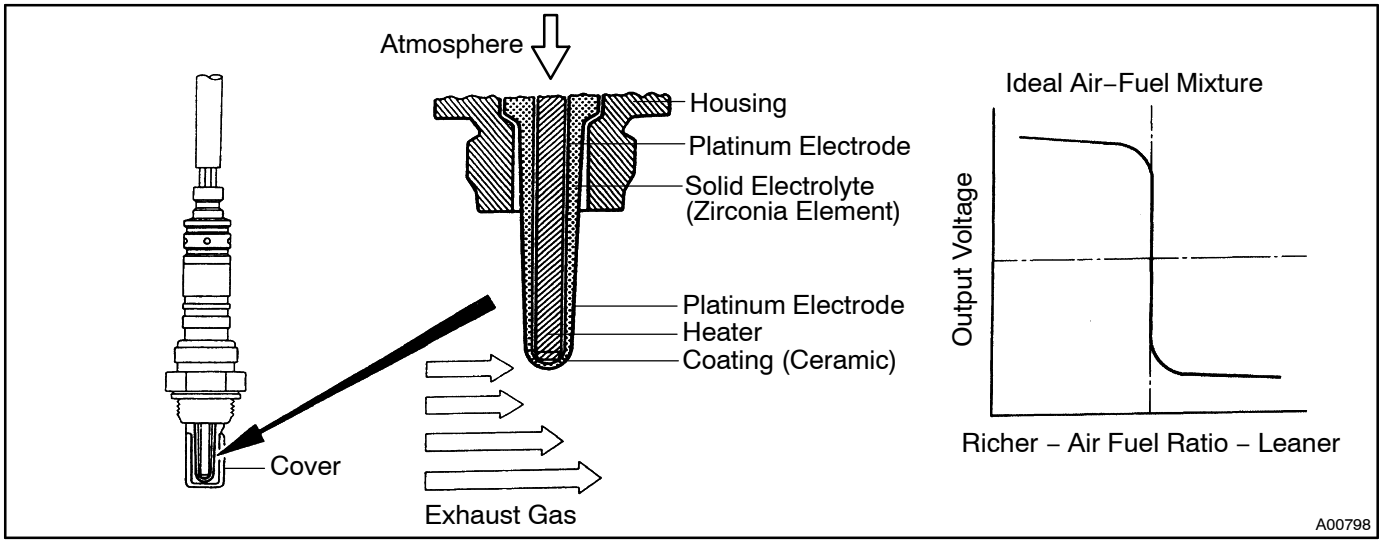
DTC	P0136	OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 1 SENSOR 2)

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

CIRCUIT DESCRIPTION

The heated oxygen sensor (HO2S) is used to monitor oxygen in the exhaust gas. For optimum catalyst operation, the air fuel mixture (air–fuel ratio) must be maintained near the ideal "stoichiometric" ratio. The HO2S output voltage changes suddenly in the vicinity of the stoichiometric ratio. The ECM adjusts the fuel injection time so that the air–fuel ratio is nearly stoichiometirc.

The HO2S generates a voltage between 0.1 and 0.9 volts in response to oxygen in the exhaust gas. If the oxygen in the exhaust gas increases, the air–fuel ratio becomes "Lean". The ECM interprets Lean when the HO2S voltage is below 0.45 volts. If the oxygen in the exhaust gas decreases, the air–fuel ratio becomes "Rich". The ECM interprets Rich when the HO2S voltage is above 0.45 volts.

