

DIAGNOSIS SYSTEM

DESCRIPTION

The ECM contains a built-in self diagnosis system by which troubles with the engine signal network are detected and a Malfunction Indicator Lamp on the combination meter lights up.

By analyzing various signals as shown in a later table (See pages [EG2-175](#) and 176) the ECM detects system malfunctions relating to the actuator sensors. The self-diagnosis system has 2 modes, a normal mode and a test mode.

If a malfunction is detected when in the normal mode, the ECM lights up the Malfunction Indicator Lamp to inform the driver of the occurrence of a malfunction. (For some codes the light does not come on.) The light goes off automatically when the malfunction has been repaired. But the diagnostic trouble code(s) remains stored in the ECM memory (except for code Nos. 43, 51 and 53). The ECM stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch off.

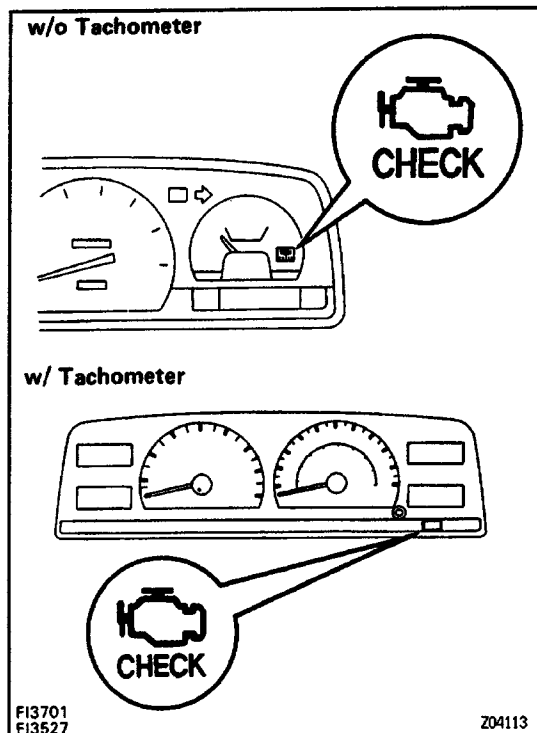
The diagnostic trouble code(s) can be read by the number of blinks of the Malfunction Indicator Lamp when TE1 and E1 terminals on the DLC1 are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.

If a malfunction is detected when in the test mode, the ECM lights up the Malfunction Indicator Lamp to inform the technician of the occurrence of a malfunction (except for code Nos. 42, 43 and 51). In this case, TE2 and E1 terminals on the DLC1 should be connected as shown later. (See page [EG2-171](#))

In the test mode, even if the malfunction is corrected, the malfunction code is stored in the ECM memory even when the ignition switch is off (except code Nos. 42, 43, 51 and 53). This also applies in the normal mode. The diagnostic mode (normal or test) and the output of the Malfunction Indicator Lamp can be selected by connecting the TE1, TE2 and E1 terminals on the DLC1, as shown later.

A test mode function has been added to the functions of the self-diagnosis system of the normal mode for the purpose of detecting malfunctions such as poor contacts, which are difficult to detect in the normal mode. This function fills up the self diagnosis system. The test mode can be implemented if technicians follow the procedure described later.

(See page [EG2-171](#)).



MALFUNCTION INDICATOR LAMP (MIL) CHECK

1. The Malfunction Indicator Lamp will come on when the ignition switch is turned ON and the engine is not running.
2. When the engine is started, the Malfunction Indicator Lamp should go off.

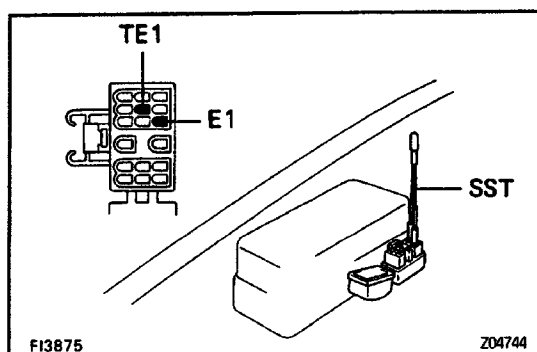
If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

