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| DTC | P2238 | OXYGEN SENSOR PUMPING CURRENT CIRCUIT LOW (FOR A/F SENSOR)(BANK 1 SENSOR 1) |
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|------------|--------------|---|
| DTC | P2239 | OXYGEN SENSOR PUMPING CURRENT CIRCUIT HIGH (FOR A/F SENSOR)(BANK 1 SENSOR 1) |
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| DTC | P2252 | OXYGEN SENSOR REFERENCE GROUND CIRCUIT LOW (FOR A/F SENSOR)(BANK 1 SENSOR 1) |
|------------|--------------|---|

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|------------|--------------|--|
| DTC | P2253 | OXYGEN SENSOR REFERENCE GROUND CIRCUIT HIGH (FOR A/F SENSOR)(BANK 1 SENSOR 1) |
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HINT:

Although the each DTC title says "oxygen sensor", these DTCs are related to the A/F sensor.

CIRCUIT DESCRIPTION

Refer to DTC P2195 on page [05-314](#) .

| DTC No. | DTC Detection Condition | Trouble Area |
|---------|---|---|
| P2238 | <ul style="list-style-type: none"> Conditions (a) or (b) continues for 5 seconds or more : <ul style="list-style-type: none"> (a) AF+ is 0.5 V or less (b) (AF+) - (AF-) is 0.8 V or more A/F sensor admittance: Less than 0.022 1/Ω | <ul style="list-style-type: none"> Open or short in A/F sensor circuit A/F sensor A/F sensor heater EFI M relay A/F sensor heater and relay circuit ECM |
| P2239 | <ul style="list-style-type: none"> Condition (a) continues for 5.0 seconds or more : <ul style="list-style-type: none"> (a) AF+ is more than 4.5 V (b) (AF+) - (AF-) is more than 0.8 V | <ul style="list-style-type: none"> Open or short in A/F sensor circuit A/F sensor A/F sensor heater EFI M relay A/F sensor heater and relay circuit ECM |
| P2252 | AF- is 0.5 V or less for 5.0 seconds or more | <ul style="list-style-type: none"> Open or short in A/F sensor circuit A/F sensor A/F sensor heater EFI M relay A/F sensor heater and relay circuit ECM |
| P2253 | AF- is more than 4.5 V for 5.0 seconds or more | <ul style="list-style-type: none"> Open or short in A/F sensor circuit A/F sensor A/F sensor heater EFI M relay A/F sensor heater and relay circuit ECM |

MONITOR DESCRIPTION

The air fuel ratio (A/F) sensor has a characteristic that it varies its voltage output in proportion to the air-fuel ratio. If impedance (alternating current resistance) or voltage output of the sensor extraordinarily deviates from the standard range, the ECM determines to detect an open or short malfunction in the A/F sensor circuit.

MONITOR STRATEGY

| | |
|-----------------------------|--|
| Related DTCs | P2238: A/F sensor pumping current circuit low P2239: A/F sensor pumping current circuit high P2252: A/F sensor reference ground circuit low P2253: A/F sensor reference ground circuit high |
| Required sensors/components | Main: A/F sensor Related: Engine speed sensor, vehicle speed sensor, engine coolant temperature sensor |
| Frequency of operation | Continuous |
| Duration | 5 seconds |
| MIL operation | Immediately |
| Sequence of operation | None |

TYPICAL ENABLING CONDITIONS

"General precondition" is defined as follows:

| | |
|--|-------------------|
| Battery voltage | 10.5 V or more |
| Power switch | ON |
| Time after power switch from OFF to ON | 5 seconds or more |

"A/F sensor admittance precondition" is defined as follows:

| | |
|-------------------------------|----------------------|
| Engine coolant temperature | 30°C (86 °F) or more |
| Engine | Running |
| Time after first engine start | 20 seconds or more |
| Time after A/F sensor heating | 20 seconds or more |

Case 1

P2238: A/F sensor pumping current circuit low
(AF+, AF- open)

| | |
|--|--------------------------------|
| The monitor will run whenever the following DTCs are not present | See page 05-20 |
| Time while A/F sensor admittance precondition is met | 20 seconds or more |

