

Diag. Code 21, 28**Main 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 catalyst is used, but for most efficient use of the three-way catalyst, the air-fuel ratio must be precisely controlled so that it is always close to the stoichiometric air-fuel ratio.

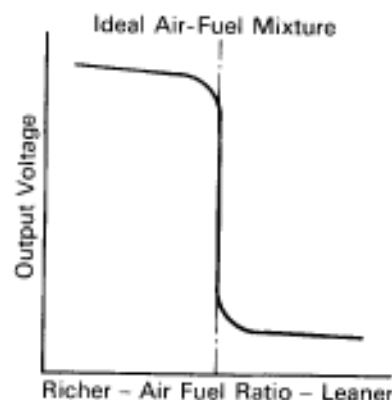
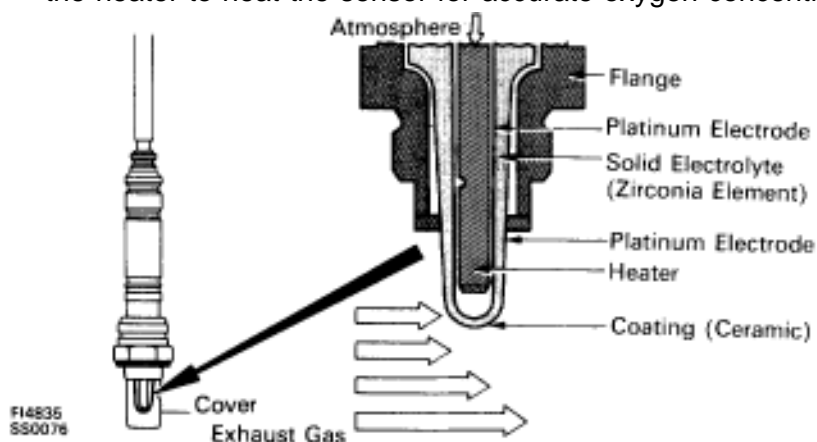
The oxygen sensor has the characteristic whereby its output voltage changes suddenly in the vicinity of the stoichiometric air-fuel ratio. This characteristic is used to detect the oxygen concentration in the exhaust gas and provide feedback to the computer for control of the air-fuel ratio.

When the air-fuel ratio becomes LEAN, the oxygen concentration in the exhaust increases and the oxygen sensor informs the ECU 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 ECU of the RICH condition (large electromotive force: 1V).

The ECU 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 ECU is unable to perform accurate air-fuel ratio control.

The main oxygen sensors include a heater which heats the Zirconia element. The heater is controlled by the ECU. 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.



Code No.	Diagnostic Code Detecting Condition	Trouble Area
21 28	(1) Open or short in heater circuit of main oxygen sensor for 0.5 sec. or more.	<ul style="list-style-type: none"> •Open or short in heater circuit of main oxygen sensor. •Main oxygen sensor heater •ECU
	(2) Main 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)* (a) Coolant temp.: Between 70°C (158°F) and 95°C (203°F). (b) Engine speed: 1,500 rpm or more. (c) Load driving (EX. ECT in 4th speed, A/C ON, Flat road, 50 mph (80km/h)). (d) Main oxygen sensor signal voltage: Alternating above and below 0.45 V.	<ul style="list-style-type: none"> •Main oxygen sensor circuit •Main oxygen sensor