DIAGNOSTIC TROUBLE CODES OUTPUT

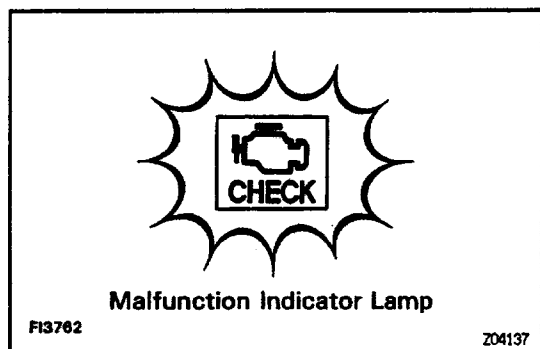
Normal mode:

To obtain an output of diagnostic trouble codes, proceed as follows:

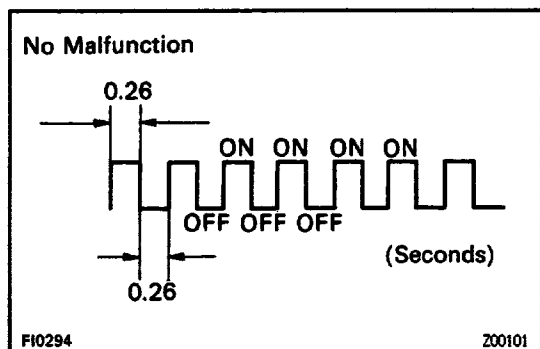
1. Initial conditions
 - (a) Battery voltage above 11 volts or more.
 - (b) Throttle valve fully closed (throttle position sensor IDL points closed).
 - (c) Transmission in neutral position.
 - (d) Accessories switched OFF.
 - (e) Engine at normal operating temperature.
2. Turn the ignition switch ON. Do not start the engine.



3. Using SST, connect terminals TE 1 and E 1 of the DLC 1.
SST 09843-18020
HINT: The DLC1 is located near the No.2 relay block.

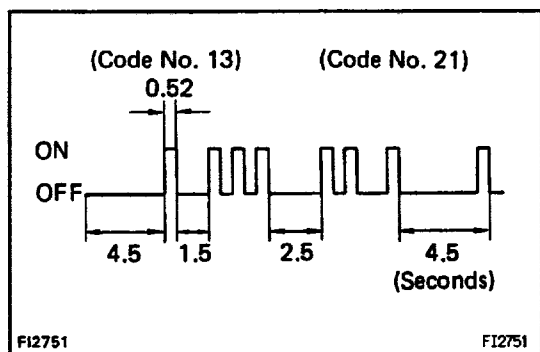


4. Read the diagnostic trouble code as indicated by the number of flashes of the Malfunction Indicator Lamp. For details of the diagnostic trouble codes, (See pages [EG2-175](#) and 176).



(a) Normal System Operation (no malfunction)

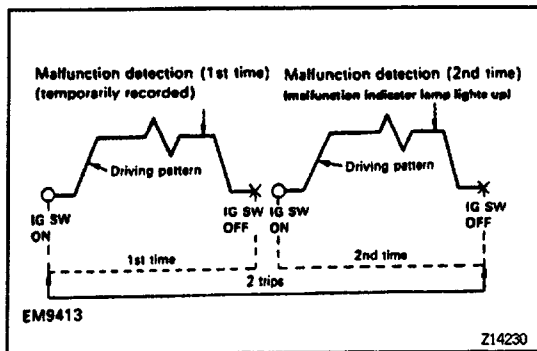
- The light will alternately blink ON and OFF at 0.26 seconds intervals.



(b) Malfunction Code Indication

- The light will blink a number of times equal to the malfunction code with pauses as follows:
 - Between the first digit and second digit, 1.5 seconds.
 - Between code and code, 2.5 seconds.
 - Between all malfunction codes 4.5 seconds.
 The diagnostic trouble code series will be repeated as long as the DLC1 terminals TE 1 and E 1 are connected.

HINT: In the event of a number of trouble codes, indication will begin from the smallest value and continue to the largest in order.



(c) 2 trip detection logic:

For diagnostic trouble codes 21, 25, 26 and 71 "2 trip detection logic" is used. With this logic, when a logic malfunction is first detected, the malfunction is temporarily stored in the ECM memory. If the same case is detected again during the second drive test, this second detection causes the malfunction indicator lamp to light up.

