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Service Category: Engine/Hybrid System		Section: Engine Control
Model Year: 2008	Model: LX570	Doc ID: RM000000PFA05VX
Title: 3UR-FE ENGINE CONTROL: SFI SYSTEM: DESCRIPTION (2008 LX570)		

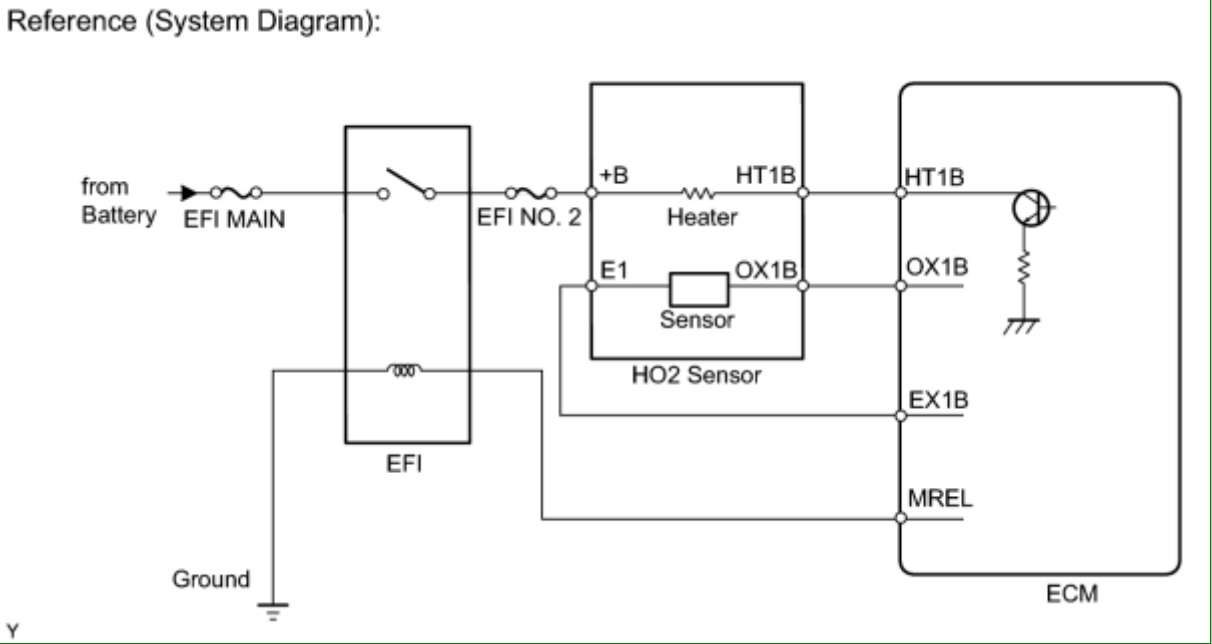
DTC	P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)
DTC	P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)
DTC	P0057	Oxygen Sensor Heater Control Circuit Low (Bank 2 Sensor 2)
DTC	P0058	Oxygen Sensor Heater Control Circuit High (Bank 2 Sensor 2)
DTC	P0141	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)
DTC	P0161	Oxygen Sensor Heater Circuit Malfunction (Bank 2 Sensor 2)

DESCRIPTION

Refer to DTC P0136 INFO .

HINT:

- When any of these DTCs is stored, the ECM enters fail-safe mode. The ECM turns off the Heated Oxygen (HO2) Sensor heater in fail-safe mode. Fail-safe mode continues until the engine switch is turned off.
- The ECM provides a pulse width modulated control circuit to adjust the current through the heater. The HO2 sensor heater circuit uses a relay on the +B side of the circuit.



