

DTC	P0171	System too Lean (Fuel Trim)
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DTC	P0172	System too Rich (Fuel Trim)
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CIRCUIT DESCRIPTION

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

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 A/F sensor is approximately proportional to the existing air-fuel ratio, and ECM compares it with the ideal theoretical value, the ECM reduces fuel volume immediately if the air-fuel ratio is RICH and increases fuel volume if it is LEAN.

Long-term fuel trim compensates for the deviation from the central value of the short-term fuel trim stored by each engine tolerance, and the deviation from the central value due to the passage of time and changes of environment.

If both the short-term fuel trim and long-term fuel trim exceed a certain value, it is detected as a malfunction and the MIL lights up.

DTC No.	DTC Detection Condition	Trouble Area
P0171	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"> • Air induction system • PCV hose connection • PCV hose • Injector blockage • Mass air flow meter • Engine coolant temp. sensor • Fuel pressure • Gas leak on exhaust system • Open or short in A/F sensor (bank 1 sensor 1) circuit • A/F sensor (bank 1 sensor 1) • ECM
P0172	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"> • Injector leak blockage • Mass air flow meter • Engine coolant temp. sensor • Ignition system • Fuel pressure • Gas leak on exhaust system • Open or short in A/F sensor (bank 1 sensor 1) circuit • A/F sensor (bank 1 sensor 1) • ECM

HINT:

- When the DTC P0171 is recorded, the actual air-fuel ratio is on the lean side. When DTC P0172 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 is recorded. The MIL then comes on.
- If the total of the short-term fuel trim value and long-term fuel trim value is within $\pm 35\%$ (80°C (176°F) or more), the system is functioning normally.
- The A/F sensor (bank 1 sensor 1) output voltage and the short-term fuel trim value can be read using the hand-held tester or OBD II scan tool.

- The ECM controls the voltage of the terminals AF1+ and AF1– of the ECM to the fixed voltage. Therefore it is impossible to confirm the A/F sensor output voltage without hand-held tester or OBD II scan tool.
- OBD II scan tool (excluding hand-held tester) displays the one fifth of the A/F sensor (bank 1 sensor 1) output voltage which is displayed on the hand-held tester.