The 2 trip repeats the same mode a 2nd time.

(However, the IG SW must be turned OFF between the 1st time and 2nd time).

5. After the diagnosis check, remove SST.

SST 09843-18020

Test mode:

HINT:

- Compared to the normal mode, the test mode has an increased sensing ability to detect malfunctions.
- It can also detect malfunctions in the starter signal circuit, air conditioning signal and park/neutral position switch signal.
- Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in test mode.

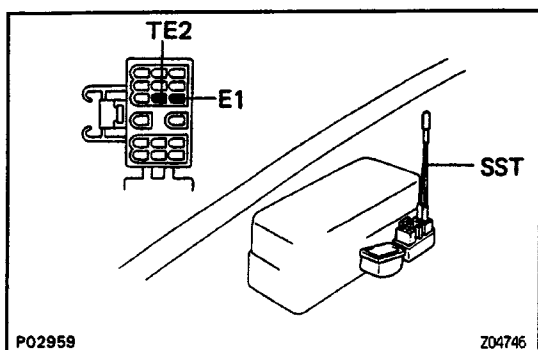
To obtain an output of diagnostic trouble codes, proceed as follows:

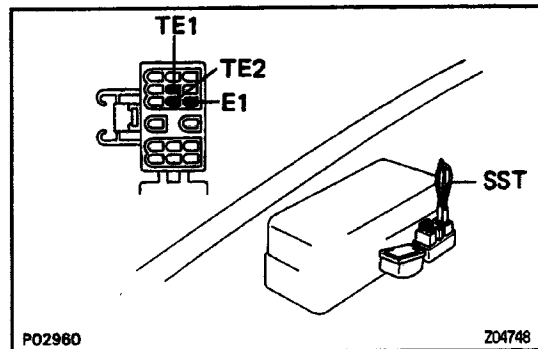
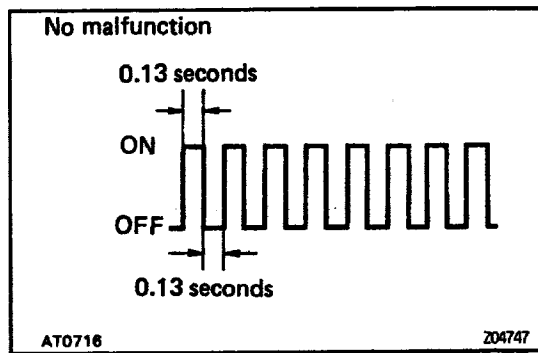
1. Initial conditions

- (a) Battery voltage 11 volts or more
- (b) Transmission in neutral position
- (c) Accessories switched OFF
- (d) Engine at normal operating temperature

2. First using SST, connect terminals TE2 and E1 of the DLC1, then turn the ignition switch ON to begin the diagnosis in the test mode.

SST 09843-18020





HINT: To confirm that the test mode is operating, check that the Malfunction Indicator Lamp flashes when the ignition switch is turned ON.

3. Start the engine and drive the vehicle at a speed of 10 km/h or higher.
4. Simulate the conditions of the malfunction described by the customer.

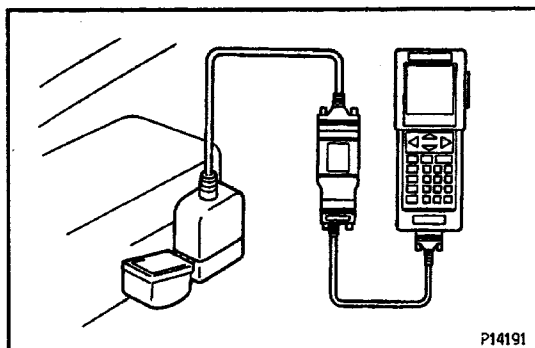
5. Connect terminals TE1 and E1 of the DLC 1.
SST 09843-18020

8. Read the diagnostic trouble code as indicated by the number of flashes of the Malfunction Indicator Lamp.
(See pages [EG2-175](#), 176)

7. After the diagnosis check, remove SST.
SST 09843-18020

HINT:

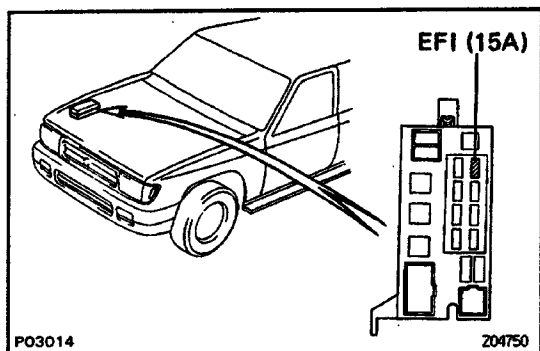
- The test mode will not start if terminals TE2 and E 1 are connected after the ignition switch is turned ON.
- The starter signal and vehicle speed signal will be diagnosed by the ECM as malfunctions, and code Nos. 42 and 43 will be output, if the operation in step 3 is not done.
- When the automatic transmission shift lever is in the "D", "2", "L" or "R" shift position, or when the air conditioning is on or when the accelerator pedal is depressed, code '51" (Switch condition signal) is output, but this is not abnormal.



DIAGNOSTIC TROUBLE CODE CHECK USING TOYOTA HAND-HELD TESTER

1. Hook up the TOYOTA hand-held tester to the DLC1.
2. Read the diagnostic trouble codes by following the prompts on the tester screen.

Please refer to the TOYOTA hand – held tester operator's manual for further details.



DIAGNOSTIC TROUBLE CODE CANCELLATION

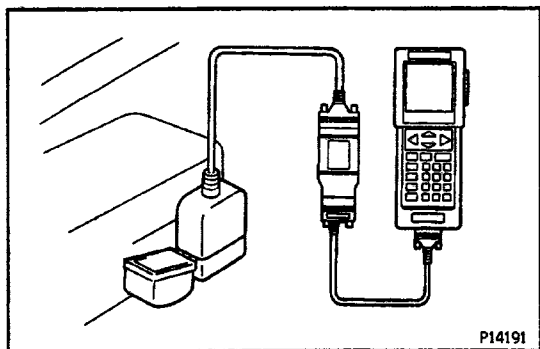
1. After repairing the trouble, the diagnostic trouble code retained in memory by the ECM must be cancelled out by removing the EFI fuse (15A) for 30 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.

HINT:

- Cancellation can also be done by removing the negative (–) terminal cable from the battery, but in this case other memory systems (radio ETR, clock etc.) will also be cancelled out.
 - If the diagnostic trouble code is not cancelled out, it will be retained by the ECM and appear along with a new code in the event of future trouble.
 - If it is necessary to work on engine components requiring removal of the negative (–) terminal cable from the battery a check must first be made to see if a diagnostic trouble code has been recorded.
2. After cancellation, road test the vehicle to check that a normal code is now read on the Malfunction Indicator Lamp. If the same diagnostic trouble code appears, it indicates that the trouble area has not been repaired thoroughly.

DIAGNOSIS INDICATION

1. When 2 or more codes are stored, the lowest number (code) will appear first.
2. All detected diagnostic trouble codes, except for code No.51 and No.53 will be retained in memory by the ECM from the time of detection until cancelled out.
3. Once the malfunction is cleared, the Malfunction Indicator Lamp on the combination meter will go off but the diagnostic trouble code(s) remain stored in ECM memory (except for code Nos.16, 43, 51 and 53).

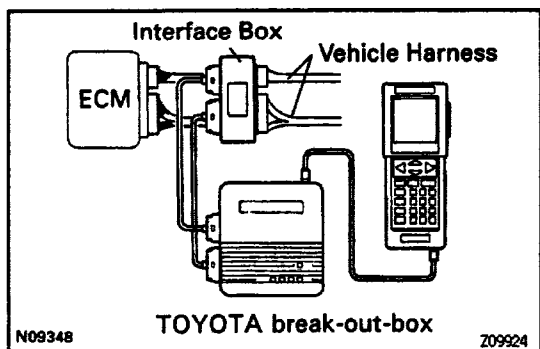


ECM DATA MONITOR USING TOYOTA HAND-HELD TESTER

1. Hookup the TOYOTA hand-held tester to the DLC1.
2. Monitor the ECM data by following the prompts on the tester screen.

HINT: TOYOTA hand-held tester has a "Snapshot" function which records the monitored data.