DTC CODE	DTC DETECTION CONDITION	TROUBLE AREA
P0037 P0057	The Heated Oxygen (HO2) sensor heater current is below 0.3 A (1 trip detection logic).	• Open in Heated Oxygen (HO2) sensor heater circuit • HO2 sensor heater (for Sensor 2) • Integration relay • ECM
P0038 P0058	The Heated Oxygen (HO2) sensor heater current is higher than 2 A (1 trip detection logic).	• Short in HO2 sensor heater circuit • HO2 sensor heater (for Sensor 2) • Integration relay • ECM
P0141 P0161	The Cumulative heater resistance correction value exceeds the threshold (2 trip detection logic).	• Open or short in HO2 sensor heater circuit • HO2 sensor heater (for Sensor 2) • Integration relay • ECM

HINT:

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

MONITOR DESCRIPTION

The sensing portion of the Heated Oxygen (HO2) sensor has a zirconia element which is used to detect the oxygen concentration in the exhaust gas. If the zirconia element is at the appropriate temperature, and the difference between the oxygen concentrations surrounding the inside and outside surfaces of the sensor is large, the zirconia element generates voltage signals. In order to increase the oxygen concentration detecting capacity of the zirconia element, the ECM supplements the heat from the exhaust with heat from a heating element inside the sensor.

Heated oxygen sensor heater range check (P0037, P0038, P0057 and P0058):

The ECM monitors the current applied to the O2 sensor heater to check the heater for malfunctions. If the current is below the threshold value, the ECM determines that there is an open circuit in the heater. If the current is higher than the threshold value, the ECM determines that there is a short circuit in the heater.

The ECM constantly monitors the current applied to the heater. If the ECM detects an open or short circuit, the ECM turns the MIL on and stores a DTC.

If a malfunction is detected, the ECM cuts off the current applied to the heater.

Example:

The ECM stores DTC P0038 or P0058 when the current in the HO2 sensor heater is higher than 2 A. Conversely, when the heater current is below 0.3 A, DTC P0037 or P0057 is stored.

Heated oxygen sensor heater performance (P0141 and P0161):

After the accumulated heater ON time exceeds 100 seconds, the ECM calculates the heater resistance using the battery voltage and the current applied to the heater.

If the resistance is higher than the threshold value, the ECM determines that there is a malfunction in the HO2 sensor heater and stores DTC P0141 or P0161.

MONITOR STRATEGY

Related DTCs	P0037: Heated oxygen sensor heater (for Bank 1) range check (Low electrical current) P0038: Heated oxygen sensor heater (for Bank 1) range check (High electrical current) P0057: Heated oxygen sensor heater (for Bank 2) range check (Low electrical current) P0058: Heated oxygen sensor heater (for Bank 2) range check (High electrical current) P0141: Heated oxygen sensor heater performance (for Bank 1) P0161: Heated oxygen sensor heater performance (for Bank 2)
Required Sensors/Components (Main)	Heated oxygen sensor heater
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous: P0037, P0038, P0057 and P0058 Once per driving cycle: P0141 and P0161
Duration	0.5 seconds: P0037 and P0057 2 seconds: P0038 and P0058 10 seconds: P0141 and P0161
MIL Operation	Immediate: P0037, P0038, P0057 and P0058 2 driving cycles: P0141 and P0161
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All:

Monitor runs whenever following DTCs not stored	None
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P0037 and P0057:

Battery voltage	10.5 to 20 V
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P0038 and P0058 (Condition A):

Battery voltage	10.5 V or higher
Engine	Running
Starter	OFF

P0038 and P0058 (Condition B):

Battery voltage	10.5 to 20 V
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P0141 or P0161 (Condition A):

All of following conditions met:	-
Battery voltage	10.5 V or higher
Fuel cut	OFF
Time after fuel cut ON to OFF	30 seconds or more
Accumulated heater ON time	100 seconds or more

P0141 or P0161 (Condition B):

Duration that rear heated oxygen sensor impedance is less than 15 kΩ	2 seconds or more
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TYPICAL MALFUNCTION THRESHOLDS**P0037 and P0057:**

Heater current	Below 0.3 A
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P0038 and P0058 (Criteria A):

Learned heater OFF current	Higher than 2 A
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P0038 and P0058 (Criteria B):

Hybrid IC high current limiter port	Fail
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P0141 or P0161:

Accumulated heater resistance	Varies with sensor element temperature (Example: Higher than 23 Ω)
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COMPONENT OPERATING RANGE

Heated Oxygen (HO ₂) sensor heater current	0.4 to 1 A (when engine idles, HO ₂ sensor warmed up and battery voltage 11 to 14 V)
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WIRING DIAGRAM

Refer to DTC P0136 [INFO](#) .

CONFIRMATION DRIVING PATTERN

These DTCs are stored when the engine idles for 110 seconds or more.

