

DTC	P0171	System Too Lean (Bank 1)
DTC	P0172	System Too Rich (Bank 1)
DTC	P0174	System Too Lean (Bank 2)
DTC	P0175	System Too Rich (Bank 2)

DESCRIPTION

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

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 (A/F) 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.

DTC No.	DTC Detection Condition	Trouble Area
P0171 P0174	With warm engine and stable air-fuel ratio feedback, fuel trim considerably in error to lean side (2 trip detection logic)	<ul style="list-style-type: none"> • Air induction system • Injector blockage • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor • Fuel pressure • Gas leakage from exhaust system • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater (sensor 1) • Integration relay • A/F sensor heater and integration relay circuits • PCV valve and hose • PCV hose connections • ECM
P0172 P0175	With warm engine and stable air-fuel ratio feedback, fuel trim considerably in error to rich side (2 trip detection logic)	<ul style="list-style-type: none"> • Injector leakage or blockage • MAF meter • ECT sensor • Ignition system • Fuel pressure • Gas leakage from exhaust system • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater (sensor 1) • Integration relay • A/F sensor heater and integration relay circuits • ECM

HINT:

- When DTC P0171 or P0174 is set, the actual air-fuel ratio is on the lean side. When DTC P0172 or P0175 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 or P0174 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.