Please refer to the TOYOTA hand-held tester operator's manual for further details.



ECM TERMINAL VALUES MEASUREMENT USING TOYOTA BREAK-OUT-BOX AND TOYOTA HAND-HELD TESTER

1. Hookup the TOYOTA break-out-box and TOYOTA hand-held tester to the vehicle.
2. Read the ECM input/output values by following the prompts on the tester screen.

HINT: TOYOTA hand-held tester has a "Snapshot" function. This records the measured values and is effective in the diagnosis of intermittent problems.

Please refer to the TOYOTA hand – held tester / TOYOTA break-out-box operator's manual for further details.











DIAGNOSTIC TROUBLE CODES

HINT:

- If a malfunction is detected during the diagnostic trouble code check, refer to the circuit indicated in the table, and turn to the corresponding page.
- Your readings may vary from the parameters listed in the table, depending on the instruments used.

DTC No.	Number of blinks Malfunction Indicator lamp	System	*1 Mal-function Indicator Lamp		Diagnosis	Trouble Area	*2 Memory	See Page
			Normal Mode	Test Made				
-		Normal	-	-	Output when no other code is recorded.		-	-
12		RPM Signal	ON	N.A.	No G or NE signal is input to the ECM for 2 secs. or more after STA turns ON.	<ul style="list-style-type: none"> Open or short in NE, G circuit Distributor Open or short in STA circuit ECM 	○	EG2-193
13		RPM Signal	ON	ON	NE signal is not input to ECM for 0.1 sec. or more when engine speed is 1,000 rpm or more.	<ul style="list-style-type: none"> Open or short in NE circuit Distributor ECM 	○	IG-17
14		Ignition Signal	ON	N.A.	IGF signal from igniter is not input to ECM for 6 consecutive ignitions.	<ul style="list-style-type: none"> Open or short in IGF or IGT circuit from igniter to ECM Igniter ECM 	○	EG2-195
316		A/T Control Signal	ON	N.A.	Normal signal is not output from ECU CPU.	<ul style="list-style-type: none"> ECM 	x	-
21		Heated Oxygen Sensor Signal	ON		(1) Open or short in heater circuit of heated oxygen sensor for 0.5 sec. or more. (HT) (2) At normal driving speed (below 60 mph and engine speed is above 1,500 rpm), amplitude of heated oxygen sensor signal (OX) is reduced to between 0.35 - 0.70 V continuously for 60 secs. or more. *2 trip detection logic (2)	<ul style="list-style-type: none"> Open or short in heater circuit of heated oxygen sensor Heated oxygen sensor heater ECM Open or short in heated oxygen sensor circuit Heated oxygen sensor ECM 	○	EG2-199
22		Engine Coolant Temp. Sensor Signal	ON	ON	Open or short in engine coolant temp. sensor circuit for 0.5 sec. or more. (THW)	<ul style="list-style-type: none"> Open or short in engine coolant temp. sensor circuit Engine coolant temp. sensor ECM 	○	EG2-192
24		Intake Air Temp. Sensor Signal	ON	ON	Open or short in intake air temp. sensor circuit for 0.5 sec. or more. (THA)	<ul style="list-style-type: none"> Open or short in intake air temp. circuit Intake air temp. sensor ECM 	○	EG2-190
25		Air-Fuel Ratio Lean Malfunction	ON	ON	(1) Heated oxygen sensor output is less than 0.45 V for at least 90 secs. When heated oxygen sensor is warmed up (racing at 2,000 rpm) and drive at 50 -100 km/h *5	<ul style="list-style-type: none"> Engine ground bolt loose Open in E1 circuit Open in injector circuit Fuel line pressure (injector blockage, etc.) Open or short in heated oxygen sensor circuit Heated oxygen sensor Ignition system Engine coolant temp. sensor Volume air flow meter (Air intake) ECM 	○	EG2-197 EG2-199
26		Air-Fuel Ratio Rich Malfunction	ON	ON	(2) When the engine speed varies by more than 15 rpm over the preceding crankshaft position period during a period of 50 seconds during idling with the engine coolant temp. 75°C (167°F) or more. *4 2 trip detection logic-(1) and (2)	<ul style="list-style-type: none"> Engine ground bolt loose Open in E1 circuit Short in injector circuit Fuel line pressure (injector leakage, etc.) Open or short in cold start injector circuit Cold start injector Open or short in heated oxygen sensor circuit Heated oxygen sensor Engine coolant temp sensor a Volume air flow meter Compression pressure ECM 	○	

