DTC	P0136	OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 1 SENSOR 2)

DTC	P0137	OXYGEN SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

DTC	P0138	OXYGEN SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

DTC	P0156	OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 2 SENSOR 2)

DTC	P0157	OXYGEN SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 2)

DTC	P0158	OXYGEN SENSOR CIRCUIT HIGH BOLTAGE (BANK 2 SENSOR 2)

CIRCUIT DESCRIPTION

The heated oxygen sensor is the planar type. Compared to the conventional type, the sensor and heater portions are narrower overall. Because the heat of the heater is conducted through the alumina to zirconia (of the sensor portion) it accelerates the activation of the sensor.

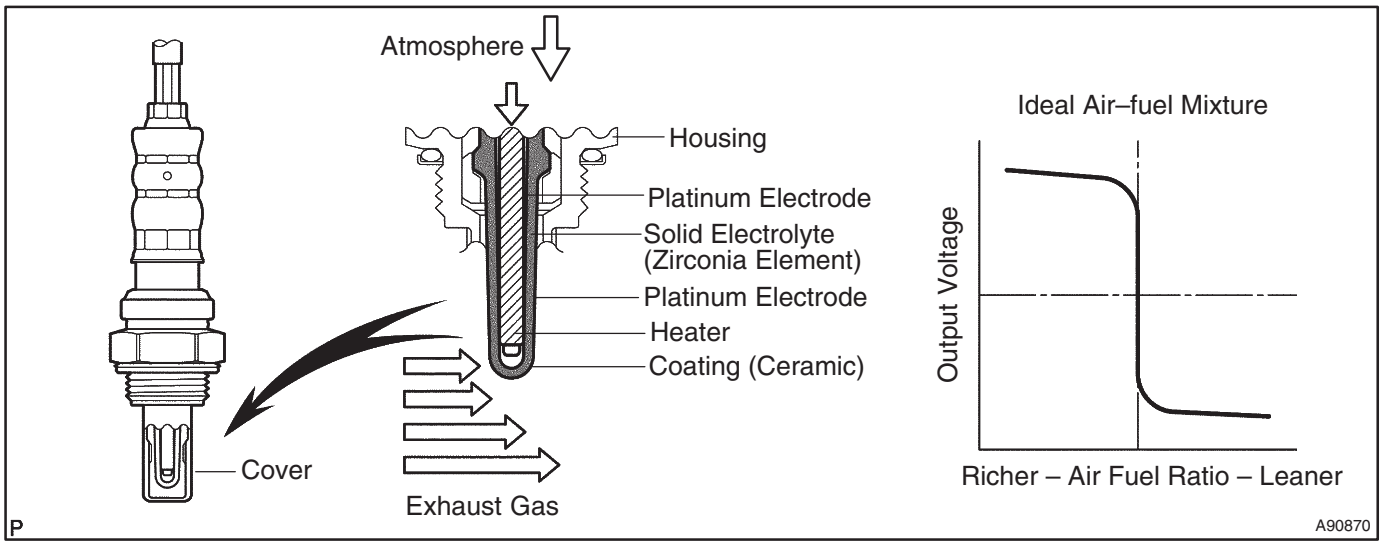
To obtain a high purification rate for the CO, HC and NOx components of the exhaust gas, a three–way catalytic converter is used. For the most efficient use of the three–way catalytic converter, the air–fuel ratio must be precisely controlled so that it is always close to the stoichiometric air–fuel ratio.

The heated oxygen sensor has the characteristic whereby its output voltage changes suddenly in the vicinity of the stoichiometric air–fuel ratio. This is used to detect the oxygen concentration in the exhaust gas and provide the ECM with feedback control the air–fuel ratio.

When the air–fuel ratio becomes LEAN, the oxygen concentration in the exhaust gas increases. And the heated oxygen sensor informs the ECM of the LEAN condition (small electromotive force: < 0.45 V).

