

DTC 21,28 (Main Heated*1) Oxygen Sensor Circuit

CIRCUIT DESCRIPTION

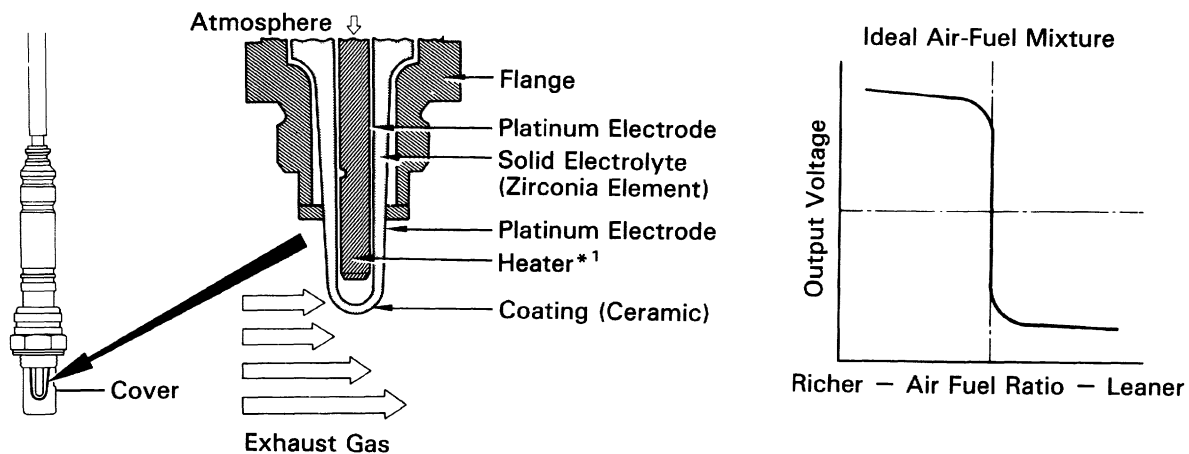
To obtain a high purification rate for the CO, HC and NO_x components of the exhaust gas, a three-way catalytic converter is used, but for most efficient use of the three-way catalytic converter, the air-fuel ratio must be precisely controlled so that it is always close to the stoichiometric air-fuel 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 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: 1 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 duration 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 main 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.)



FI4835
SS0076

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
21 - 28	(1) *1 Open or short in heater circuit of main heated oxygen sensor for 0.5 sec. or more.	<ul style="list-style-type: none"> Open or short in heater circuit of main heated oxygen sensor. Main heated oxygen sensor heater ECM
	(2) (Main heated*) oxygen sensor signal voltage is reduced to between 0.35 V and 0.70 V for 60 sec. under conditions (a) ~ (d). (2 trip detection logic) * 2 (a) Engine coolant temp.: Between 80°C (176°F) and 95 °C (203°F). (b) Engine speed: 1,500 rpm or more. (c) Load driving (EX. A/T in Overdrive (5th for M/T)), A/C ON, Flat road, 50 mph (80 km/h)). (d) (Main heated*) oxygen sensor signal voltage: Alternating above and below 0.45 V.	<ul style="list-style-type: none"> (Main heated*) oxygen sensor circuit (Main heated*) oxygen sensor

HINT: Diagnostic trouble code "21" is for the (main heated*) oxygen sensor (Fr) circuit.

Diagnostic trouble code "28" is for the (main heated*) oxygen sensor (Rr) circuit.

* 1: Main heated oxygen sensor ONLY for California specification vehicles.

*2: See page [EG-639](#).

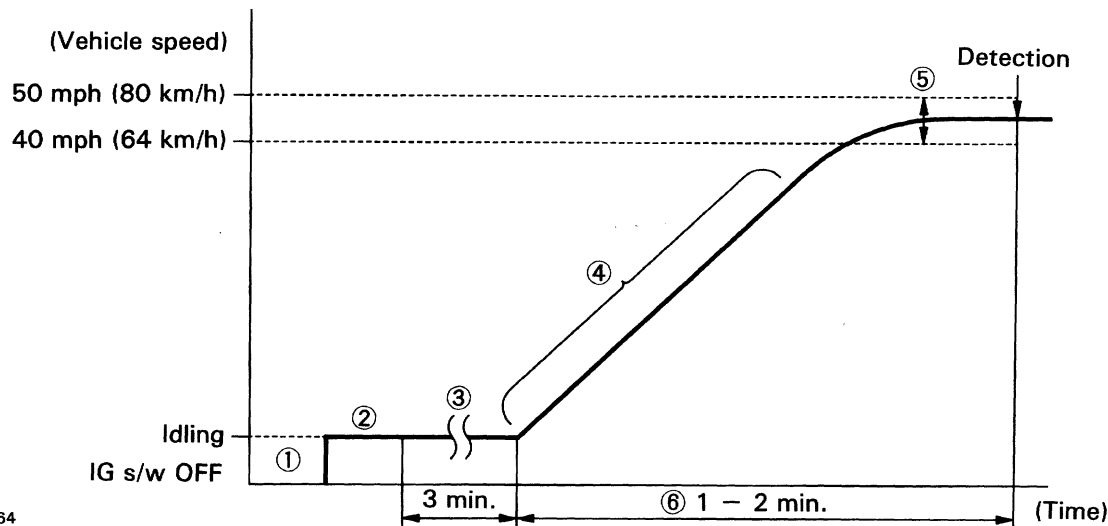
CIRCUIT DESCRIPTION (Cont'd)

