DTC	P0031	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 1)

DTC	P0032	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 1)

DTC	P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)

DTC	P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)

DTC	P0051	Oxygen Sensor Heater Control Circuit Low (Bank 2 Sensor 1)

DTC	P0052	Oxygen Sensor Heater Control Circuit High (Bank 2 Sensor 1)

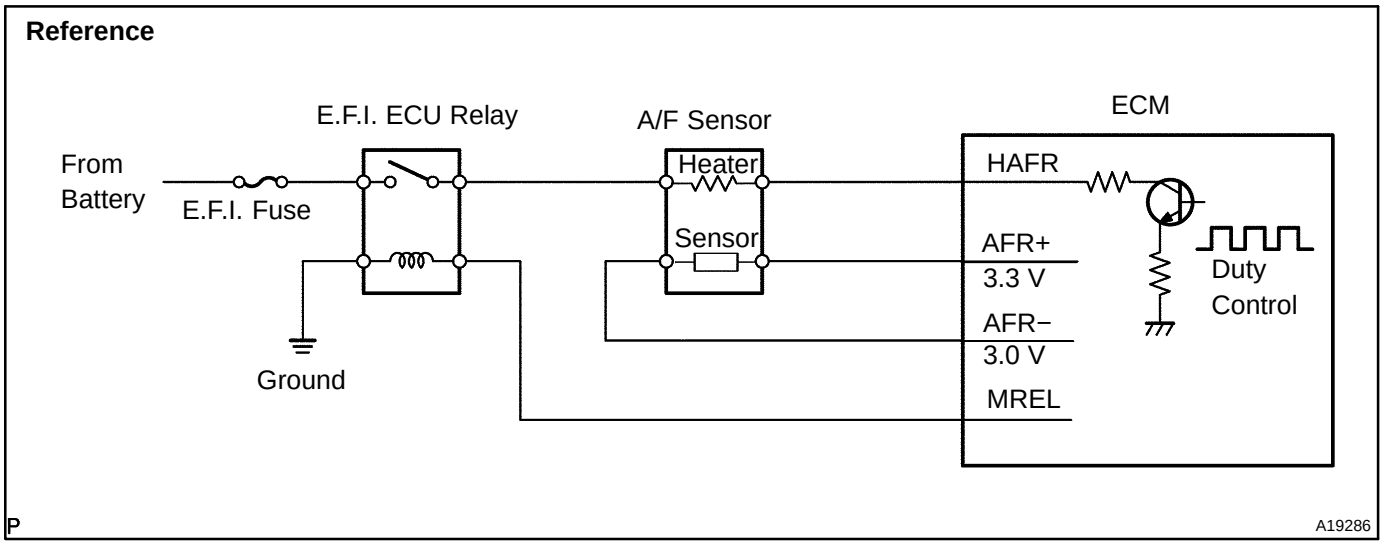
DTC	P0057	Oxygen Sensor Heater Control Circuit Low (Bank 2 Sensor 2)

DTC	P0058	Oxygen Sensor Heater Control Circuit High (Bank 2 Sensor 2)

CIRCUIT DESCRIPTION

HINT:

The ECM provides a pulse width modulated control circuit to adjust current through the heater. The A/F ratio sensor heater circuit uses a relay on the B+ side of the circuit.



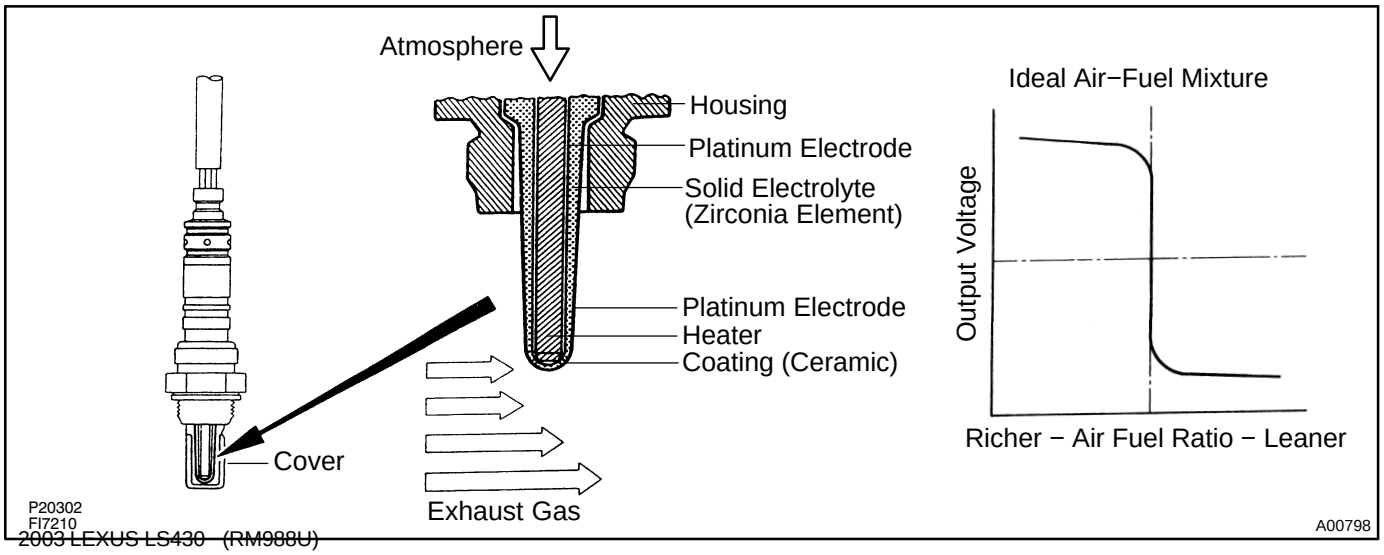
To obtain a high purification rate for the CO, HC and NOx components of the exhaust gas, a three−way catalytic converter is used, but for the most efficient use of the three−way catalytic converter, the air−fuel ratio must be precisely controlled so that it is always close to the stoichiometric air−fuel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