Case 2

P2238: A/F sensor pumping current circuit low
(AF+, AF- short)

| | |
|----------------------|-----|
| General precondition | Met |
|----------------------|-----|

Case 3

P2238: A/F sensor pumping current circuit low
(AF+, GND short)

| | |
|----------------------|-----|
| General precondition | Met |
|----------------------|-----|

Case 4

P2239: A/F sensor pumping current circuit high

| | |
|----------------------|-----|
| General precondition | Met |
|----------------------|-----|

Case 5

P2252: A/F sensor reference ground circuit low

| | |
|----------------------|-----|
| General precondition | Met |
|----------------------|-----|

Case 6

P2253: A/F sensor reference ground circuit high

| | |
|----------------------|-----|
| General precondition | Met |
|----------------------|-----|

TYPICAL MALFUNCTION THRESHOLDS

Case 1

P2238: A/F sensor pumping current circuit low
(AF+, AF- open)

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|-----------------------|---------------------|
| A/F sensor admittance | Less than 0.022 1/Ω |
|-----------------------|---------------------|

Case 2

P2238: A/F sensor pumping current circuit low
(AF+, AF- short)

| | |
|----------------------|-----------------|
| AF+ terminal voltage | Less than 0.1 V |
|----------------------|-----------------|

Case 3

P2238: A/F sensor pumping current circuit low
(AF+, GND short)

| | |
|---|-----------------|
| Difference between voltage of terminals AF+ and AF- | Less than 0.5 V |
|---|-----------------|

Case 4

P2239: A/F sensor pumping current circuit high

| | |
|---|-----------------|
| AF+ terminal voltage (AF+ and +B, or AF+ and VCC short) | More than 4.5 V |
|---|-----------------|

Case 5

P2252: A/F sensor reference ground circuit low

| | |
|--|---------------|
| AF- terminal voltage (AF- and GND short) | 0.5 V or less |
|--|---------------|

Case 6

P2253: A/F sensor reference ground circuit high

| | |
|---|-----------------|
| AF- terminal voltage (AF- and +B, or AF- and VCC short) | More than 4.5 V |
|---|-----------------|

WIRING DIAGRAM

Refer to DTC P2195 on page [05-314](#) .

INSPECTION PROCEDURE

HINT:

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 area are malfunctioning or not.

(a) Perform the ACTIVE TEST A/F CONTROL operation.

HINT:

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

- (1) Connect the hand-held tester to the DLC3 on the vehicle.
- (2) Turn the power switch ON (IG).
- (3) Put the engine in inspection mode (see page [01-27](#)).
- (4) Warm up the engine by running the engine at 2,500 rpm with the accelerator pedal depressed more than 60 % for approximately 90 seconds.
- (5) Select the item: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
- (6) Perform the A/F CONTROL operation with the engine in an idle condition (press the right or left button).

Result:

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

+25 % → rich output: Less than 3.0 V

-12.5 % → lean output: More than 3.35 V

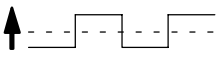


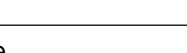
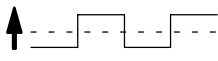

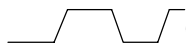
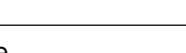
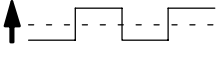

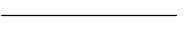
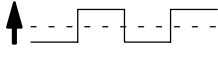


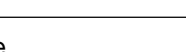
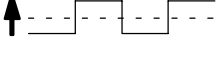


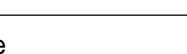
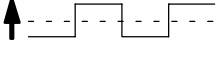


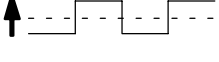


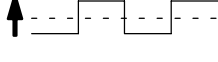


Heated oxygen sensor reacts in accordance with increase and decrease of injection volume:

+25 % → rich output: More than 0.55 V

-12.5 % → lean output: Less than 0.4 V

NOTICE:

The 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  Less than 3.0 V  OK | Injection volume +25 %  -12.5 %  Output voltage More than 0.55 V  Less than 0.4V  OK | — |
| 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  Less than 0.4V  OK | A/F sensor (A/F sensor, sensor heater, sensor circuit) |
| Case 3 | Injection volume +25 %  -12.5 %  Output voltage More than 3.35 V  Less than 3.0V  OK | 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 ac- tual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.) |

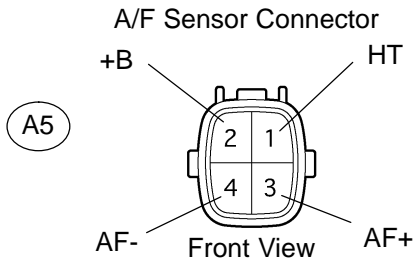
The following A/F CONTROL procedure enables the technician to check and graph the voltage output of both A/F sensor and heated oxygen sensor.

To display the graph, enter ACTIVE TEST/ A/F CONTROL/USER DATA, select "AFS B1S1 and O2S B1S2" by pressing the "YES" button followed by the "ENTER" button and then the "F4" button.

- Read freeze frame data using the hand-held tester or the OBD II scan tool. Freeze frame data records the engine condition when 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 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 low 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 INSPECT AIR FUEL RATIO SENSOR(RESISTANCE OF A/F SENSOR HEATER)

Component Side:



- (a) Disconnect the A5 A/F sensor connector.
- (b) Measure the resistance between the terminals of the A/F sensor.

Standard:

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

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

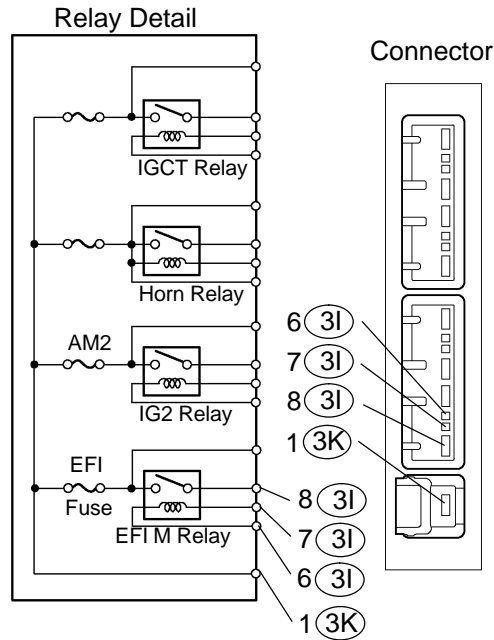
NG

REPLACE AIR FUEL RATIO SENSOR

OK

2 INSPECT INTEGRATION RELAY(EFI M RELAY)

Integration Relay:



- (a) Remove the integration relay from the engine room R/B.
- (b) Inspect the EFI M relay.

Standard:

| Tester Connection | Specified Condition |
|-------------------|--|
| (3K-1) - (3I-8) | 10 k Ω or higher |
| (3K-1) - (3I-8) | Below 1 Ω (Apply battery voltage to terminals 3I-6 and 3I-7) |

- (c) Reinstall the integration relay.

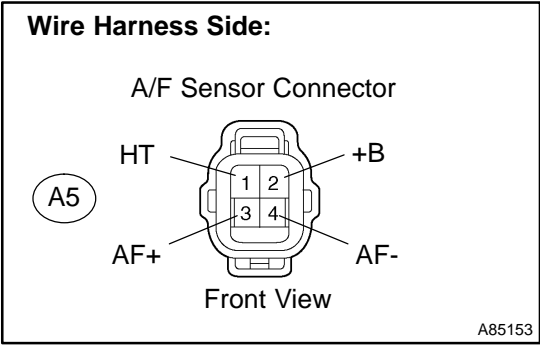
NG

REPLACE INTEGRATION RELAY

OK

3

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



- (a) Disconnect the A5 A/F sensor connector.
- (b) Disconnect the E5 ECM connector.
- (c) Check the resistance between the wire harness side connectors.