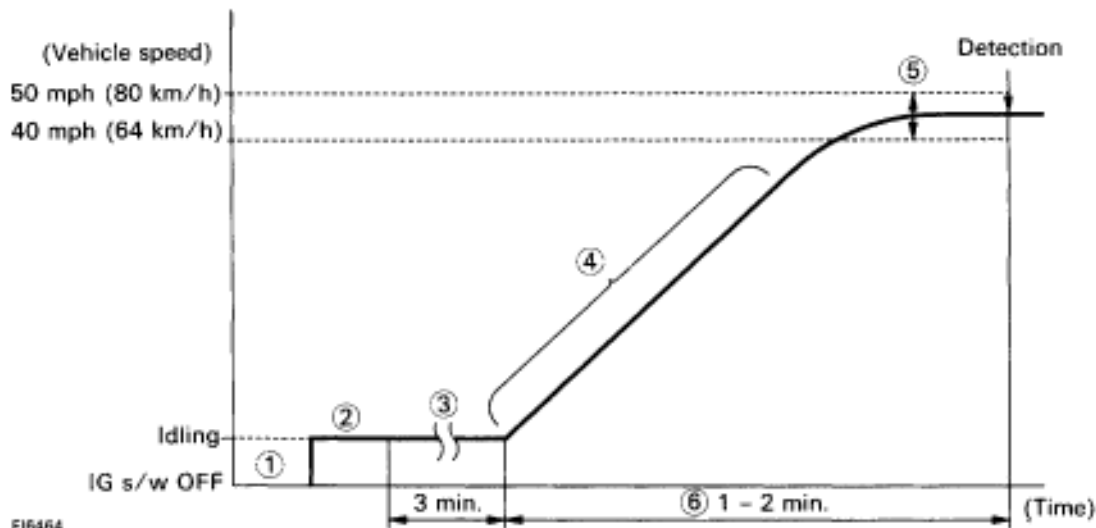
*: See page [TR-21](#).

HINT: Diag. code 21 is for the left bank main oxygen sensor circuit. Diag. code 28 is for the right bank main oxygen sensor circuit.

CIRCUIT DESCRIPTION (Cont'd)**DIAGNOSIS CODE DETECTION DRIVING PATTERN**

Purpose of the driving pattern.

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

Malfunction: Main Oxygen Sensor Deterioration

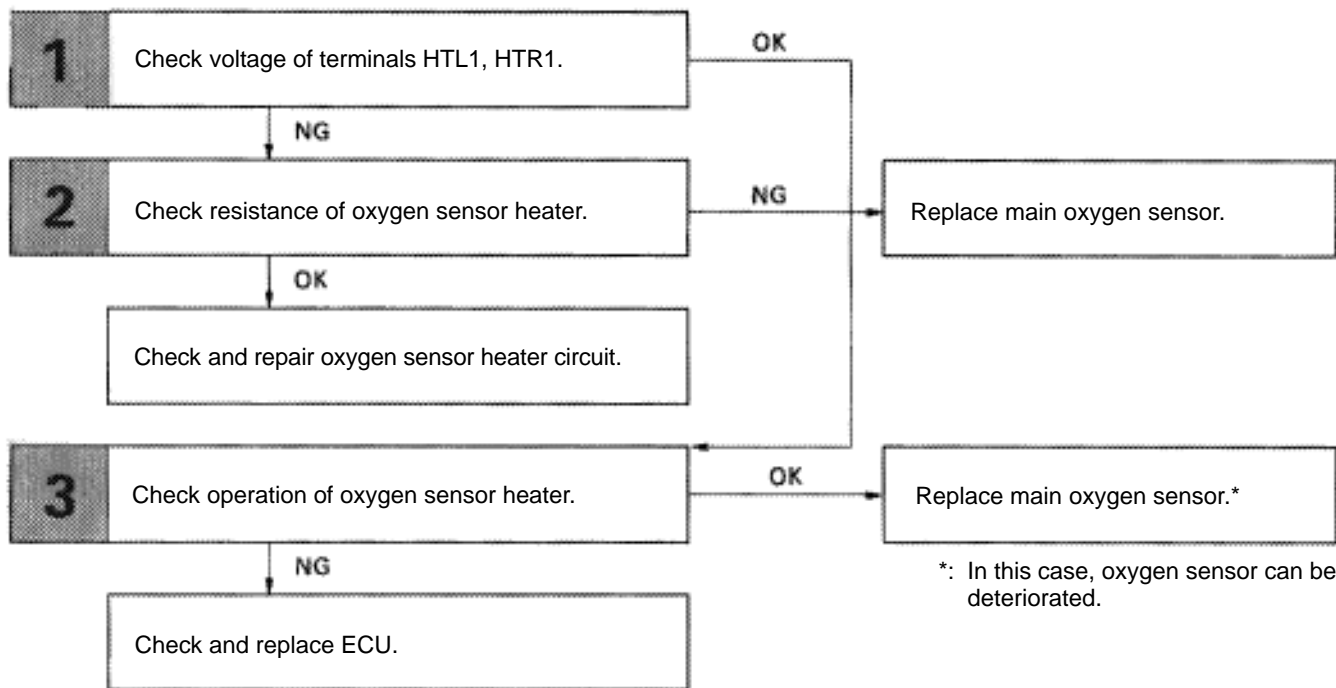
- ① Initiate test mode (See page [TR-12](#)).
- ② Start engine and warm up.
- ③ After engine is warmed up, let it idle for 3 min.
- ④ With the A/C ON and the transmission in D range (O/D ON), perform gradual acceleration with in the range 1,300 – 1,700 rpm (centered around 1,500 rpm).
(Take care that the engine speed does not fall below 1,200 rpm when shifting. Gradually depress the accelerator pedal and kept it. Steady so that engine braking does not occur.)
- 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 "CHECK" engine warning light will light up after approx. 60 sec. from the start of acceleration.

