DTC	P0171	SYSTEM TOO LEAN (FUEL TRIM) (BANK 1)

DTC	P0172	SYSTEM TOO RICH (FUEL TRIM) (BANK 1)

DTC	P0174	SYSTEM TOO LEAN (BANK 2)

DTC	P0175	SYSTEM TOO RICH (BANK 2)

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 stoichiometric air–fuel ratio. The signal from the Heated Oxygen Sensor (HO2S) indicates whether the air–fuel ratio is RICH or LEAN compared to the stoichiometric air–fuel ratio. This variance triggers 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 short–term fuel trim varies from the central value due to individual engine differences, wear over time and changes in the operating environment. The long–term fuel trim, which controls overall fuel compensation, steadies long–term deviations of the short–term fuel trim from the central value.

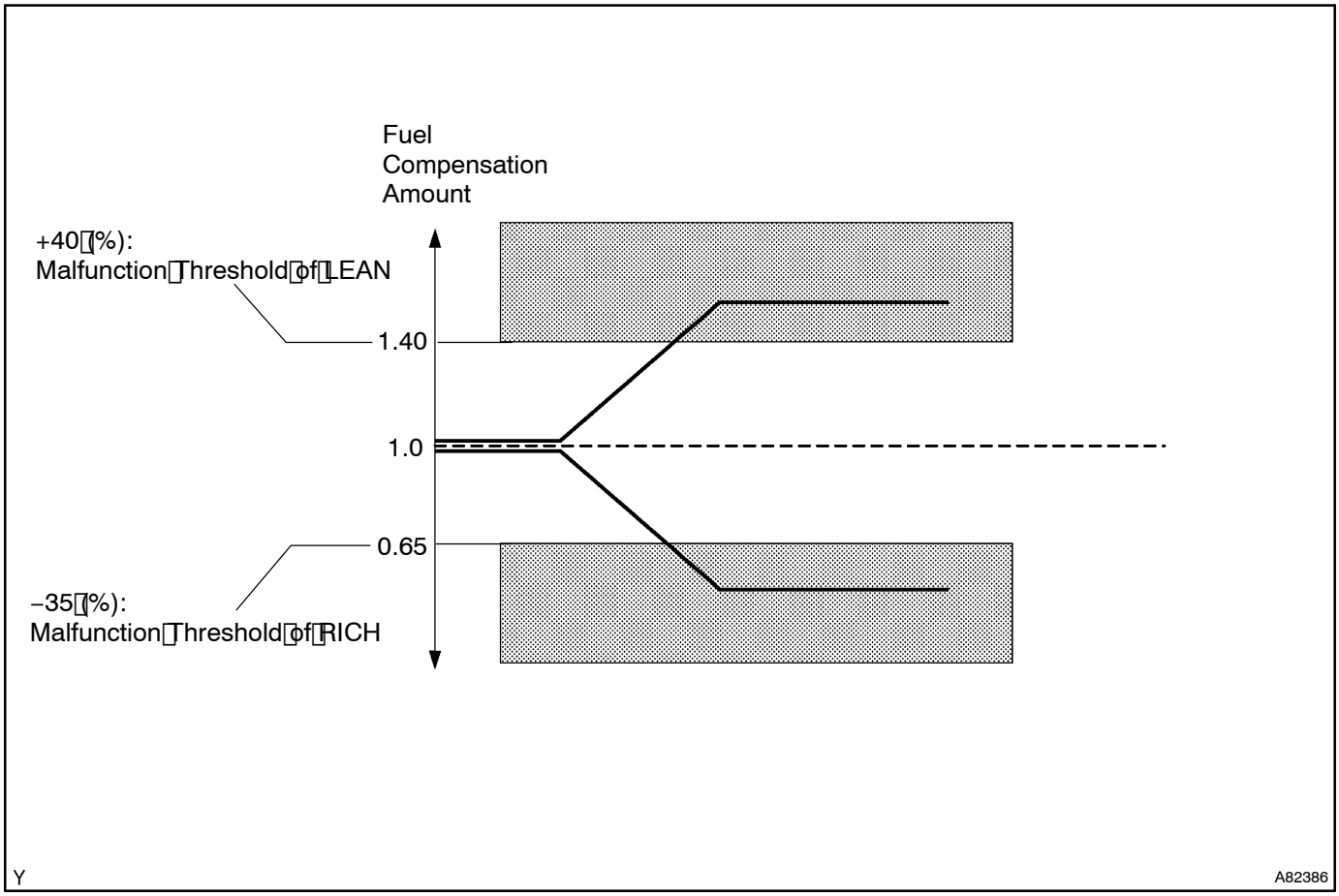
If both the short–term fuel trim and the long–term fuel trim are LEAN or RICH beyond a certain value, it is detected as a malfunction, the MIL is illuminated and a DTC is set.

