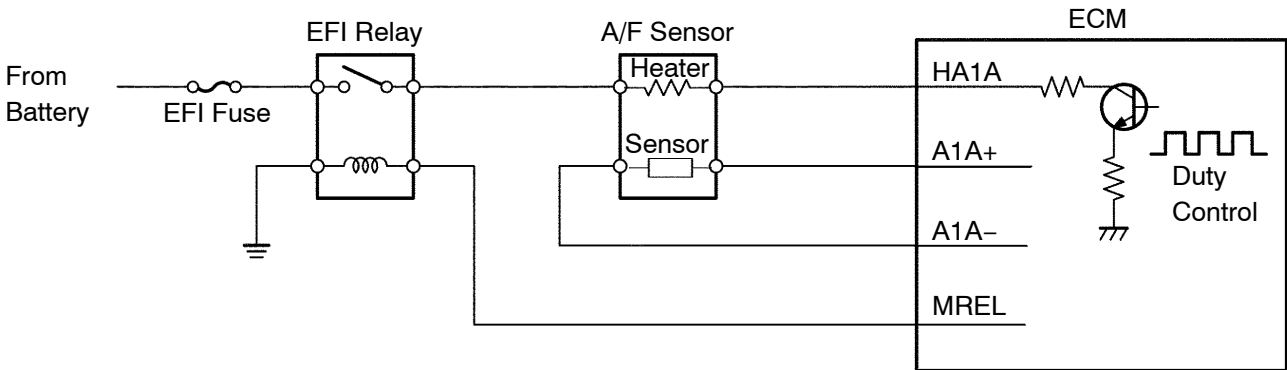
Tester Connection	Specified Condition
HT (A4-1) or HA1A (E10-5) - Body ground	10 kΩ or higher
AF+ (A4-3) or A1A+ (E10-23) - Body ground	10 kΩ or higher
AF- (A4-4) or A1A- (E10-31) - Body ground	10 kΩ or higher

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



A55005

Reference:



P

B62793

NG

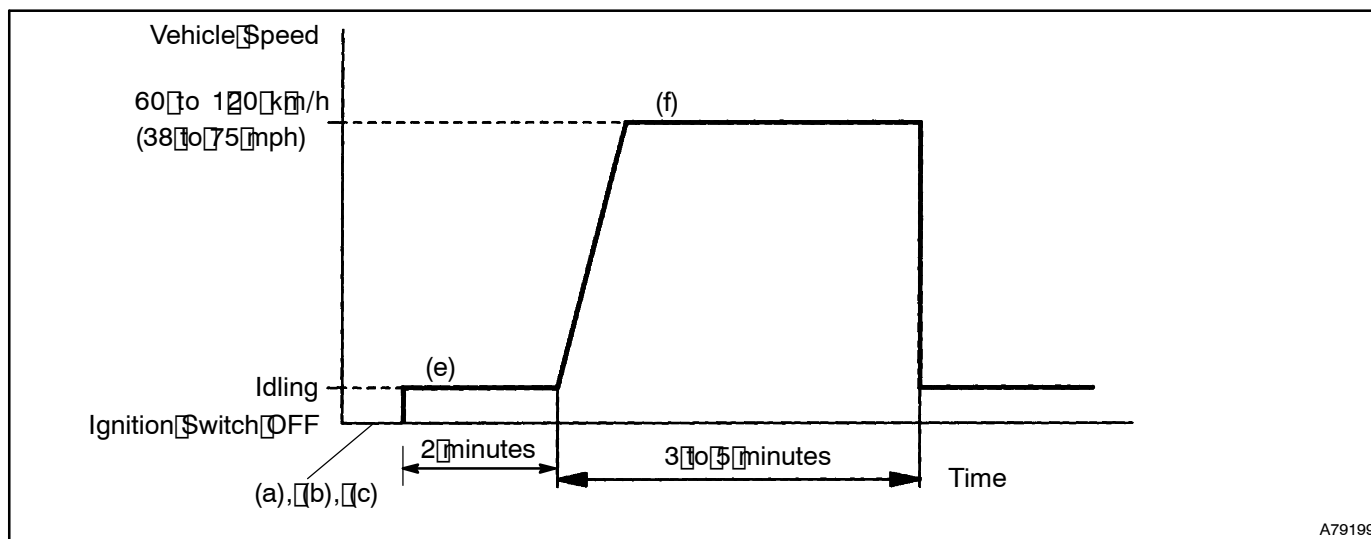
REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

13

REPLACE AIR FUEL RATIO SENSOR

GO

14 PERFORM CONFIRMATION DRIVING PATTERN

- (a) Connect the Intelligent Tester II to the DLC3.
- (b) Turn the Ignition switch to ON and turn the Intelligent Tester II ON.
- (c) Clear the DTC(s) using the Intelligent Tester II (see page 05-20).
- (d) Switch the ECM from normal mode to check mode using the Intelligent Tester II (see page 05-22).
- (e) Start the engine and warm it up with all the accessories switched OFF.
- (f) Drive the vehicle at 60 to 120 km/h (38 to 75 mph) and at engine speed of 1,400 to 3,200 rpm for 3 to 5 minutes.

HINT:

If a malfunction exists, the MIL will be illuminated during step (f).

NOTICE:

If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the Intelligent Tester II, turn the Ignition switch to OFF after performing steps (e) and (f), then perform step (f) again.

GO**15 CHECK IF DTC OUTPUT RECURS (DTC P0171/25 AND/OR P0172/26)**

- (a) Connect the Intelligent Tester II to the DLC3.
- (b) Turn the Ignition switch to ON and turn the Intelligent Tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
No output	A
P0171/25 and/or P0172/26	B

B

REPLACE ECM (See page 10-30) AND PERFORM CONFIRMATION DRIVING PATTERN (Refer to step 14)

A

16 CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST**NO****CHECK FOR INTERMITTENT PROBLEMS**
(See page 05-9)**YES****DTCS ARE CAUSED BY RUNNING OUT OF FUEL (DTCS P0171/25 AND/OR P0172/26)****17 PERFORM CONFIRMATION DRIVING PATTERN****HINT:**

Clear all DTCs prior to performing the confirmation driving pattern (refer to step 14).

GO**18 CHECK IF DTC OUTPUT RECURS(DTC P0171/25 AND/OR P0172/26)**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0171/25 and/or P0172/26	A
No output	B

B**Go to step 22****A****19 REPLACE AIR FUEL RATIO SENSOR****GO****20 PERFORM CONFIRMATION DRIVING PATTERN****HINT:**

Clear all DTCs prior to performing the confirmation driving pattern (refer to step 14).

GO

21 CHECK IF DTC OUTPUT RECURS (DTC P0171/25 AND/OR P0172/26)

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the ignition switch to ON and turn the intelligent tester ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
No output	A
P0171/25 and/or P0172/26	B

B

REPLACE ECM (See page 10-30) AND PERFORM CONFIRMATION DRIVING PATTERN (Refer to step 14)

A

22 CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO

CHECK FOR INTERMITTENT PROBLEMS (See page 05-9)

YES

DTCS ARE CAUSED BY RUNNING OUT OF FUEL (DTCS P0171/25 AND/OR P0172/26)