When the air–fuel ratio is RICHER than the stoichiometric air–fuel ratio, the oxygen concentration in the exhaust gas is reduced. And the heated oxygen sensor informs the ECM of the RICH condition (large electromotive force: > 0.45 V). The ECM judges by the electromotive force from the heated oxygen sensor whether the air–fuel ratio is RICH or LEAN and controls the injection time accordingly. If the malfunction of the heated oxygen sensor causes an output of abnormal electromotive force, the ECM becomes unable to perform the accurate air–fuel ratio control.

The heated oxygen sensors include a heater which heats the zirconia element. The heater is controlled by the ECM. When the intake air volume is low (the temperature of the exhaust gas is low), current flows to the heater in order to heat the sensor for the accurate oxygen concentration detection.

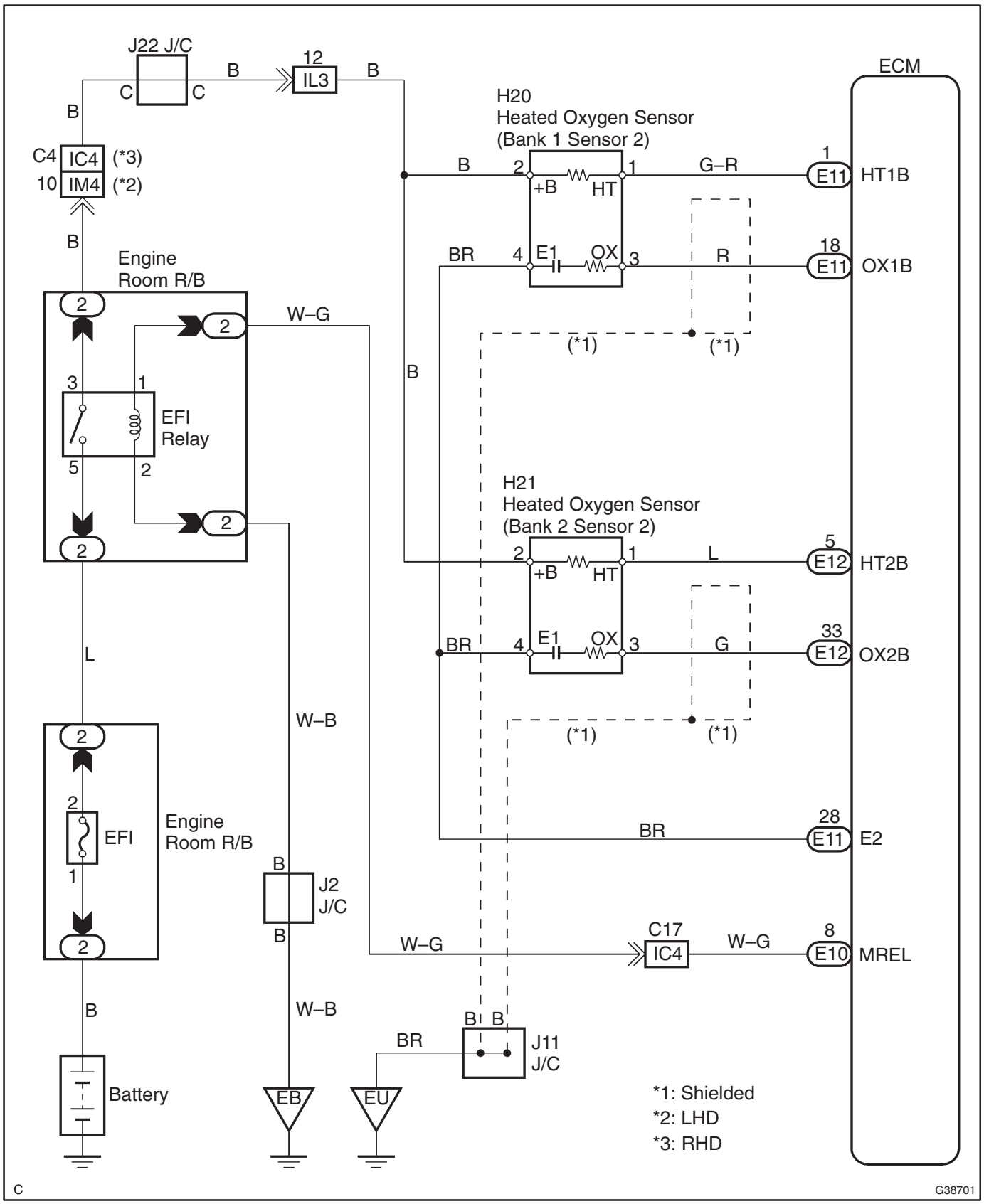


DTC No	DTC Detection Condition	Trouble Area