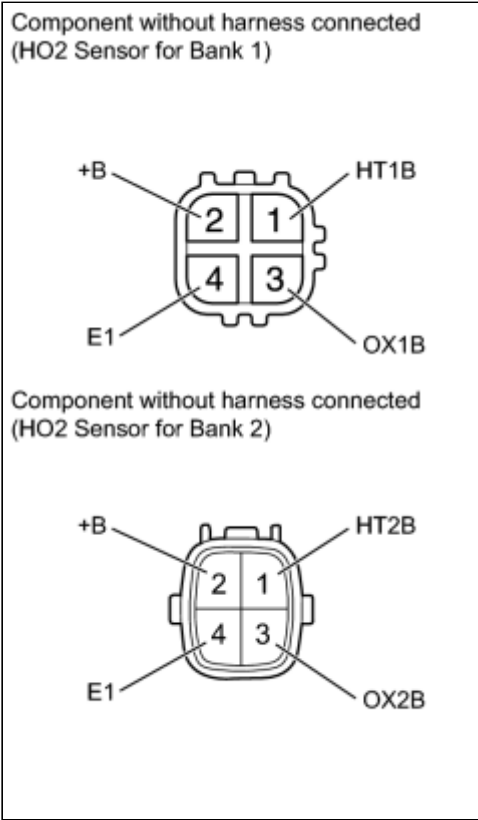
INSPECTION PROCEDURE**HINT:**

- Sensor 2 refers to the sensor mounted behind the Three-Way Catalytic Converter (TWC) and located far from the engine assembly.
- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

PROCEDURE

1.

INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



- (a) Disconnect the C17 or C18 heated oxygen (HO2) sensor connector.
- (b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 (HT1B) - 2 (+B)	20°C (68°F)	11 to 16 Ω
1 (HT1B) - 4 (E1)	Always	10 kΩ or higher
1 (HT2B) - 2 (+B)	20°C (68°F)	11 to 16 Ω
1 (HT2B) - 4 (E1)	Always	10 kΩ or higher

OK

▼

2.

CHECK TERMINAL VOLTAGE (+B OF HO2 SENSOR)

Front view of wire harness connector:
(to HO2 Sensor for Bank 1)



Front view of wire harness connector:
(to HO2 Sensor for Bank 2)



- (a) Disconnect the C17 or C18 HO2 sensor connector.
- (b) Turn the engine switch on (IG).
- (c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C17-2 (+B) - Body ground	Engine switch on (IG)	11 to 14 V
C18-2 (+B) - Body ground	Engine switch on (IG)	11 to 14 V

Result

RESULT	PROCEED TO
NG	A
OK	B

A

3.

INSPECT INTEGRATION RELAY (EFI)

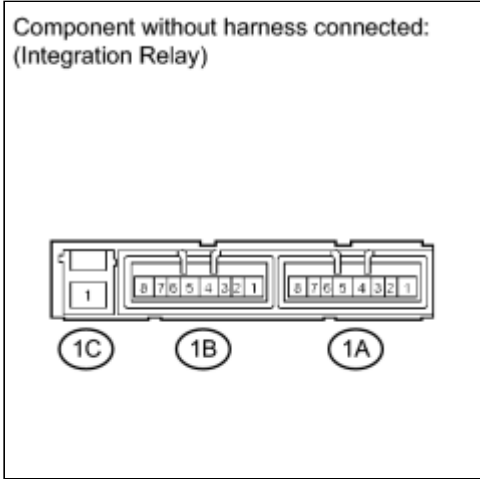
- (a) Remove the integration relay from the engine room relay block.
- (b) Inspect the EFI MAIN fuse.
 - (1) Remove the EFI MAIN fuse from the integration relay.

(2) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN fuse	Always	Below 1 Ω

(3) Reinstall the EFI MAIN fuse.



(c) Inspect the EFI relay.

(1) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1C-1 - 1B-4	No battery voltage applied to terminals 1B-2 and 1B-3	10 kΩ or higher
	Battery voltage applied to terminals 1B-2 and 1B-3	Below 1 Ω

OK

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4.	CHECK HARNESS AND CONNECTOR (HO2 SENSOR - INTEGRATION RELAY)
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(a) Check the EFI NO. 2 fuse.