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN

Purpose of the driving pattern.

- (a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.
- (b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

Malfunction: (Main Heated*) Oxygen Sensor Deterioration



FI6464

It is vital that this test routine is adhered to detect the malfunction:

- (1) Disconnect the EFI No. 1 fuse (30 A) for 10 sec. or more, with IG switch OFF. Initiate test mode (Connect terminal TE2 and E1 of data link connector 2 with IG switch OFF).
- (2) Start the engine and warm up with all ACC switched OFF.
- (3) After the engine is warmed up, let it idle for 3 min.
- (4) After performing the idling in (3), perform gradual acceleration with in the range 1,300 – 1,700 rpm (centered around 1,500 rpm) with the A/C switched ON and D position for A/T (5th for M/T)).

HINT:

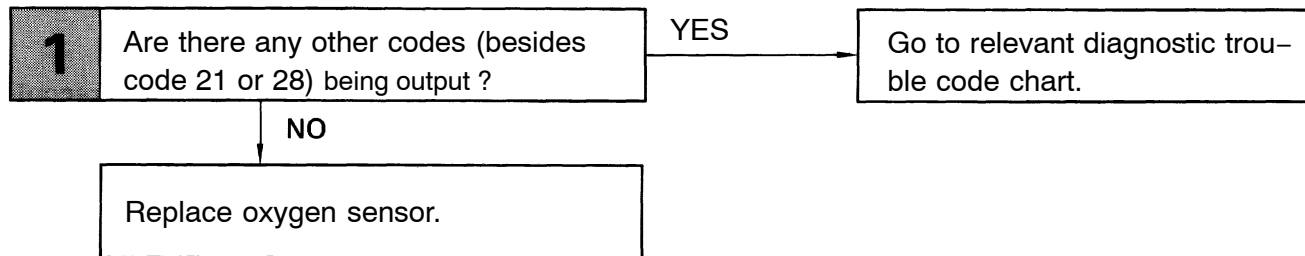
- Ensure engine rpm does NOT fall below 1200 rpm.
- Gradually –depress the accelerator pedal at a suitable rate to comply with the test requirements on the above graph. .
- Never allow engine rpm to drop at any time during the test.
- (5) Maintain the vehicle speed at 40 – 50 mph (64 – 80 km/h).
- (6) Keep the vehicle running for 1 – 2 min. after starting acceleration.

HINT: If a malfunction exists, the Malfunction Indicator Lamp will light up after approx. 60 sec. from the start of acceleration.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

*: Main heated oxygen sensor ONLY for California specification vehicles.

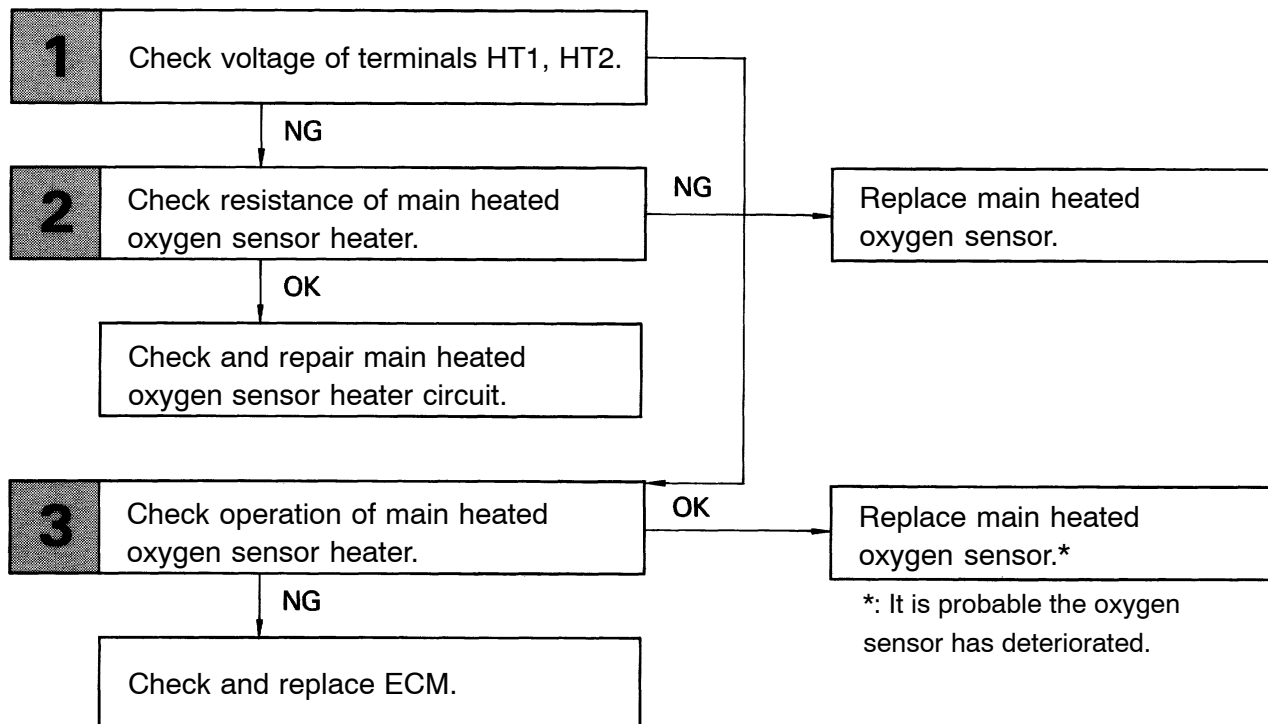
DIAGNOSTIC CHART (Exc. California specification vehicles)