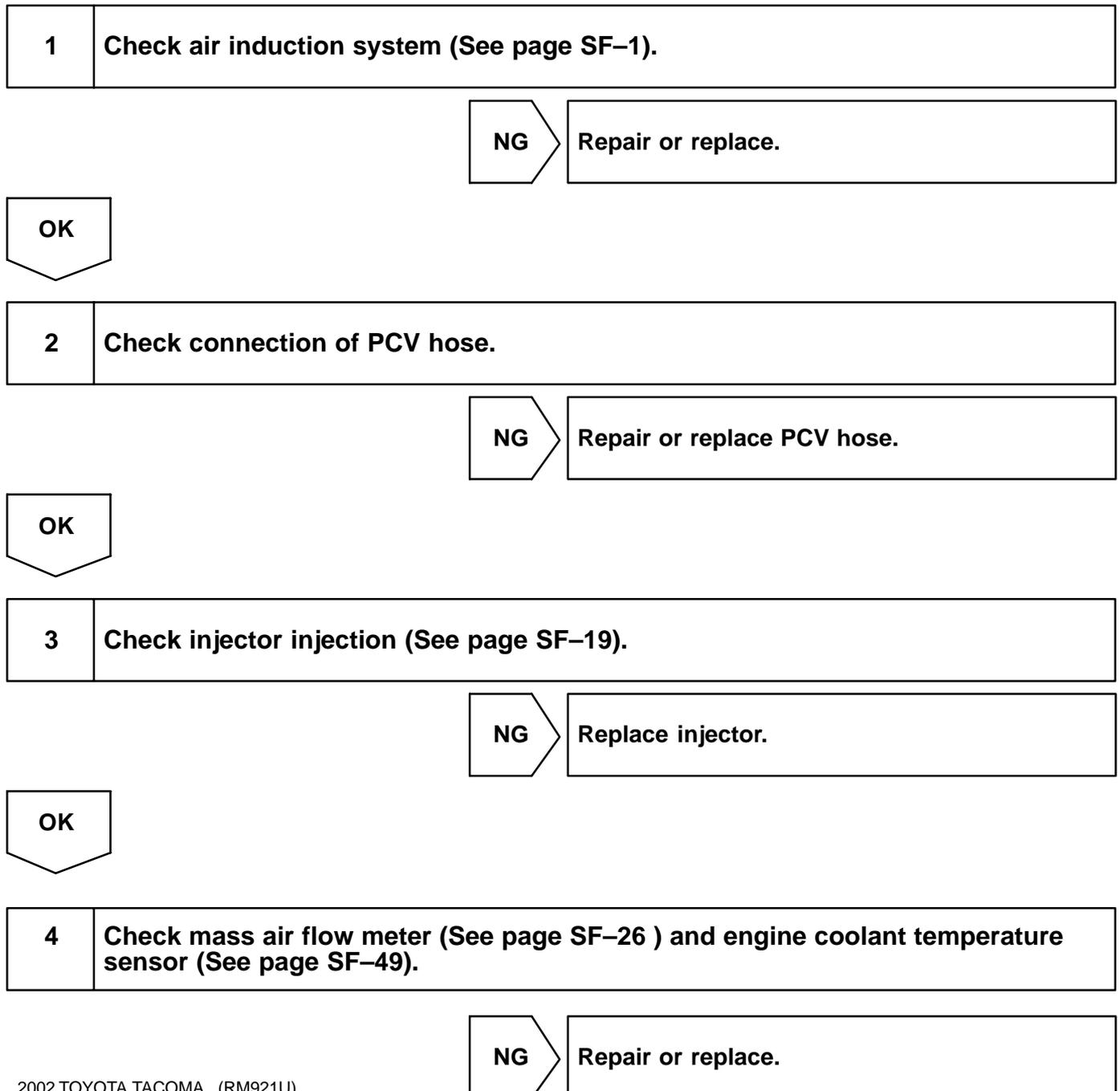
WIRING DIAGRAM

Refer to DTC P0125 on page [DI-195](#).

INSPECTION PROCEDURE

HINT:

Read freeze frame data using hand-held tester or OBD II scan tool, as freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air-fuel ratio was lean or rich, etc. at the time of the malfunction.



OK

5	Check for spark and ignition (See page IG-1).
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NG

Repair or replace.

OK

6	Check fuel pressure (See page SF-5).
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NG

Check and repair fuel pump, pressure regulator, fuel pipe line and filter.

OK

7	Check gas leak on exhaust system.
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NG

Repair or replace.

OK

8	Check output voltage A/F sensor (bank 1 sensor 1).
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PREPARATION:

- (a) Connect the hand-held tester or OBD II scan tool to the DLC3.
- (b) Warm up the A/F sensor with the engine speed of 2,500 rpm for approximately 90 seconds.

CHECK:

Read the voltage value of the A/F sensor on the screen of the hand-held tester or OBD II scan tool, when performing all the following conditions.

HINT:

The voltage of the AF1+ terminal of the ECM is fixed at 3.3 V and the AF- terminal is fixed at 3.0 V. Therefore it is impossible to check the A/F sensor output voltage at the terminals (AF1+/AF1-) of the ECM.

OK:

Condition	A/F Sensor Voltage value
Engine idling	<ul style="list-style-type: none"> • Not remains at 3.30 V (0.660 V*) • Not remains at 3.8 V (0.76 V*) or more • Not remains at 2.8 V (0.56 V*) or less *: When using the OBD II scan tool (excluding hand-held tester)
Engine racing	
Driving at engine speed 1,500 rpm or more and vehicle speed 40 km/h (25 mph) or more, and operating throttle valve open and close	

HINT:

- Although there is a case that the output voltage of the A/F sensor is below 2.8 V (0.56 V*) during fuel enrichment, it is normal.
- Although there is case that the output voltage of the A/F sensor is above 3.8 V (0.76 V*) during fuel cut, it is normal.
- If the output voltage of the A/F sensor remains at 3.30 V (0.660 V*) even after performing all the above conditions, the A/F sensor circuit may be open.
- If the output voltage of the A/F sensor remains at 3.8 V (0.76 V*) or more, or 2.8 V (0.56 V*) or less even after performing all the above conditions, the A/F sensor circuit may be short.

*: When using the OBD II scan tool (excluding hand-held tester).

OK

Go to step 9.

NG

9 Check for open and short in harness and connector between ECM and A/F sensor (bank 1 sensor 1) (See page [IN-28](#)).

NG

Repair or replace harness or connector.

OK

Replace A/F sensor.

10 Perform confirmation driving pattern (See page [DI-260](#)).

Go

11 Is there DTC P0171 or P0172 being output again?

YES

Check and replace ECM (See page [IN-28](#)).

NO

12 Did vehicle run out of fuel in past?

NO

Check for intermittent problems (See page [DI-157](#)).

YES

DTC P0171 or P0172 is caused by shortage of fuel.