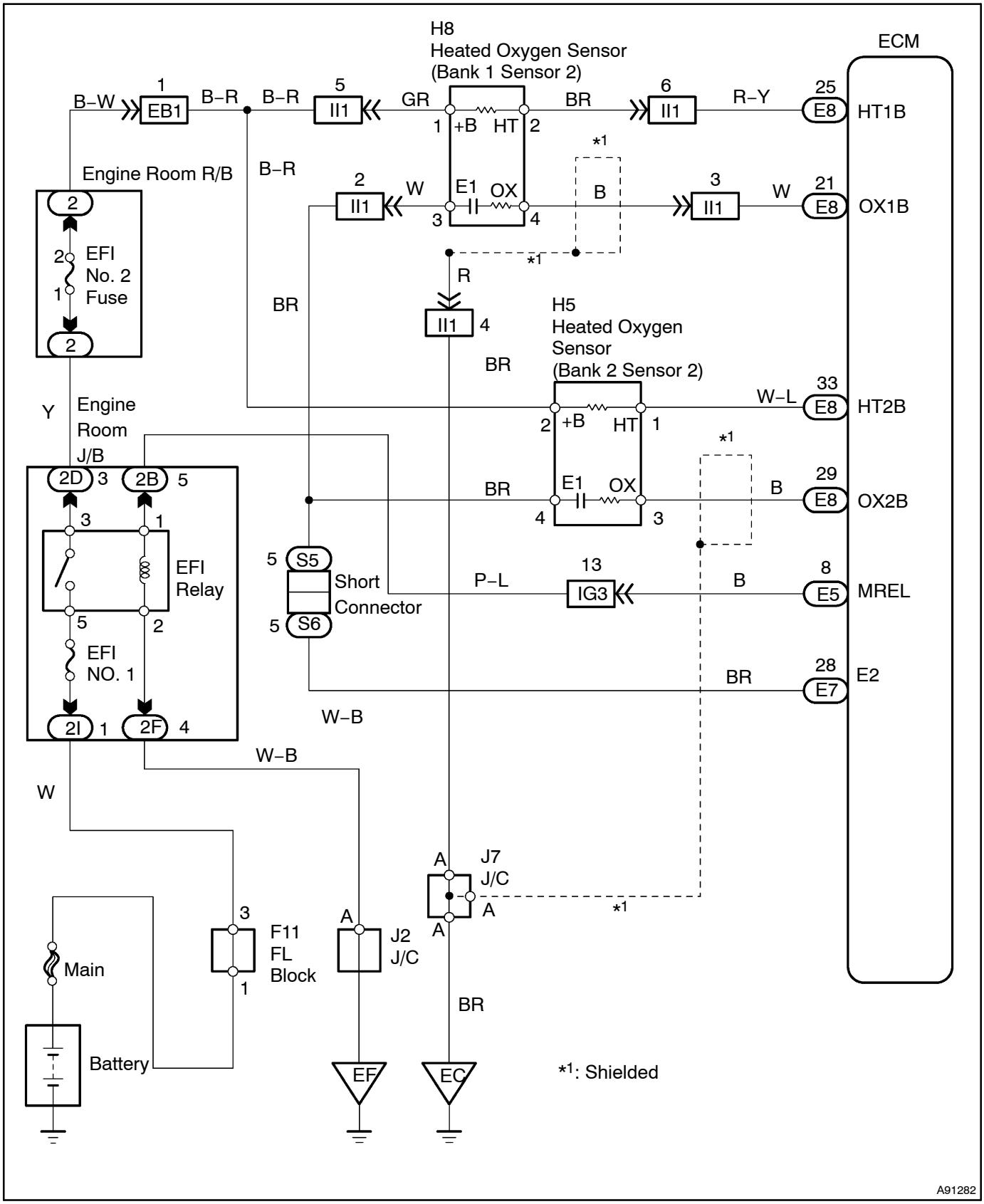


DTC No	DTC Detection Condition	Trouble Area
P0136 P0156	Following condition (a) (b) or (c) is met : (a) During driving with engine warmed up, heated oxygen sensor output does not change for 8 minutes (b) Heated oxygen sensor output is very low most of time during 220 seconds (c) The rear heated oxygen sensor voltage does not drop to below 0.2 V immediately when the vehicle decelerates and the fuel cut is operating	• 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) • EFI relay

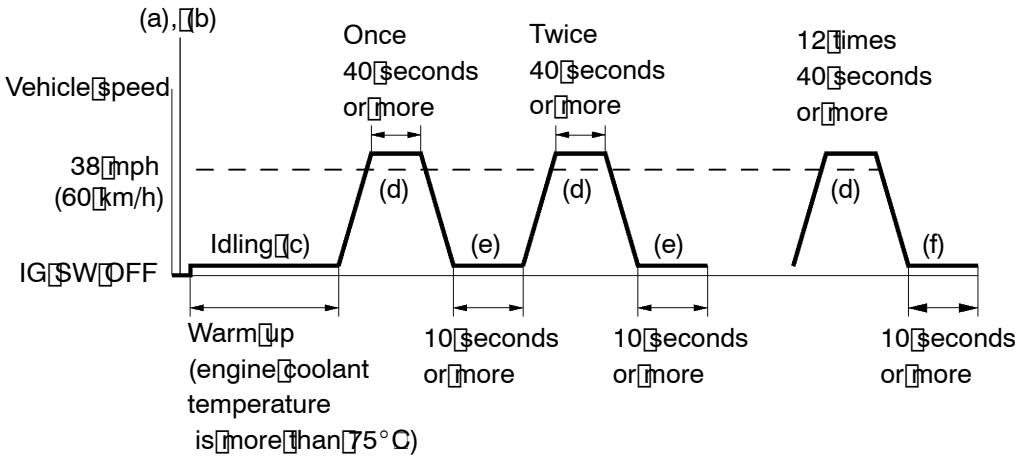
HINT:

- 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



(a) Connect the hand–held tester to the DLC3.
(b) Switch the hand–held tester from the normal mode to the check (test) mode (see page 05–18).
(c) Start the engine and warm up the engine until engine coolant temperature is more than 75°C.
(d) Drive the vehicle at 38 mph (60 km/h) or more for 40 seconds or more.
(e) Let the engine idle for 10 seconds or more.
(f) Perform steps (d) to (e) 12 times.

HINT:
If a malfunction exists, the MIL will illuminate during step (f).

NOTICE:
If the conditions in this test are not strictly followed, detection of a malfunction will not occur. If you do not have a hand–held tester, turn the ignition switch OFF after performing steps from (c) to (f), then perform steps from (c) to (f) again.

INSPECTION PROCEDURE

HINT:
Hand–held tester only:
It is possible the malfunctioning area can be found using 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 areas 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 ignition switch ON.
(3) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
(4) Enter the following menus: DIAGNOSIS / OBD / MOBD / ACTIVE TEST / A/F CONTROL.
(5) Perform the A/F CONTROL operation with the engine idle (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)	Mainly 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, heater, A/F 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, heater, heated oxygen 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 actual 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 outputs of both the A/F sensor and the heated oxygen sensor.
For displaying the graph, enter ”ACTIVE TEST / A/F CONTROL / USER DATA”, select ”AFS B1S1 and O2S B1S2” by pressing ”YES” and push ”ENTER”. Then press ”F4”.
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.

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P0136 AND/OR P0156)

(a) Read the DTC using the hand–held tester.

Result:

Display (DTC Output)	Proceed to
Only P0136 and/or P0156 are output	A
P0136 or P0156 and other DTCs are output	B

HINT:

If any other codes besides P0136 and/or P0156 are output, perform the troubleshooting for those codes first.

B → **GO TO RELEVANT DTC CHART (See page 05–27)**

A

2	READ VALUE OF HAND–HELD TESTER (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) After warming up the engine, run the engine at 2,500 rpm for 3 minutes.

(b) Read the output voltage of the heated oxygen sensor when the engine rpm is suddenly increased.

HINT:

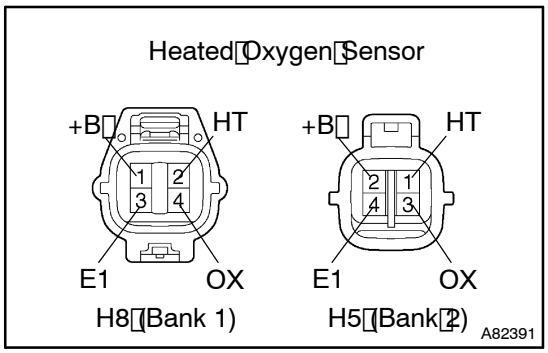
Quickly accelerate the engine to 4,000 rpm 3 times by using the accelerator pedal.

Heated oxygen sensor output voltage: 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)



(a) Disconnect the H5 or H8 heated oxygen sensor connector.

(b) Check the resistance of the heated oxygen sensor terminals.

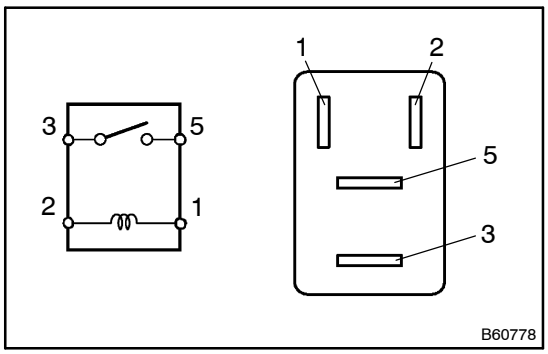
Standard (bank 1, 2 sensor 2):

Tester Connection	Condition	Specified Condition
H8–2 (HT) – H8–1 (+B) H5–1 (HT) – H5–2 (+B)	20°C (68°F)	11 to 16 Ω
H8–3 (HT) – H8–3 (E1) H5–1 (HT) – H5–4 (E1)	800°C (1,472°F)	23 to 32 Ω

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

4	INSPECT RELAY (EFI)



(a) Remove the EFI relay from the engine room J/B.
(b) Check the resistance of the EFI relay.