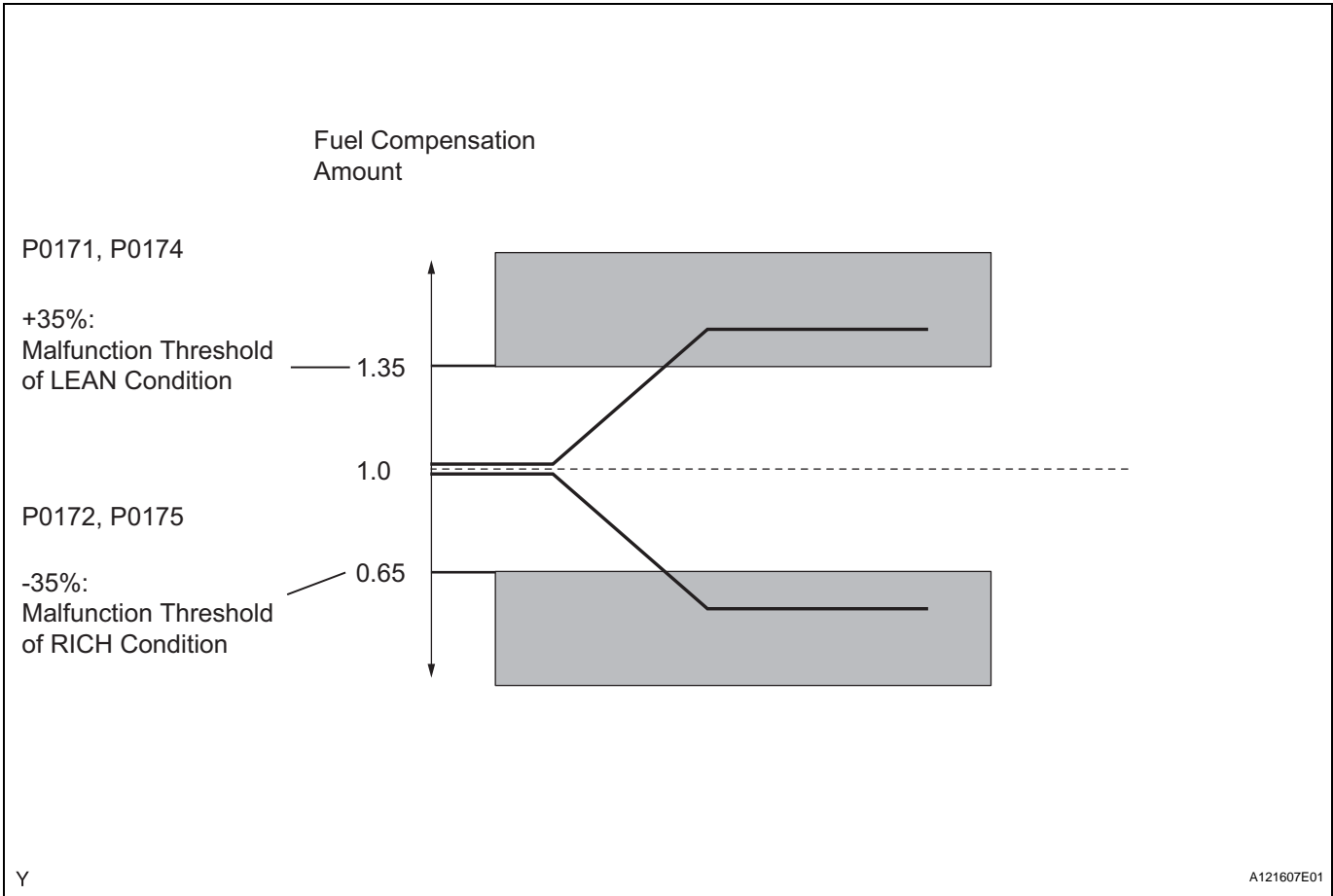
MONITOR DESCRIPTION

Under closed-loop fuel control, fuel injection volumes that deviate from those estimated by the ECM cause 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 values. Deviations from the ECM's estimated fuel injection volumes also affect 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 the malfunction threshold, the ECM interprets this as a fault in the fuel system and sets a DTC.

Example:

The average fuel trim learning value is +35% or more or -35% or less, the ECM interprets this as a fuel system malfunction.

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MONITOR STRATEGY

Related DTCs	P0171: Fuel trim lean (bank 1) P0172: Fuel trim rich (bank 1) P0174: Fuel trim lean (bank 2) P0175: Fuel trim rich (bank 2)
Required Sensors/Components (Main)	Fuel system
Required Sensors/Components (Related)	A/F 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

Monitor runs whenever following DTCs not present	P0010, P0020 (VVT OCV) P0011 (VVT System 1 - Advance) P0012 (VVT System 1 - Retard) P0021 (VVT System 2 - Advance) P0022 (VVT System 2 - Retard) P0031, P0032, P0051, P0052 (A/F sensor heater - Sensor 1) P0100 - P0103 (MAF meter) P0115 - P0118 (ECT sensor) P0120 - P0223, P2135 (TP sensor) P0125 (Insufficient ECT for Closed Loop) P0335 (CKP sensor) P0340 (CMP sensor) P0351 - P0354 (Igniter) P0500 (VSS)
Fuel system status	Closed loop
Battery voltage	11 V or more
Either of following conditions 1 or 2 set	-
1. Engine RPM	Below 1,100 rpm
2. Intake air amount per revolution	0.22 g/rev or more
Catalyst monitor	Not executed

TYPICAL MALFUNCTION THRESHOLDS

Purge-cut	Executing
Either of following conditions 1 or 2 met	-
1. Average of short-term fuel trim and long-term fuel trim	35% or more (varies with ECT)
2. Average of short-term fuel trim and long-term fuel trim	-35% or less (varies with ECT)

WIRING DIAGRAM

Refer to DTC P2195 (see page [ES-339](#)).

INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the intelligent tester. Freeze frame data records 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 for conditions that would cause the engine to run rich.
- A high A/F sensor voltage could be caused by a lean air-fuel mixture. Check for conditions that would cause the engine to run lean.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0171, P0172, P0174 OR P0175)
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- Connect the intelligent tester to the DLC3.
- Turn the ignition switch ON and turn the tester ON.
- Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
- Read DTCs.

Result

Display (DTC Output)	Proceed to
P0171, P0172, P0174 or P0175	A

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

HINT:

If any DTCs other than P0171, P0172, P0174 or P0175 are output, troubleshoot those DTCs first.

B **GO TO DTC CHART**

A

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

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- (a) Connect the intelligent tester to the DLC3.
- (b) Start the engine and turn the tester ON.
- (c) Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
- (d) On the tester, select the following menu items:
DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
- (e) Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
- (f) Monitor the output voltages of A/F and HO2 sensors (AFS B1S1 and O2S B1S2 or AFS B2S1 and O2S B2S2) displayed on the tester.

Result:

The A/F sensor reacts in accordance with increases and decreases in the fuel injection volume:

+25% = Rich output:









Less than 3.0 V



-12.5% = Lean output:

More than 3.35 V

NOTICE:

The A/F sensor has an output delay of a few seconds and the HO2 sensor has a maximum output delay of approximately 20 seconds.