HINT: If diagnostic trouble code "21" is output replace oxygen sensor (Fr).
 If diagnostic trouble code "28" is output, replace oxygen sensor (Rr).

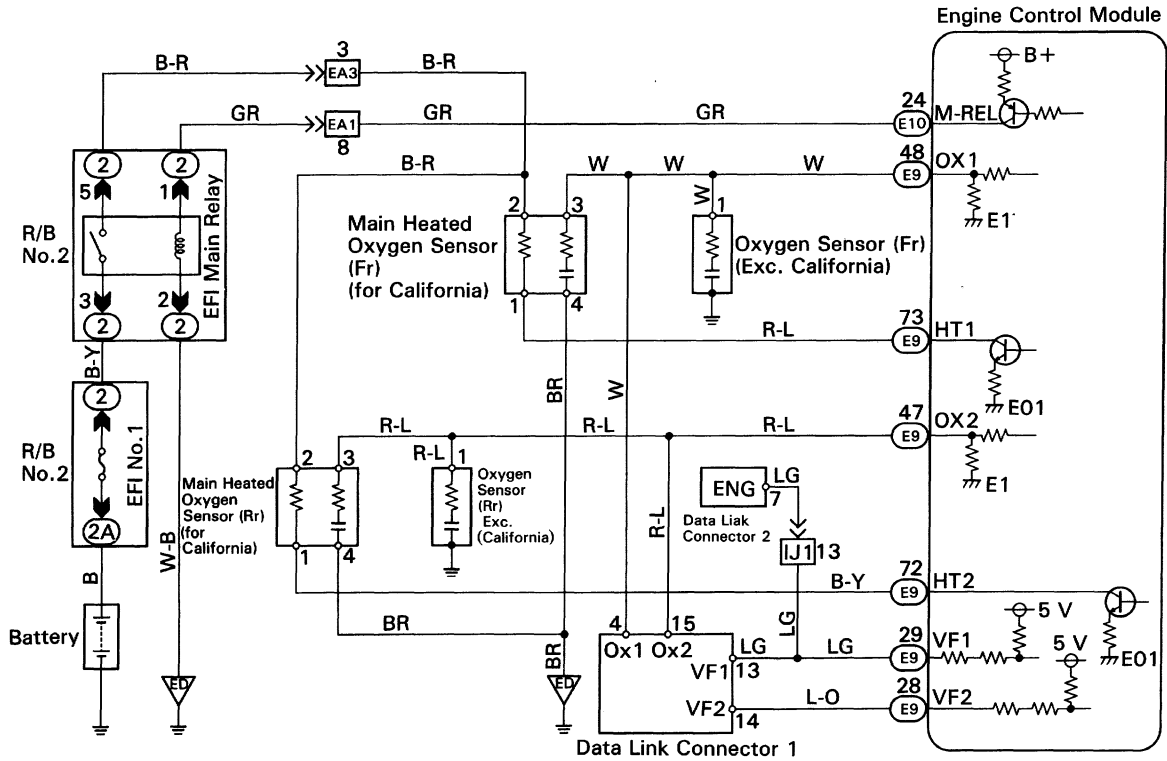
DIAGNOSTIC CHART (Only for California specification vehicles)

HINT: If diagnostic trouble code "21" is output, check the main heated oxygen sensor (Fr) circuit.
 If diagnostic trouble code "28" is output, check the main heated oxygen sensor (Rr) circuit.