Standard:

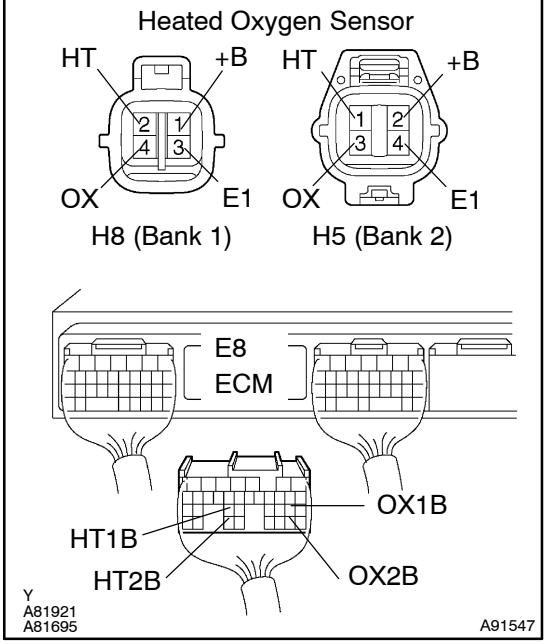
Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → **REPLACE EFI RELAY**

OK

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

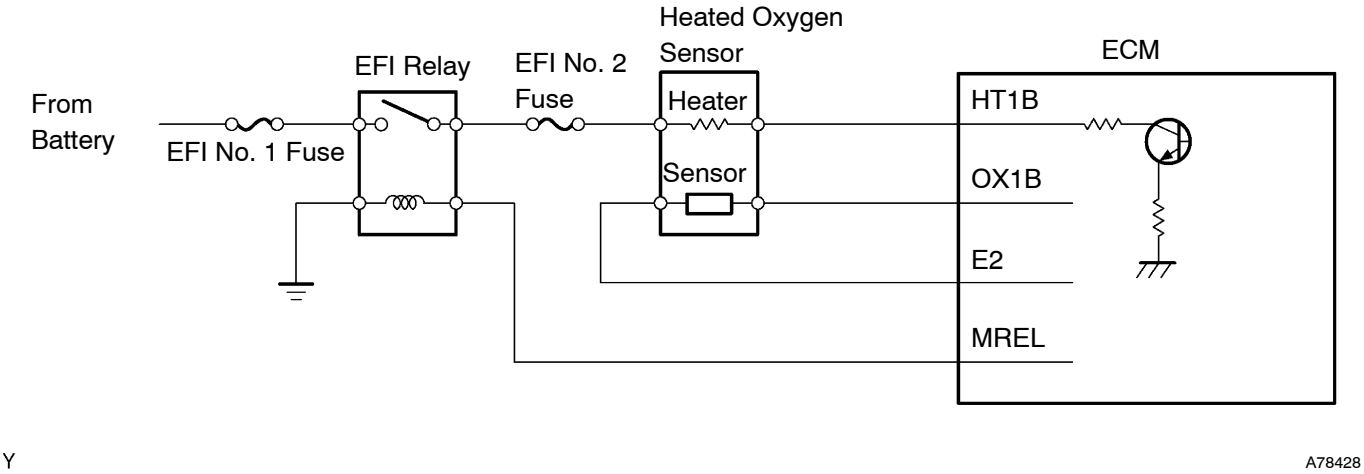
Wire Harness Side



(a) Disconnect the H5 or H8 heated oxygen sensor connector.
(b) Disconnect the E8 ECM connector.
(c) Check the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
H8–3 (OX) – E8–21 (OX1B) H8–1 (HT) – E8–25 (HT1B) H5–3 (OX) – E8–29 (OX2B) H5–1 (HT) – E8–33 (HT2B)	Below 1 Ω
H8–3 (OX) or E8–21 (OX1B) – Body ground H8–1 (HT) or E8–25 (HT1B) – Body ground H5–3 (OX) or E8–29 (OX2B) – Body ground H5–1 (HT) or E8–33 (HT2B) – 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 performing the confirmation driving pattern.

GO

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

(a) Read the DTC using the hand–held tester.
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 05–8)