DTC No.	DTC Detection Condition	Trouble Area
P0171 P0174	When air–fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on LEAN side (2 trip detection logic)	• Air induction system • Injector blockage • Mass Air Flow (MAF) Meter • Engine Coolant Temperature (ECT) sensor • Fuel pressure • Gas leakage in exhaust system • HO2S (bank 1 sensor 1) • HO2S heater (bank 1 sensor 1) • EFI MAIN relay • PCV valve and hose • ECM
P0172 P0175	When air–fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on RICH side (2 trip detection logic)	• Injector leak or blockage • MAF meter • ECT sensor • Ignition system • Fuel pressure • Gas leakage in exhaust system • HO2S (bank 2 sensor 1) • HO2S heater (bank 2 sensor 1) • EFI MAIN relay • ECM

HINT:

- When DTC P0171 or P0174 is recorded, the actual air–fuel ratio is on the LEAN side. When DTC P0172 or P0175 is recorded, 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 or P0174 may be recorded. The MIL then turns on.
- If the total of the short–term fuel trim value and long–term fuel trim value is within the malfunction threshold (ECT is more than 75°C (167°F)), the system is functioning normally.

MONITOR DESCRIPTION



Under closed–loop fuel control, fuel injection amounts that deviate from the ECM's estimated fuel amount will cause a change in the long–term fuel trim compensation value. This long–term fuel trim is adjusted when there are persistent deviations in the short–term fuel trim values. And the deviation from a simulated fuel injection amount by the ECM affects the smoothed fuel trim learning value. The smoothed fuel trim learning value is the combination of smoothed short term fuel trim (fuel feedback compensation value) and smoothed long term fuel trim (learning value of the air–fuel ratio). When the smoothed fuel trim learning value exceeds the DTC threshold, the ECM interprets this as a fault in the fuel system and sets a DTC.
Example:
The smoothed fuel trim leaning value is above 40% or below –35%. The ECM interprets this as a failure in the fuel system.

WIRING DIAGRAM

Refer to DTC P0031 on page 05–54.

INSPECTION PROCEDURE

HINT:

It is possible the malfunctioning area can be found using the active test ”Control the injection volume A/F sensor” operation. The active test can determine if the HO2S or othe potential trouble areas are malfunctioning or not.

The injection volume can be switched to –12.5 % (decrease) or +25 % (increase) by the active test.

The active test procedure enables a technician to check and graph the voltage outputs of the HO2Ss.

Procedure:

(a) Connect the Intelligent Tester II to the DLC3 on the vehicle.

(b) Turn the ignition switch ON.

(c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.

(d) Enter the following menus: Active Test/ Control the injection volume A/F sensor.

(e) Perform the active test at the engine idling.

Standard:

The HO2S reacts in accordance with increase and decrease of injection volume +25 % → Rich output: more than 0.55 V

–12.5 % → Lean output: Less than 0.4 V

NOTICE:

The HO2S (sensor 1) output has a few seconds of delay and the HO2S (sensor 2) output has a maximum of 20 seconds of delay.

If the vehicle is short of fuel, the air–fuel ratio becomes LEAN and the DTCs will be recorded.