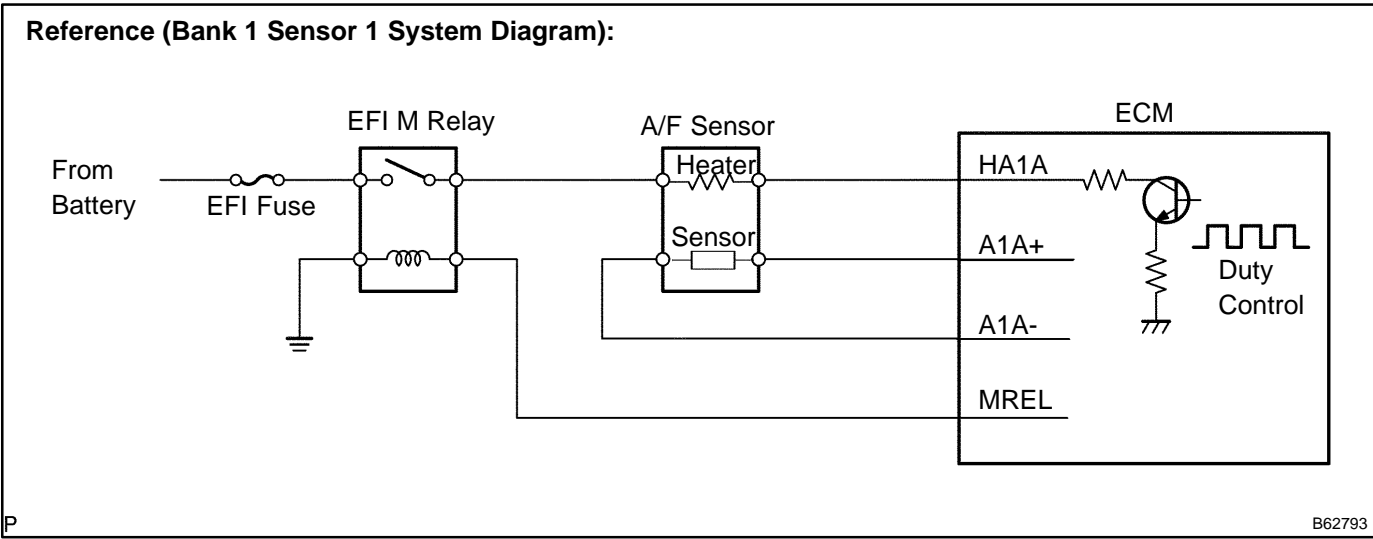
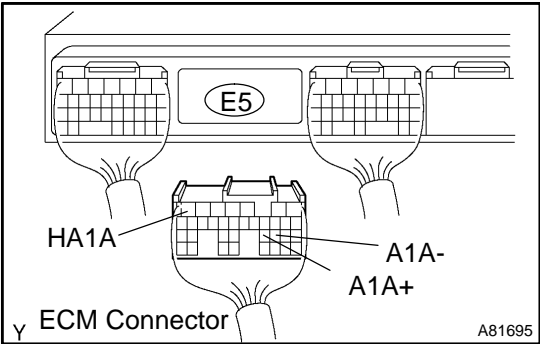
Standard (Check for open):

| Tester Connection | Specified Condition |
|---------------------------|---------------------|
| AF+ (A5-3) - A1A+ (E5-23) | Below 1 Ω |
| AF- (A5-4) - A1A- (E5-22) | Below 1 Ω |
| HT (A5-1) - HA1A (E5-7) | Below 1 Ω |

Standard (Check for short):

| Tester Connection | Specified Condition |
|--|---------------------|
| AF+ (A5-3) or A1A+ (E5-23) - Body ground | 10 kΩ or higher |
| AF- (A5-4) or A1A- (E5-22) - Body ground | 10 kΩ or higher |
| HT (A5-1) or HA1A (E5-7) - Body ground | 10 kΩ or higher |

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



NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM (See page 10-24)