P0136 P0156	During active control, heated oxygen sensor output voltage 0.2 to 0.6 V.	• Open or short in heated oxygen sensor (bank 1, 2 sensor 2) circuit • Heated oxygen sensor (bank 1, 2 sensor 2) • Heated oxygen sensor heater (bank 1, 2 sensor 2) • A/F sensor (bank 2 sensor 1) • A/F sensor heater • EFI relay
P0136 P0156	(a) and (b) is met for more than 90 seconds. (c) Estimated rear oxygen sensor temperature is less than 800 °C (1472 °F). (d) Rear oxygen sensor impedance is less than 5 Ω.	
P0137 P0157	During active control, heated oxygen sensor output voltage less than 0.2 V.	
P0137 P0157	(a) and (b) is met for more than 90 seconds. (e) Estimated rear oxygen sensor temperature is less than 450 °C (842 °F). (f) Rear oxygen sensor impedance is more than 15 kΩ.	
P0138 P0158	During active control, heated oxygen sensor output voltage more than 0.6 V.	
P0138 P0158	Rear oxygen sensor output voltage is 1.2 V or higher for mor than 30 seconds.	

HINT:

- Bank 1 refers to the bank that includes cylinder No.1.
- Bank 2 refers to the bank that does not include cylinder No.1.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

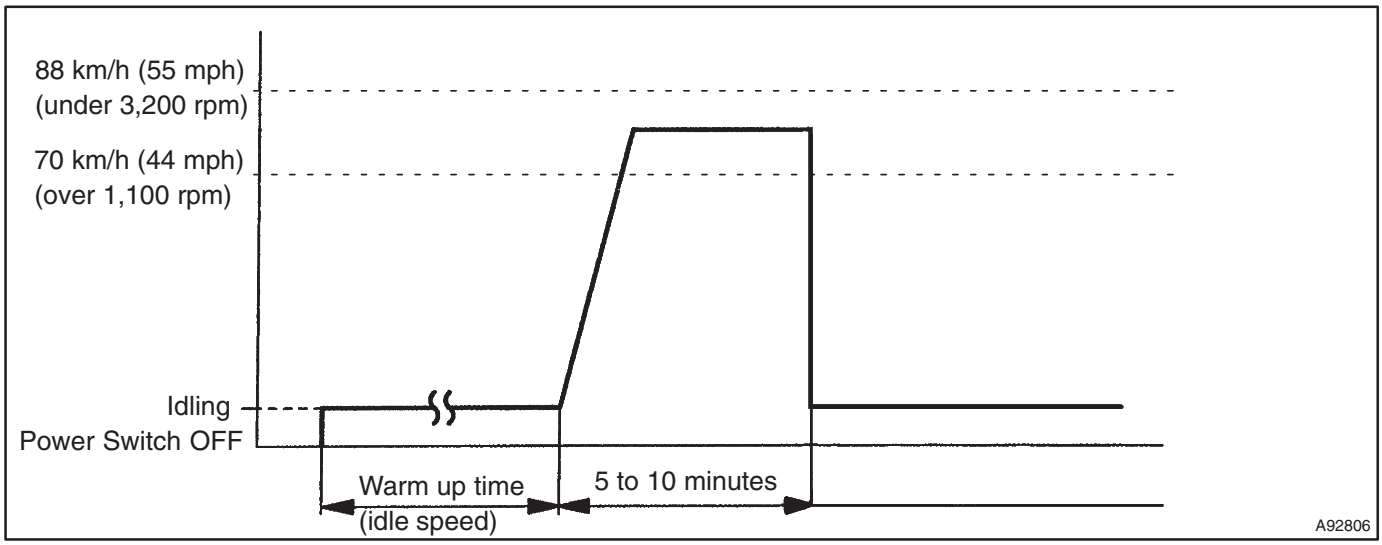
WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN

HINT:

Performing this confirmation pattern will activate the DTC detection (P0136) of the ECM. This is very useful for verifying the completion of a repair.



(a) Clear the DTC (See page 05–209).
(b) Put the check mode (see page 05–210).
(c) Start the engine and warm it up with all the accessory switches OFF.
(d) Deactivate the inspection mode and drive the vehicle at 70 to 120 km/h (44 to 70 mph) for 5 to 10 minutes.
(e) Read DTCs.

NOTICE:

- **If the conditions in this test are not strictly followed, no malfunction will be detected.**
- **Do not drive the vehicle without deactivating inspection mode. otherwise damaging the transaxle may result.**

INSPECTION PROCEDURE

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

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.

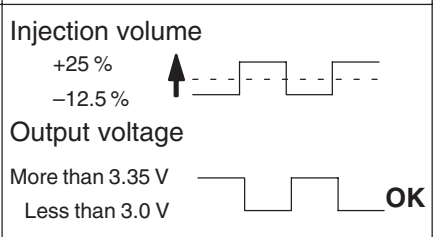
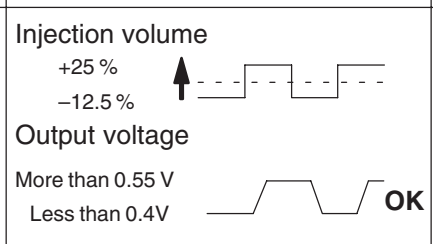
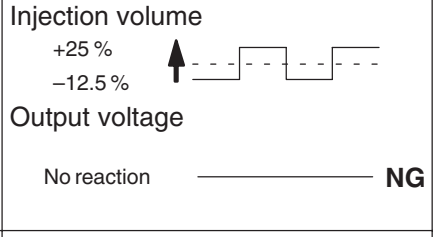
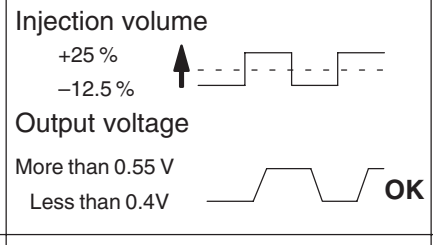
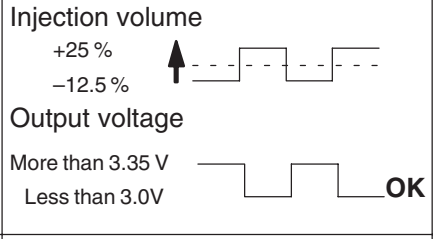
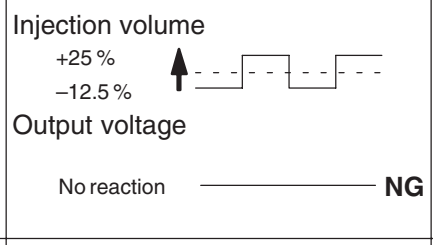
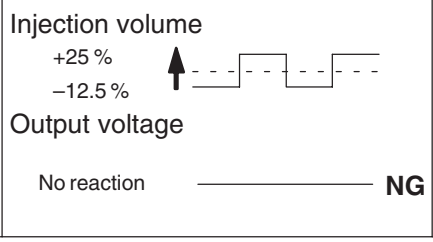
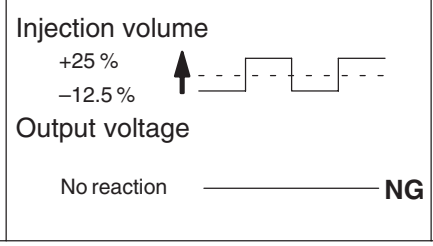
(b) Turn the ignition switch to ON.
(c) Warm up the engine with the engine speed at 2,500 rpm for approx. 90 sec.
(d) Enter the following menus: Active Test/ Control the injection volume A/F sensor.
(e) Perform the active test at the engine idling.