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

When the air−fuel ratio becomes LEAN, the oxygen concentration in the exhaust increases and the 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 oxygen sensor informs the ECM of the RICH condition (large electromotive force: > 0.45 V). The ECM judges by the electromotive force from the oxygen sensor whether the air−fuel ratio is RICH or LEAN and controls the injection time accordingly. However, if malfunction of the oxygen sensor causes output of abnormal electromotive force, the ECM is unable to perform 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 to heat the sensor for accurate oxygen concentration detection.

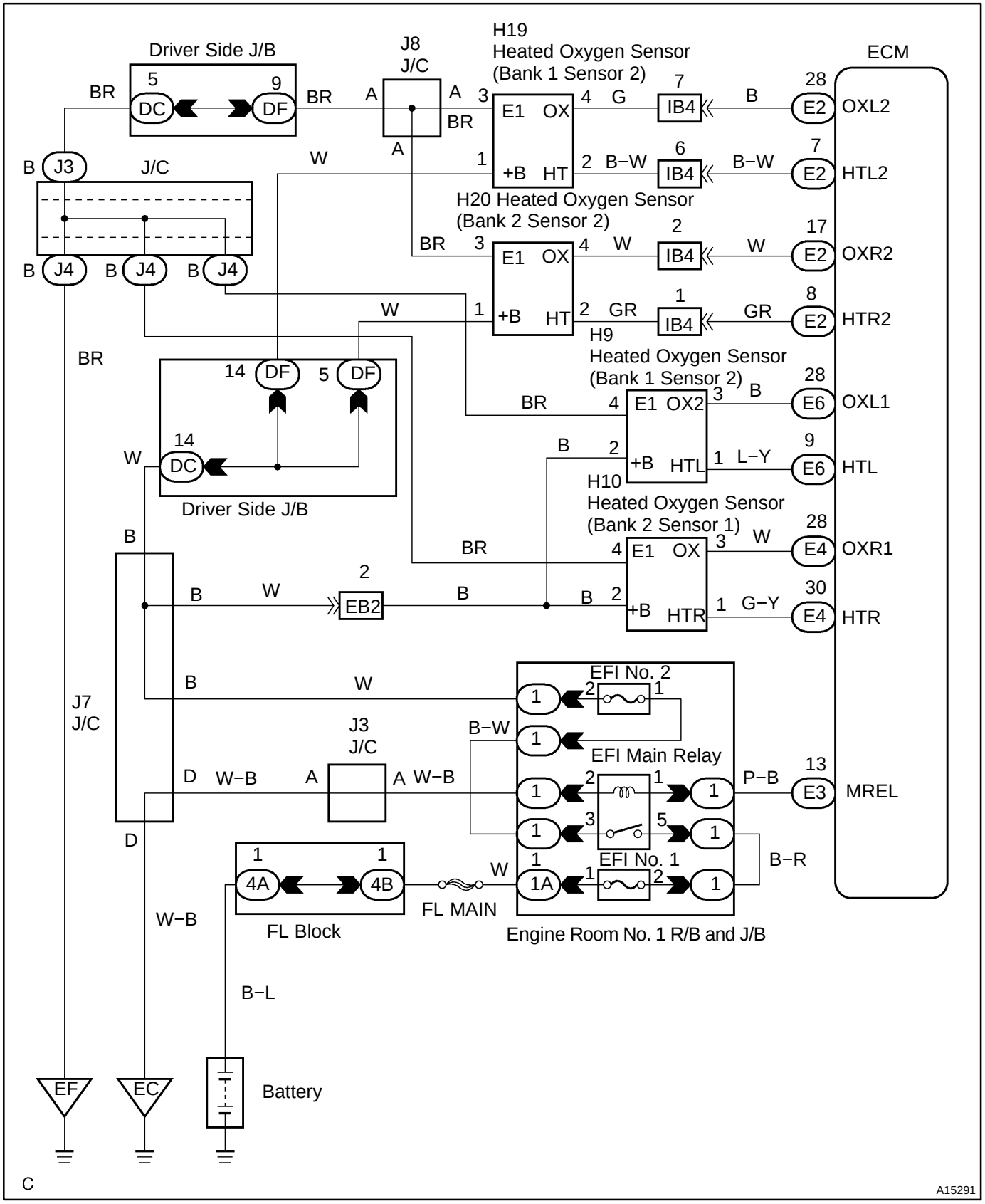


DTC No.	DTC Detecting Condition	Trouble Area
P0031 P0037	Heater current of 0.2 A or less when heater operates with +B > 10.5 V and < 11.5 V (1 trip detection logic)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • EFI MAIN relay • ECM
P0051 P0058	Heater current of 0.25 A or less when heater operates with +B ≧ 11.5 V (1 trip detection logic)	
P0032 P0038 P0052 P0058	When heater operates, heater current exceeds 2 A (1 trip detection logic)	

HINT:

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

WIRING DIAGRAM

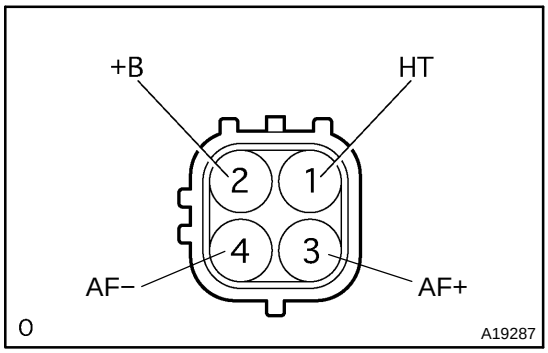


INSPECTION PROCEDURE

HINT:

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