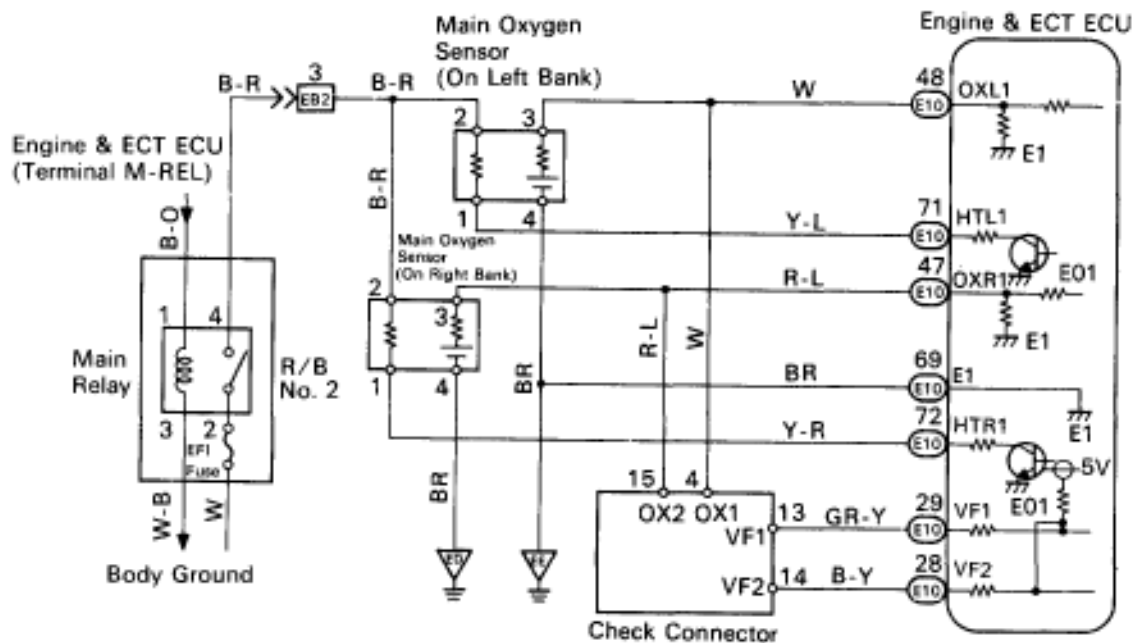
NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC CHART

HINT: If diag. code "21" is output, check the left bank main oxygen sensor circuit. If diag. code "28" is output, check the right bank main oxygen sensor circuit.

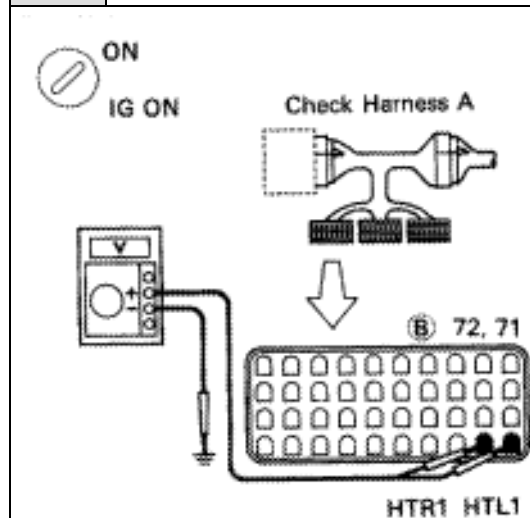


WIRING DIAGRAM



INSPECTION PROCEDURE

- 1** Disconnect the engine & ECT ECU connector, check voltage between terminals HTL1, HTR1 of engine & ECT ECU connector and body ground.