DIAGNOSTIC TROUBLE CODES (Cont'd)

DTC No.	Number of blinks Malfunction Indicator Lamp	System	*1 Malfunction Indicator Lamp		Diagnosis	Trouble Area	*2 Memory	See Page
			Normal Mode	Test Mode				
*27	 FI3294	Sub Heated Oxygen Sensor Signal	ON	ON	(1) Open or short in heater circuit of sub heated oxygen sensor for 0.5 sec. or more. (HT2) (2) When sub heated oxygen sensor is warmed up and full acceleration continued for 2 seconds, output of main heated oxygen sensor is 0.45 V or more (rich) and output of sub heated oxygen sensor is 0.45 V or less (lean). (OX2) (2 trip detection logic)	<ul style="list-style-type: none"> Open or short in heater circuit of sub heated oxygen sensor circuit Short or open in sub heated oxygen sensor circuit Sub heated oxygen sensor ECM 	O	EG2-199
31	 FI1612	Volume Air Flow Meter Signal	ON	ON	At idling, open or short detected continuously for 0.5 sec. or more in volume air flow meter circuit.	<ul style="list-style-type: none"> Open - VC Short - VC - E2 	O	EG2-190
32	 FI1613	Volume Air Flow Meter Signal	ON	ON	Open or short detected continuously for 0.5 sec. or more in volume air flow meter circuit.	<ul style="list-style-type: none"> Open - E2 Short - VS - VC 	O	EG2-190
41	 FI1614	Throttle Position Sensor Signal	•	ON	Open or short detected in throttle position sensor signal (VTA) for 0.5 sec. or more. IDL contact is ON and VTA output exceeds 1.45 V	<ul style="list-style-type: none"> Open or short in throttle position sensor circuit Throttle position sensor ECM 	O	EG2-188
42	 FI1615	Vehicle Speed Sensor Signal	ON	OFF	SPD signal is not input to the ECM for at least 8 seconds during high load driving with engine speed between 2,750 rpm and 4,000 rpm.	<ul style="list-style-type: none"> Open or short in vehicle speed sensor circuit Vehicle speed sensor ECM 	O	-
43	 FI1616	Starter Signal	N.A.	OFF	Starter signal (STA) is not input to ECM even once until engine reaches 800 rpm or more when cranking.	<ul style="list-style-type: none"> Open or short in starter signal circuit Open or short in IG SW or main relay circuit ECM 	x	EG2-193
52	 FI1618	Knock Sensor Signal	ON	Y1.A	With engine speed between 1,600 rpm - 5,200 rpm, signal from knock sensor is not input to ECM for 6 revolution. (KN K)	<ul style="list-style-type: none"> Open or short in knock sensor circuit Knock sensor (looseness, etc.) ECM 	O	-
53	 FI1619	Knock Control Signal	ON	N.A.	Engine speed is between 650 rpm and 5,200 rpm and engine control module (for knock control) malfunction is detected.	<ul style="list-style-type: none"> ECM 	x	-
71	 FI2622	EGR System Malfunction	ON	ON	With the engine coolant temp. at 0°C (32°F) or more, 240 seconds from start of EGR operation. The EGR gas temp. is less than 55°C (131°F) and the EGR gas temp. has risen less than 20°C (36°C) during the 240 seconds. *4 2 trip detection logic	<ul style="list-style-type: none"> Open in EGR gas temp. sensor circuit Open in VSV circuit for EGR EGR vacuum hose disconnected, valve stuck Clogged in EGR gas passage ECM 	O	EG2-149
51	 FI1617	Switch Condition Signal	N.A.	OFF	Displayed when A/C is ON, IDL contact OFF or shift position in "R", "D", "2", or "L" positions with the D LC1 terminals E1 and TE1 connected.	<ul style="list-style-type: none"> A/C switch circuit Throttle position sensor IDL circuit Park/Neutral position switch circuit Accelerator pedal cable ECM 	x	EG2-188

REMARKS

*1: "ON" displayed in the diagnosis mode column indicates that the malfunction indicator lamp is lighted up when a malfunction is detected. "OFF" indicates that the "CHECK" does not light up during malfunction diagnosis, even if a malfunction is detected. "N.A." indicates that the item is not included in malfunction diagnosis.