Standard:

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:

There is a few second delay in the A/F sensor output and there is about 20 seconds delay in the heated oxygen sensor output.

	Output voltage of A/F sensor (sensor 1)	Output voltage of heated oxygen sensor (sensor 2)	Mainly suspect trouble area
Case 1			—
Case 2			A/F sensor (A/F sensor, heater, A/F sensor circuit)
Case 3			Heated oxygen sensor (heated oxygen sensor, heater, heated oxygen sensor circuit)
Case 4			Extremely rich or lean of the actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

HINT:

- If different DTCs that are related to a different system are output simultaneously while terminal E2 is used as a ground terminal, terminal E2 may be open.
- Read freeze frame data using the Intelligent Tester II. 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.

1	CHECK OTHER DTC OUTPUT(BESIDES DTC P0136, P0137, P0138, P0156, P0157 AND/OR P0158)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester II ON.
(d) On the intelligent tester II, select the item: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result:

Display (DTC output)	Proceed to
Only "P0136, P0137, P0138, P0156, P0157 and/or P0158" are output	A
"P0136, P0137, P0138, P0156, P0157 and/or P0158" and other DTCs are output	B

HINT:
If any other codes besides "P0136, P0137, P0138, P0156, P0157 and/or P0158" are output, perform the troubleshooting for those DTCs first.

B → **GO TO PELEVANT DTC CHART (See page 05–220)**

A

2	READ VALUE OF INTELLIGENT TESTER II (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) After warming up the engine, race the engine at 2,500 rpm for 3 minutes.
(b) Read the output voltage of the heated oxygen sensor when the engine is suddenly raced.

HINT:
Perform a quick racing to 4,000 rpm 3 times by using the accelerator pedal.

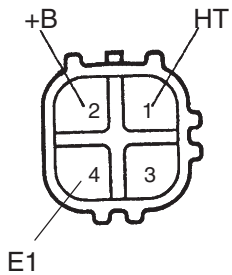
Standard: Alternates 0.4 V or less and 0.5 V or more.

OK → **Go to step 6**

NG

3	INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)

Bank 1, 2 Sensor 2



(a) Measure the resistance between the terminals of the heated oxygen sensor connector.

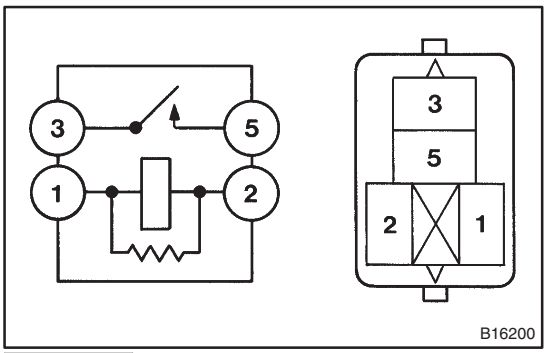
Standard (Bank 1, 2 sensor 2):

Terminal No.	Resistance
1 (HT) – 2 (+B)	11 to 16 Ω at 20 °C (68 °F)
1 (HT) – 4 (E1)	10 kΩ or higher

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

4 INSPECT EFI RELAY



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

Standard:

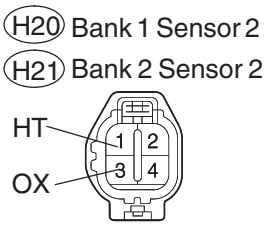
Terminal No.	Specified condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage terminals 1 and 2)