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PI6497

- P** (2) Connect the Check Harness A.
(See page [TR-30](#))
(2) Disconnect engine & ECT ECU connector.
(2) Turn ignition switch on.

- C** Measure voltage between terminals HTL1, HTR1 of engine & ECT ECU connector and body ground.

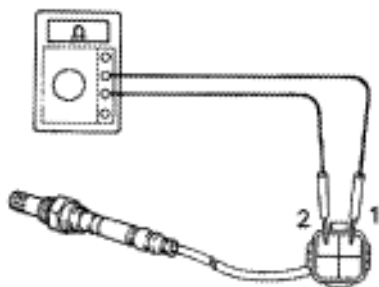
OK Voltage: 10 – 14 V

OK

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Go to step [3].

- 2** Check main oxygen sensor heater.



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- P** Disconnect main oxygen sensor connector.

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

OK Resistance: 5.1 – 6.3 Ω at 20°C (68°F)

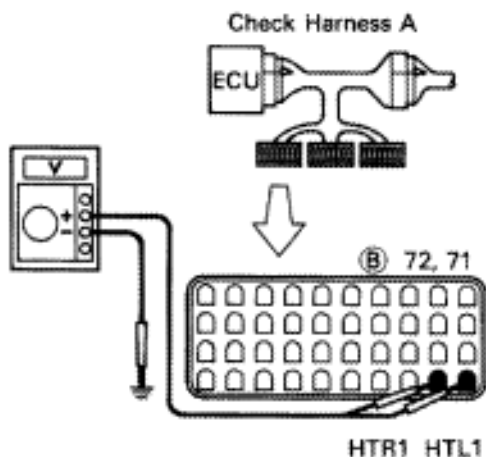
OK

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Replace main oxygen sensor.

Check and repair harness or connector between main relay and main oxygen sensor, main oxygen sensor and engine & ECT ECU.

3 Check voltage between terminals HTL1, HTR1 of engine & ECT ECU connector and body ground.



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- P** (1) Connect engine & ECT ECU connector.
(2) Warm up engine to normal operating temperature.

C Measure voltage between terminals of HTL1, HTR1 of engine & ECT ECU connector and body ground, when engine is idling and racing at 4,000 rpm.

OK

	Voltage
Idling	0 V
Racing at 4,000 rpm	10 – 14 V

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

OK

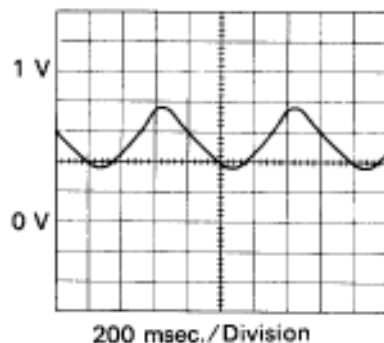
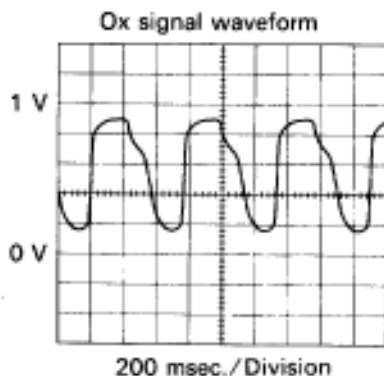
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Replace main oxygen sensor.*

*: In this case, oxygen sensor can be deteriorated.

Check and replace engine & ECT ECU.

Reference | INSPECTION USING OSCILLOSCOPE



- With the engine racing (4,000 rpm) measure between terminals OXL1, OXR2 and E1 of engine & ECT ECU.

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 is deteriorated, the amplitude of the voltage is reduced as shown on the left.

—MEMO—