2: "O" in the memory column indicates that a diagnostic trouble code is recorded in the ECM memory when a malfunction occurs. "X" indicates that a diagnostic trouble code is not recorded in the ECM memory even if a malfunction occurs. Accordingly, output of diagnostic results is performed with the IG SW ON.

*3: Only vehicles with A/T.

*4: "2 trip detection logic" (See page EG2-171).

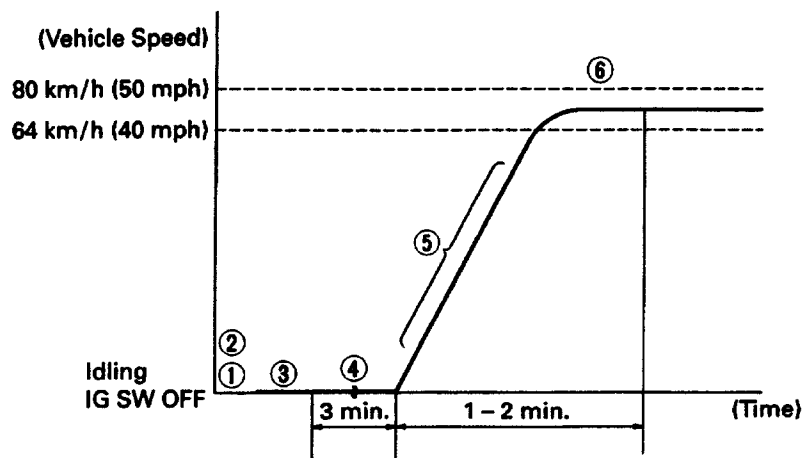
*5: No. (2) in the diagnostic contents of codes No.25 and 26 apply to California specification vehicles only, while (1) applies to all models.

*6: The malfunction indicator lamp comes on if malfunction occurs only for California specifications.

*7: Only for California specification vehicles.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)**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.

DTC 21 Heated Oxygen Sensor Circuit**Malfunction: Heated Oxygen Sensor Deterioration**

P02547

- (1) Disconnect the fuse EFI (15 Ay for 10 sec. or more, with IG switched OFF)
- (2) Initiate test mode (Connect terminal TE2 and E1 of DLC1) with IG switched OFF.
- (3) Start the engine and warm it up with all accessories switched OFF
- (4) Idle the engine for 3 min.
- (5) Accelerate gradually and maintain at approximately 1,500 rpm, or within the 1,300 to 1,700 rpm range. Turn the A/C on, and drive in "D" for automatic, or in case of manual transmission, upshift appropriately. Shift carefully so that the engine speed does not fall below 1,200 rpm. Depress the accelerator pedal gradually and maintain a steady speed to avoid engine braking.
- (6) Maintain the vehicle speed at 64 – 80 km/h (40 – 50 mph). Keep the vehicle running for 1– 2 min. after starting acceleration.

HINT: If a malfunction is detected the Malfunction Indicator Lamp will light up during step (6).

NOTICE: If this procedure is not strictly followed, you cannot detect the malfunction.