NG → **REPLACE EFI RELAY**

OK

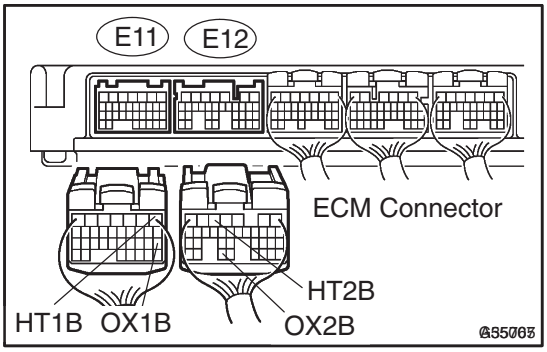
5 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)

Wire Harness Side



Heated Oxygen Sensor Connector

A72895



(a) Disconnect the H20 or H21 heated oxygen sensor connector.
(b) Disconnect the E11 and E12 ECM connector.
(c) Check for resistance between the wire harness side connectors.

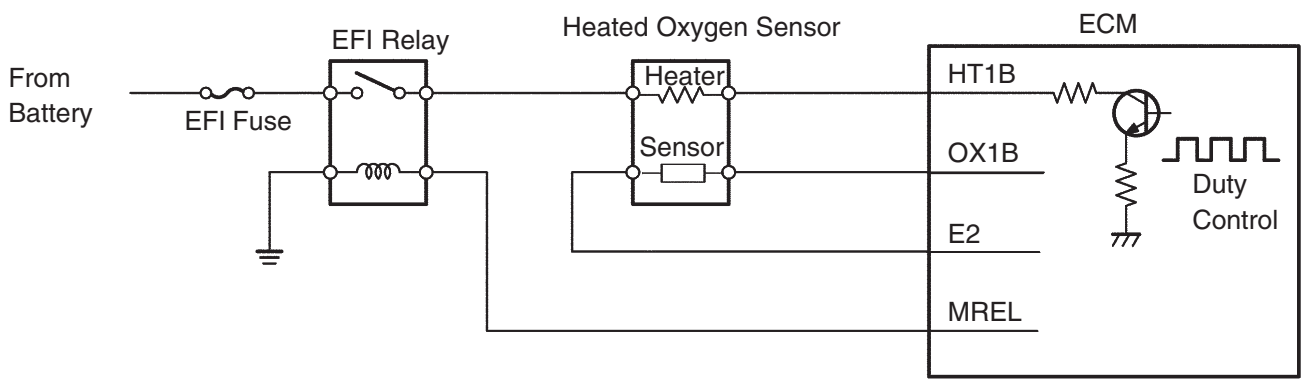
Standard (Check for open):

Symbols (Terminal No.)	Specified condition
OX (H20–3) – OX1B (E11–18)	Below 1 Ω
HT (H20–1) – HT1B (E11–1)	Below 1 Ω
OX (H21–3) – OX2B (E12–38)	Below 1 Ω
HT (H21–1) – HT2B (E12–5)	Below 1 Ω

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
OX (H20–3) or OX1B (E11–18) – Body ground	10 kΩ or higher
HT (H20–1) or HT1B (E11–1) – Body ground	10 kΩ or higher
OX (H21–3) or OX2B (E12–38) – Body ground	10 kΩ or higher
HT (H21–1) or HT2B (E12–5) – Body ground	10 kΩ or higher

Reference (Bank 1 Sensor 2 System Drawing)



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HEATED OXYGEN SENSOR

6	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to perform the confirmation driving pattern.

GO

7	READ OUTPUT DTC(DTC P0136 AND/OR P0156 ARE OUTPUT AGAIN)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester II ON.
(d) On the intelligent tester II , select the item: Powertrain / Engine and ECT / DTC / Pending.
(e) Read DTCs.

Result:

Display (DTC output)	Proceed to
”P0136 and/or P0156” are not output again	A
”P0136 and/or P0156” are output again	B

B → REPLACE HEATED OXYGEN SENSOR

A

CHECK FOR INTERMITTENT PROBLEMS (See page 05–199)