*: It is probable the oxygen sensor has deteriorated.

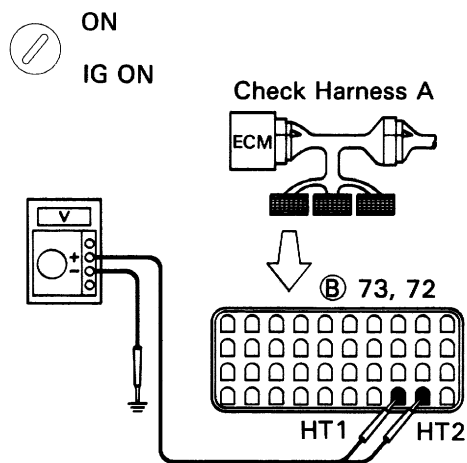
WIRING DIAGRAM



INSPECTION PROCEDURE (Only for California specification vehicles)

1

Check voltage between terminals HT 1, HT2 of engine control module connector and body ground.

BE6653
FI6890

P Connect the check Harness A (See page [EG-648](#)).

C Measure voltage between terminals HT1, HT2 of engine control module connector and body ground.

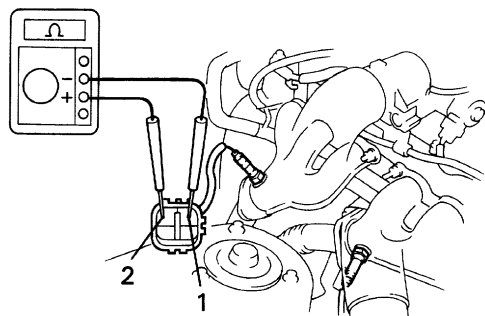
OK Voltage: 9 - 14 V

NG

OK Go to step **3**.

2

Check main heated oxygen sensor heater.



P11484

P Disconnect main heated oxygen sensor connector.

C Measure resistance between terminals 1 and 2 of main heated oxygen sensor connector.

OK Resistance: 11.7 - 14.3 Ω at 20 $^{\circ}$ C (68 $^{\circ}$ F)

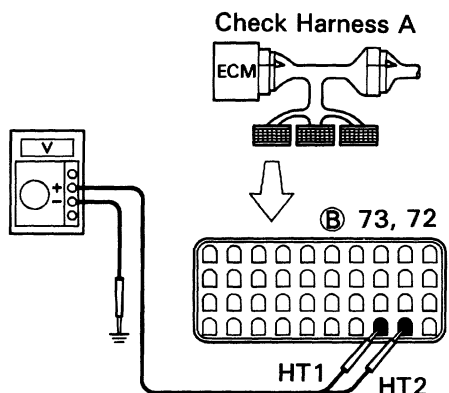
OK

NG Replace main heated oxygen sensor.

Check and repair harness or connector between main relay and main heated oxygen sensor, mainheated oxygen sensor and engine control module.

3

Check voltage between terminals HT1, HT2 of engine control module connector and body ground.



FI6890

P Warm up engine to normal operating temperature.

C Measure voltage between terminals HT1, HT2 of engine control module connector and body ground, when engine is idling and racing at 4,000 rpm.

OK	Voltage
Idling	0 V
Racing at 4,000 rpm	9 - 14V

Hint In the 4,000 rpm racing check, continue engine racing at 4,000 rpm for approx. 20 seconds or more.

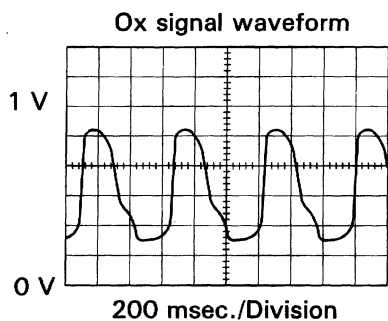
NG

OK Replace main heated oxygen sensor.*

Check and replace engine control module.

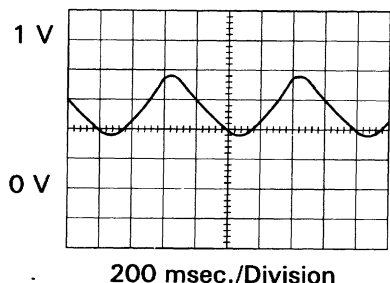
It is probable the oxygen sensor has deteriorated. Usually, this can not be confirmed by visual inspection.

Reference INSPECTION USING OSCILLOSCOPE



- with the engine racing (4,000 rpm) measure waveform between terminals OX 1, OX2 and E 1 of engine control module.

HINT: The correct waveform appears as shown in the illustration on the left, oscillating between approx. 0.1 V and 0.9 V



If the oxygen sensor has deteriorated, the amplitude of the voltage will be reduced as shown on the left.

FI6514
FI6515