Case	HO2S Voltage (Sensor 1)	HO2S Voltage (Sensor 2)	Main Suspected Trouble Area
1	Injection Volume +25 % –12.5 % HO2S Voltage 0.55 V or more Below 0.4 V **OK**	Injection Volume +25 % –12.5 % HO2S Voltage 0.5 V or more Below 0.4 V **OK**	–
2	Injection Volume +25 % –12.5 % HO2S Voltage Almost no reaction **NG**	Injection Volume +25 % –12.5 % HO2S Voltage 0.5 V or more Below 0.4 V **OK**	HO2S (sensor 1) HO2S heater (sensor 1)
3	Injection Volume +25 % –12.5 % HO2S Voltage 0.55 V or more Below 0.4 V **OK**	Injection Volume +25 % –12.5 % HO2S Voltage Almost no reaction **NG**	HO2S (sensor 2) HO2S heater (sensor 2)
4	Injection Volume +25 % –12.5 % HO2S Voltage Almost no reaction **NG**	Injection Volume +25 % –12.5 % HO2S Voltage Almost no reaction **NG**	Injector Fuel Pressure Exhaust Gas Leak etc. (Air–Fuel ratio is extremely Lean or Rich)

HINT:
Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.
A high HO2S sensor 1 voltage (0.55 V or more) indicates Rich air fuel ratio.
A low HO2S sensor 1 voltage (0.4 V or less) indicates Lean air fuel ratio.

1	CHECK OTHER DTC OUTPUT

Display (DTC output)	Proceed to
P0171, P0172, P0174 or P0175	A
P0171, P0172, P0174 or P0175 and other DTCs	B

B → GO TO RELEVANT DTC CHART (See page 05–36)

A

2	CHECK CONNECTION OF PCV HOSE

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

NG → REPAIR OR REPLACE PCV HOSE

OK

3	CHECK AIR INDUCTION SYSTEM (See page 13–3)

Check the air induction system for vacuum leaks.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

4	PERFORM ACTIVE TEST

Perform the Active test ”Control the injection volume A/F sensor” with Intelligent Tester II and check the HO2S status.

Standard:

The HO2S reacts in accordance with increase and decrease of injection +25 % volume → Rich output: More than 0.55 V

–12.5 % → Lean output: Less than 0.4 V

Related DTCs	HO2S Status				A/F Condition and HO2S Condition	Misfire	Main Suspected Trouble Area	Go to Step
	B1S1	B1S2	B2S1	B2S2				
N/A	L/R	L/R	L/R	L/R	Normal	None	None	N/A
P0171 P0174	L	L	L	L	Actual A/F is Lean at all cylinders	May Occur	PCV hose Air induction system Fuel pressure, MAF or ECT	5
P0172 P0175	R	R	R	R	Actual A/F is Rich at all cylinders	None	Fuel pressure, MAF or ECT	
P0171	L	L	L/R	L/R	Actual A/F is Lean at bank 1	May Occur	Spark plug, ignition system, Injector or exhaust gas leak	8
P0174	L/R	L/R	L	L	Actual A/F is Lean at bank 2			
P0172	R	R	L/R	L/R	Actual A/F is Rich at bank 1	None	Spark plug, ignition system or Injector	10
P0175	L/R	L/R	R	R	Actual A/F is Rich at bank 2			
P0171	L	R	L/R	L/R	HO2S (bank 1 sensor 1) malfunction	None	HO2S (bank 1 sensor 1)	11
P0174	L/R	L/R	L	R	HO2S (bank 2 sensor 1) malfunction	None	HO2S (bank 2 sensor 1)	
P0172	R	L	L/R	L/R	HO2S (bank 1 sensor 1) malfunction	None	HO2S (bank 1 sensor 1)	
P0175	L/R	L/R	R	L	HO2S (bank 2 sensor 1) malfunction	None	HO2S (bank 2 sensor 1)	

L: During the Active Test, the HO2S voltage almost always indicates 0.4 V or less (LEAN).

R: During the Active Test, the HO2S voltage almost always indicates 0.5 V or more (RICH).

5	READ VALUE OF HANDE HELD TESTER (COOLANT TEMP)

(a) Connect the Intelligent Tester II to the DLC3.
(b) Enter the following menus: Enter/ Diagnosis/ OBD·MOBD/ Power train/ Engine and ECT/ Data List/ All Data/ Coolant Temp.
(c) Measure the Coolant Temp when the engine is cold and warmed up.
Standard:
ECT when the engine is cold: same as ambient temperature.
ECT when the engine is warming–up: 75 to 95°C (167 to 203°F)