(1) Remove the EFI NO. 2 fuse from the engine room relay block.

(2) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI NO. 2 fuse	Always	Below 1 Ω

(3) Reinstall the EFI NO. 2 fuse.

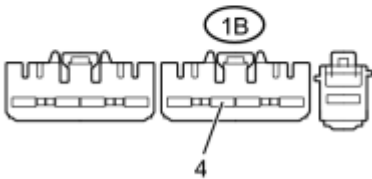
Front view of wire harness connector:
(to HO2 Sensor for Bank 1)



Front view of wire harness connector:
(to HO2 Sensor for Bank 2)



Front view of wire harness connector:
(to Integration Relay)



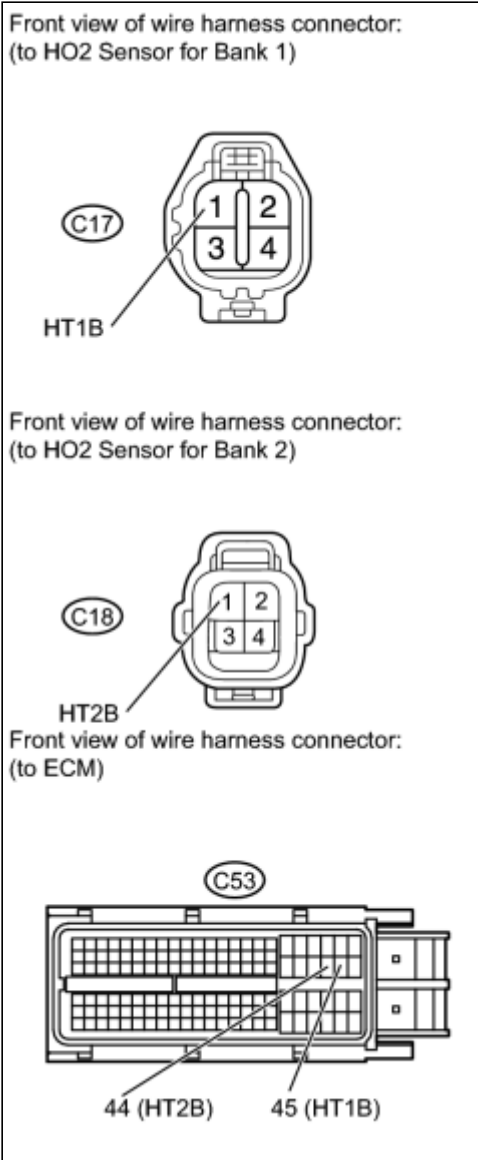
- (b) Disconnect the C17 or C18 HO2 sensor connector.
- (c) Remove the integration relay from the engine room relay block.
- (d) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C17-2 (+B) - 1B-4	Always	Below 1 Ω
C18-2 (+B) - 1B-4	Always	Below 1 Ω
C17-2 (+B) or 1B-4 - Body ground	Always	10 k Ω or higher
C18-2 (+B) or 1B-4 - Body ground	Always	10 k Ω or higher

OK
▼

9. CHECK HARNESS AND CONNECTOR (HO2 SENSOR - ECM)



- (a) Disconnect the C17 or C18 HO2 sensor connector.
 - (b) Disconnect the C53 ECM connector.
 - (c) Measure the resistance according to the value(s) in the table below.
- Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C17-1 (HT1B) - C53-45 (HT1B)	Always	Below 1 Ω
C18-1 (HT2B) - C53-44 (HT2B)	Always	Below 1 Ω
C17-1 (HT1B) or C53-45 (HT1B) - Body ground	Always	10 kΩ or higher
C18-1 (HT2B) or C53-44 (HT2B) - Body ground	Always	10 kΩ or higher

OK

10.	CHECK WHETHER DTC OUTPUT RECURS
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- (a) Connect the Techstream to the DLC3.
- (b) Turn the engine switch on (IG).
- (c) Turn the Techstream on.
- (d) Clear DTCs  .
- (e) Start the engine.
- (f) Allow the engine to idle for 2 minutes or more.
- (g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
- (h) Read DTCs.

Result

RESULT	PROCEED TO
No DTC is output	A
P0037, P0038, P0057, P0058, P0141 and/or P0161 are output	B

A