1	**Check resistance of heated oxygen sensor heater.**

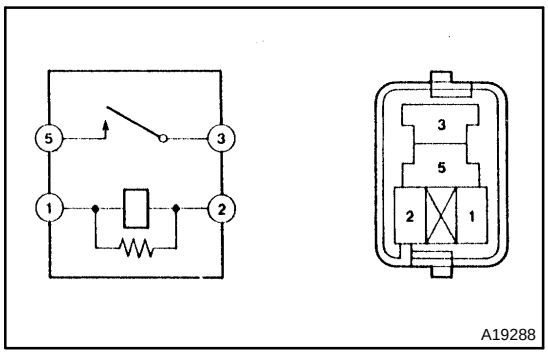


(a) Disconnect the air fuel ratio sensor connector.
(b) Measure resistance between the terminals HT and +B of the air fuel ratio sensor.
Resistance: 11 − 16 Ω (20°C)

NG → **Replace heated oxygen sensor.**

OK

2	**Check EFI MAIN relay.**



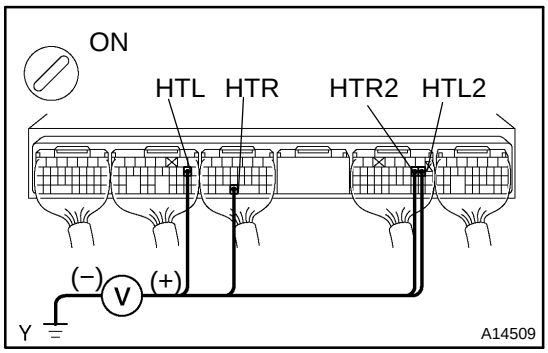
(a) Remove the EFI MAIN relay from the engine room J/B.
(b) Inspect the EFI MAIN relay.
Standard:

Terminal No.	Condition	Specified condition
1 − 2	Constant	Continuity
3 − 5	Usually	No Continuity
	Apply B+ between terminals 1 and 2	Continuity

NG → **Replace EFI MAIN relay.**

OK

3	**Check voltage between terminals HTR, HTR2, HTL, HTL2 of ECM connectors and body ground.**



PREPARATION:

(a) Remove the engine room ECU cover (See page SF−86).

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals HTR, HTR2, HTL, HTL2 of the ECM connectors and body ground.

HINT:

- Connect terminal HTR to bank 2 sensor 1.
- Connect terminal HTR2 to bank 2 sensor 2.
- Connect terminal HTL to bank 1 sensor 1.
- Connect terminal HTL2 to bank 1 sensor 2.

OK:

Voltage: 9 − 14 V

OK	**Check and replace ECM (See page IN−34).**

NG

Check and repair harness or connector between EFI main relay (Marking: EFI) and heated oxygen sensor, and heated oxygen sensor and ECM (See page IN−34).