NG → **REPLACE ECT SENSOR**

OK

6	READ VALUE OF INTELLIGENT TESTER II (MAF)

(a) Enter the following menus: Enter/ Diagnosis/ OBD·MOBD/ Power train/ Engine and ECT/ Data List/ All Data/ MAF.
(b) Allow the engine to idle until the ECT reaches 75°C (167°F).
(c) Measure the MAF at idle rpm and 3,000 rpm.
Standard:
MAF at idle rpm: 3 to 6 g/s (shift position: N and A/C: OFF)
MAF at 3,000 rpm: 11 to 23 g/s (shift position: N and A/C: OFF)

NG → **REPLACE MAF METER**

OK

7	CHECK FUEL PRESSURE (See page 11–9)

NG → **REPAIR OR REPLACE FUEL SYSTEM**

OK

8	CHECK FOR EXHAUST GAS LEAKAGE

NG → **REPAIR OR REPLACE EXHAUST SYSTEM (See page 15–1)**

OK

9	CHECK FOR SPARK AND IGNITION (See page 18–4)

HINT:
If the spark plugs or ignition system malfunction, engine misfires may occur. The misfire counter can be read with the Intelligent Tester II. Enter the following menus: Enter/ Diagnosis/ OBD·MOBD/ Power train/ Engine and ECT/ Data List/ All Data/ Cylinder #1 (to #8) Misfire Rate.

NG → **REPAIR OR REPLACE IGNITION SYSTEM**

OK

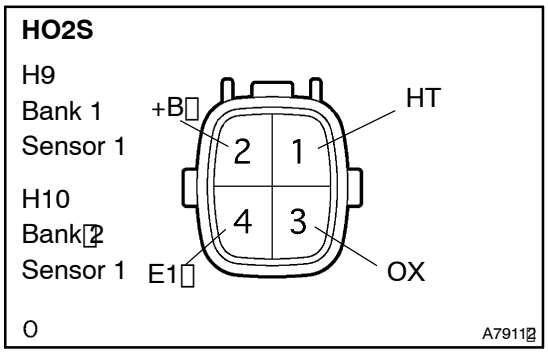
10	INSPECT FUEL INJECTOR ASSY (See page 11–9)

HINT:
If the injectors malfunction, engine misfire may occur. The misfire counter can be read with the Intelligent Tester II. Enter the following menus: Enter/ Diagnosis/ OBD·MOBD/ Power train/ Engine and ECT/ Data List/ All Data/ Cylinder #1 (to #8) Misfire Rate.

NG → **REPLACE FUEL INJECTOR ASSY (See page 11–15)**

OK

11	INSPECT HEATED OXYGEN SENSOR (SENSOR 1)



(a) Disconnect the H9 or H10 HO2S connector.
(b) Measure the resistance between the terminals of the HO2S.

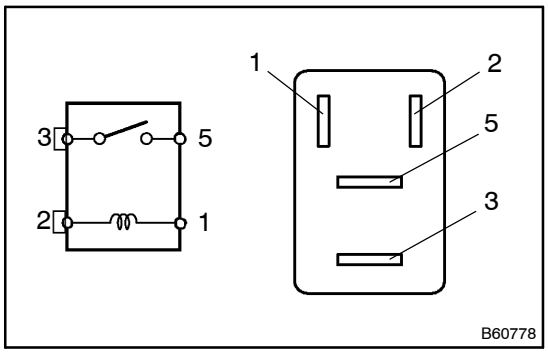
Standard:

Tester Connection	Specified Condition
H9–1 (HT) – H9–2 (+B)	5 to 10 Ω at 20°C (68°F)
H9–1 (HT) – H9–4 (E1)	10 kΩ or higher
H10–1 (HT) – H10–2 (+B)	5 to 10 Ω at 20°C (68°F)
H10–1 (HT) – H10–4 (E1)	10 kΩ or higher

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

12	INSPECT EFI MAIN RELAY



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

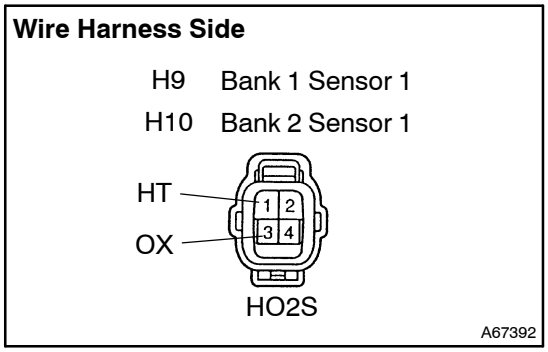
Standard:

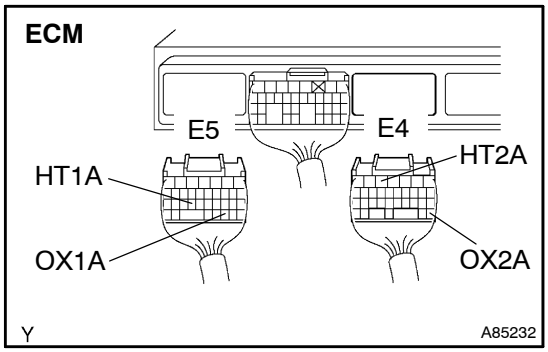
Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (apply battery voltage to terminals 1 and 2)

NG → **REPLACE EFI MAIN RELAY**

OK

13 CHECK WIRE HARNESS (FRONT HO2S – ECM)





(a) Disconnect the H9 and H10 HO2S connector.
(b) Disconnect the E4 and E5 ECM connectors.
(c) Measure the resistance between the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
H9–1 (HT) – E6–24 (HT1A)	Below 1 Ω
H9–3 (OX) – E6–30 (OX1A)	Below 1 Ω
H10–1 (HT) – E5–5 (HT2A)	Below 1 Ω
H10–3 (OX) – E5–28 (OX2A)	Below 1 Ω
H9–1 (HT) or E6–24 (HT1A) – Body ground	10 kΩ or higher
H9–3 (OX) or E6–30 (OX1A) – Body ground	10 kΩ or higher
H10–1 (HT) or E5–5 (HT2A) – Body ground	10 kΩ or higher
H10–3 (OX) or E5–28 (OX2A) – Body ground	10 kΩ or higher

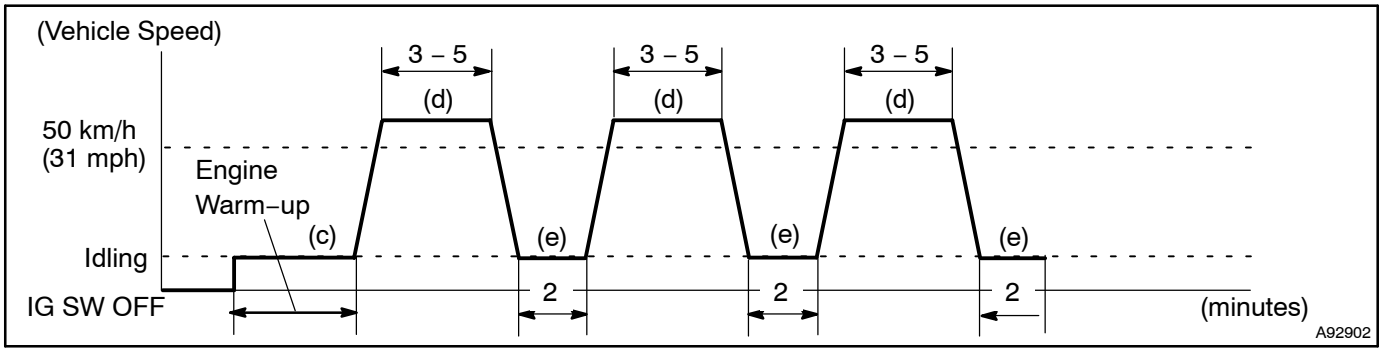
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

14 REPLACE HEATED OXYGEN SENSOR

NEXT

15	PERFORM CONFIRMATION DRIVING PATTERN



(a) Connect the Intelligent Tester II to the DLC3.
(b) Switch from normal mode to check mode.
(c) Warm up the engine until the Engine Coolant Temperature (ECT) reaches to 75°C (167°F).
(d) Drive the vehicle at 31 mph (50 km/h) or more for 3 to 5 minutes.
(e) Allow the engine to idle for 2 minutes.
(f) Perform procedure (d) and (e) at least 3 times.
(g) Confirm that no DTC occurs.

NEXT

END