Case	A/F Sensor (Sensor 1) Output Voltage		HO2 Sensor (Sensor 2) Output Voltage		Main Suspected Trouble Area
1	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		-
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage More than 0.5 V Less than 0.4 V		
2	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		<ul style="list-style-type: none"> • A/F sensor • A/F sensor heater • A/F sensor circuit
	Output Voltage Almost no reaction		Output Voltage More than 0.5 V Less than 0.4 V		

Case	A/F Sensor (Sensor 1) Output Voltage		HO2 Sensor (Sensor 2) Output Voltage		Main Suspected Trouble Area
3	Injection volume +25% -12.5%		Injection Volume +25% -12.5%		Extremely rich or lean actual air-fuel ratio <ul style="list-style-type: none"> • Injector leakage or blockage • Gas leakage from exhaust system • Fuel pressure • MAF meter • ECT sensor • Air induction system • PCV hose connections
	Output Voltage Almost no reaction	————— NG	Output Voltage Almost no reaction	————— NG	

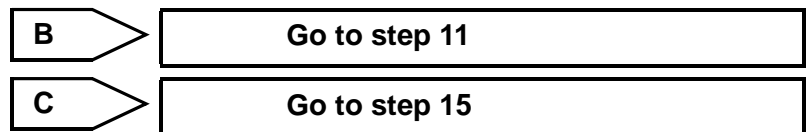
Following the A/F CONTROL procedure enables technicians to check and graph the voltage outputs of both the A/F and HO2 sensors.

To display the graph, select the following menu items on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL / USER DATA / AFS B1S1 and O2S B1S2 or AFS B2S1 and O2S B2S2; then press the YES button and then the ENTER button followed by the F4 button.

ES

Result

Result	Proceed to
Case 1	C
Case 2	B
Case 3	A



3 READ VALUE USING INTELLIGENT TESTER (MAF)

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the ignition switch ON and turn the tester ON.
- (c) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / MAF and COOLANT TEMP.
- (d) Allow the engine to idle until the COOLANT TEMP reaches 75°C (167°F) or more.
- (e) Read the MAF with the engine in an idling condition and at an engine speed of 2,500 rpm.

Standard:

MAF while engine idling: Between 1 g/sec. and 3 g/sec. (shift position: N; A/C: OFF).

MAF at engine speed of 2,500 rpm: Between 2 g/sec. and 6 g/sec. (shift position: N; A/C: OFF).



4 READ VALUE USING INTELLIGENT TESTER (COOLANT TEMP)

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the ignition switch ON and turn the tester ON.
- (c) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / COOLANT TEMP.
- (d) Read the COOLANT TEMP twice, when the engine is both cold and warmed up.

Standard:

With cold engine: Same as ambient air temperature.

With warm engine: Between 75°C and 100°C (167°F and 212°F).

NG

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK

5 CHECK PCV HOSE CONNECTIONS

- (a) Check for PCV hose connections.

OK:

PCV hose is connected correctly and is not damaged.

NG

REPAIR OR REPLACE PCV HOSE

OK

6 CHECK AIR INDUCTION SYSTEM

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

OK:

No leakage from air induction system.

NG

REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7 CHECK FOR SPARKS AND IGNITION (See page ES-204)

NG

REPAIR OR REPLACE IGNITION SYSTEM

OK

8 CHECK FOR EXHAUST GAS LEAK

- (a) Check for exhaust gas leakage.

OK:
No gas leakage.

NG

REPAIR OR REPLACE EXHAUST SYSTEM

OK

9 CHECK FUEL PRESSURE

(a) Check the fuel pressure (see page [FU-6](#)).

Standard pressure:

304 to 343 kPa (3.1 to 3.5 kgf/cm², 44.1 to 49.7 psi)

NG

REPAIR OR REPLACE FUEL SYSTEM

OK

10 INSPECT FUEL INJECTOR (INJECTION AND VOLUME)

(a) Check the injection volume (see page [FU-11](#)).

Standard injection volume:

45 to 58 cm³ (2.9 to 3.5 cu. in.) per 15 seconds

NG

REPLACE FUEL INJECTOR

OK

11 INSPECT AIR-FUEL RATIO SENSOR (HEATER RESISTANCE) (See page [ES-110](#))

NG

REPLACE AIR-FUEL RATIO SENSOR

OK

12 INSPECT INTEGRATION RELAY (A/F RELAY) (See page [ES-111](#))

NG

REPLACE INTEGRATION RELAY

OK

13 CHECK WIRE HARNESS (A/F SENSOR - ECM) (See page [ES-354](#))

NG

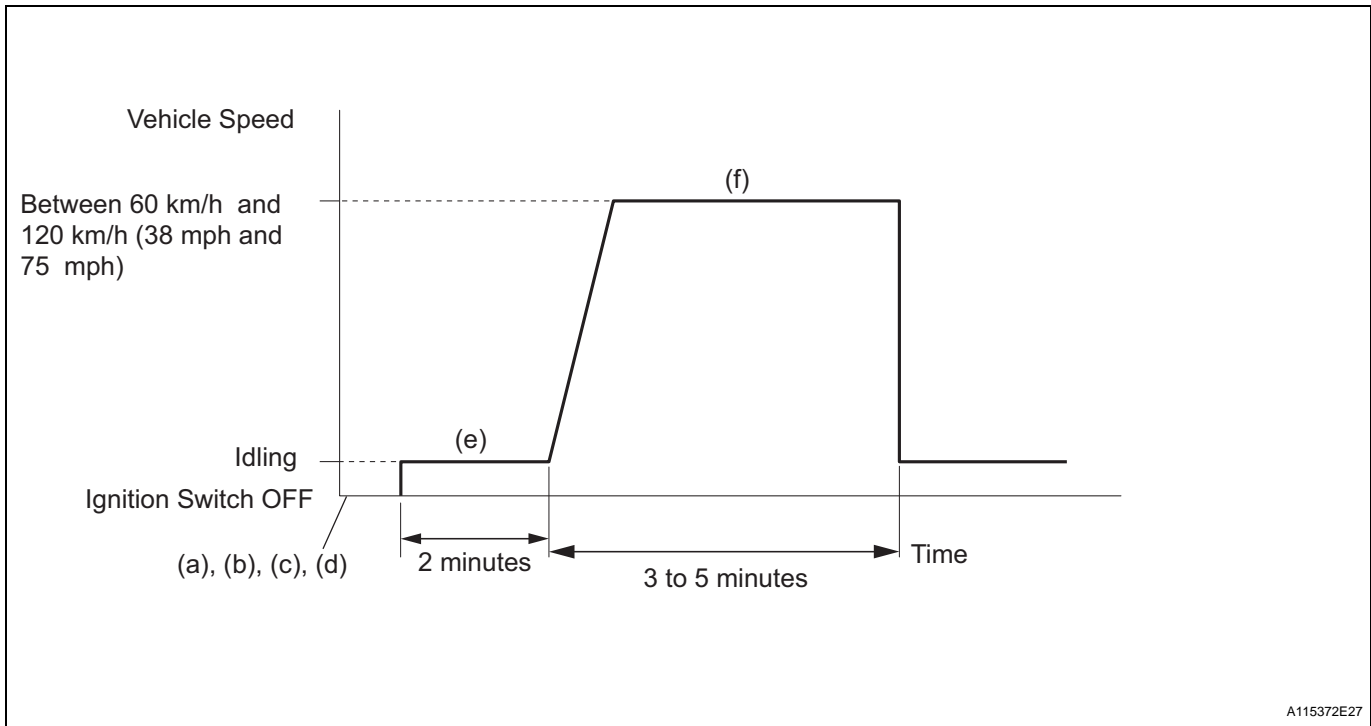
REPAIR OR REPLACE HARNESS AND
CONNECTOR

OK

14 REPLACE AIR-FUEL RATIO SENSOR

NEXT

15 PERFORM CONFIRMATION DRIVING PATTERN



- (a) Connect the intelligent tester to the DLC3.
 (b) Turn the ignition switch ON and turn the tester ON.
 (c) Clear DTCs (see page [ES-39](#)).
 (d) Switch the ECM from normal mode to check mode using the tester (see page [ES-42](#)).
 (e) Start the engine and warm it up with all the accessories switched OFF.
 (f) Drive the vehicle at between 60 km/h and 120 km/h (38 mph and 75 mph) and at an engine speed of between 1,400 rpm and 3,200 rpm for 3 to 5 minutes.

HINT:

If the system is still malfunctioning, the MIL will be illuminated during step (f).

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, P0172, P0174 OR P0175)

- (a) On the intelligent tester, select the following menu items:
DIAGNOSIS / ENHANCED OBD II / DTC INFO /
CURRENT CODES.
- (b) Read DTCs.

Result

Display (DTC Output)	Proceed to
No output	A
P0171, P0172, P0174 or P0175	B



END