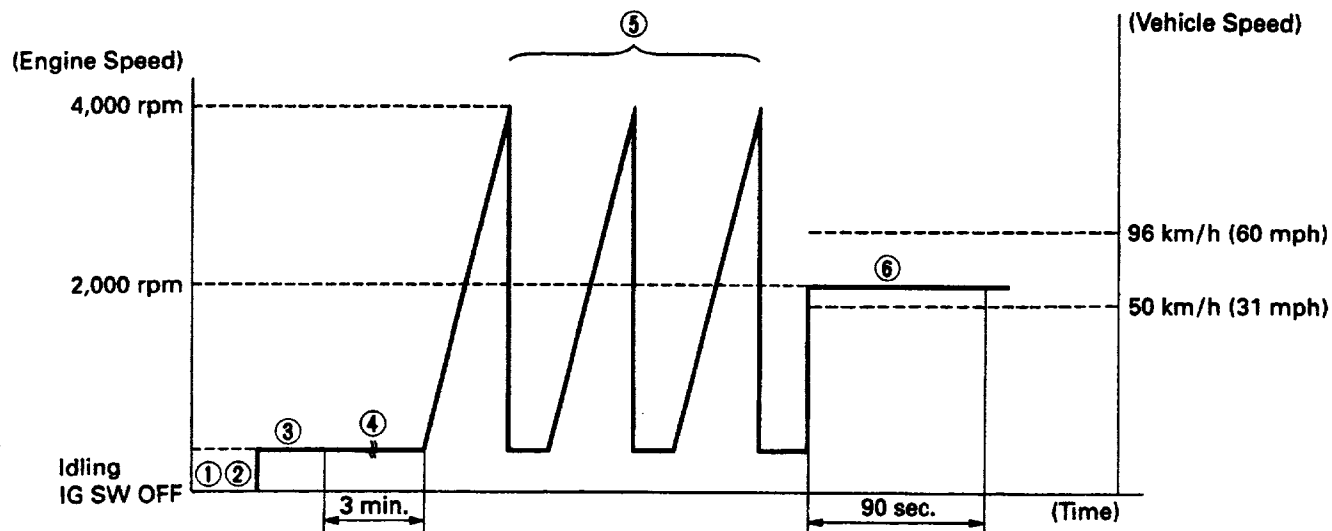
DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)**Purpose of the driving pattern.**

- (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.

DTC 25 Air Fuel Ratio Lean Malfunction

26 Air Fuel Ratio Rich Malfunction

Malfunction: Open or Short in Heated Oxygen Sensor



P02491

- (1) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switched OFF
- (2) Initiate test mode (Connect terminal TE2 and E1 of DLC1) with IG switched OFF
- (3) Start the engine and warm it up with all accessories switched OFF
- (4) Idle the engine for 3 min.
- (5) Quickly race the engine to 4,000 rpm 3 times.
- (6) Drive at 50 – 96 km/h (30 – 60 mph) (Engine speed 2,000 rpm) for 90 sec.

HINT: If a malfunction is detected the Malfunction Indicator Lamp will light up during step (6)

NOTICE: If this procedure is not strictly followed, you cannot detect the malfunction.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN

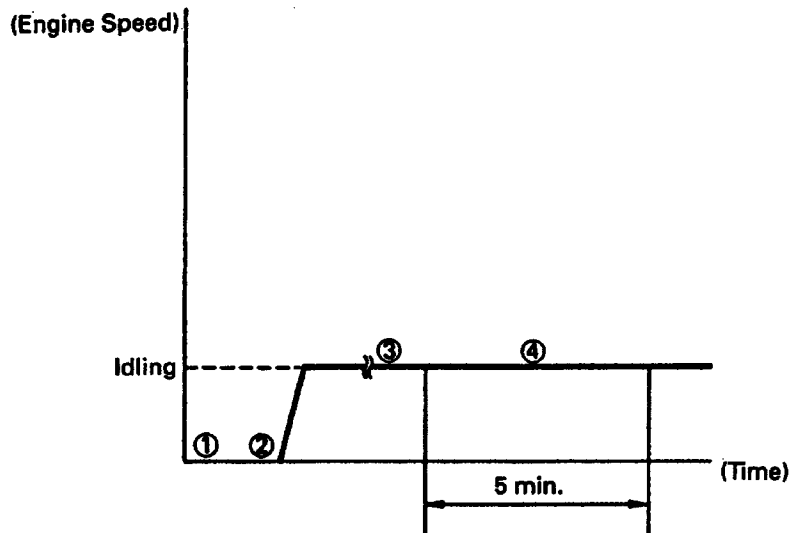
(Cont'd)

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.

DTC	25	Air Fuel Ratio Lean Malfunction
	26	Air Fuel Ratio Rich Malfunction

Malfunction: Open or Short in Injector Leak, Blockage



P02005

HINT: Before starting this test, ensure engine coolant temp. is 40°C (104°F) or less.
Before this test, check the feedback voltage for heated oxygen sensor.

- (1) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switched OFF
- (2) Initiate test mode (Connect terminal TE2 and E1 of DLC1) with IG switched OFF
- (3) Start the engine and warm it up with all accessories switched OFF
- (4) Idle the engine for 5 min.

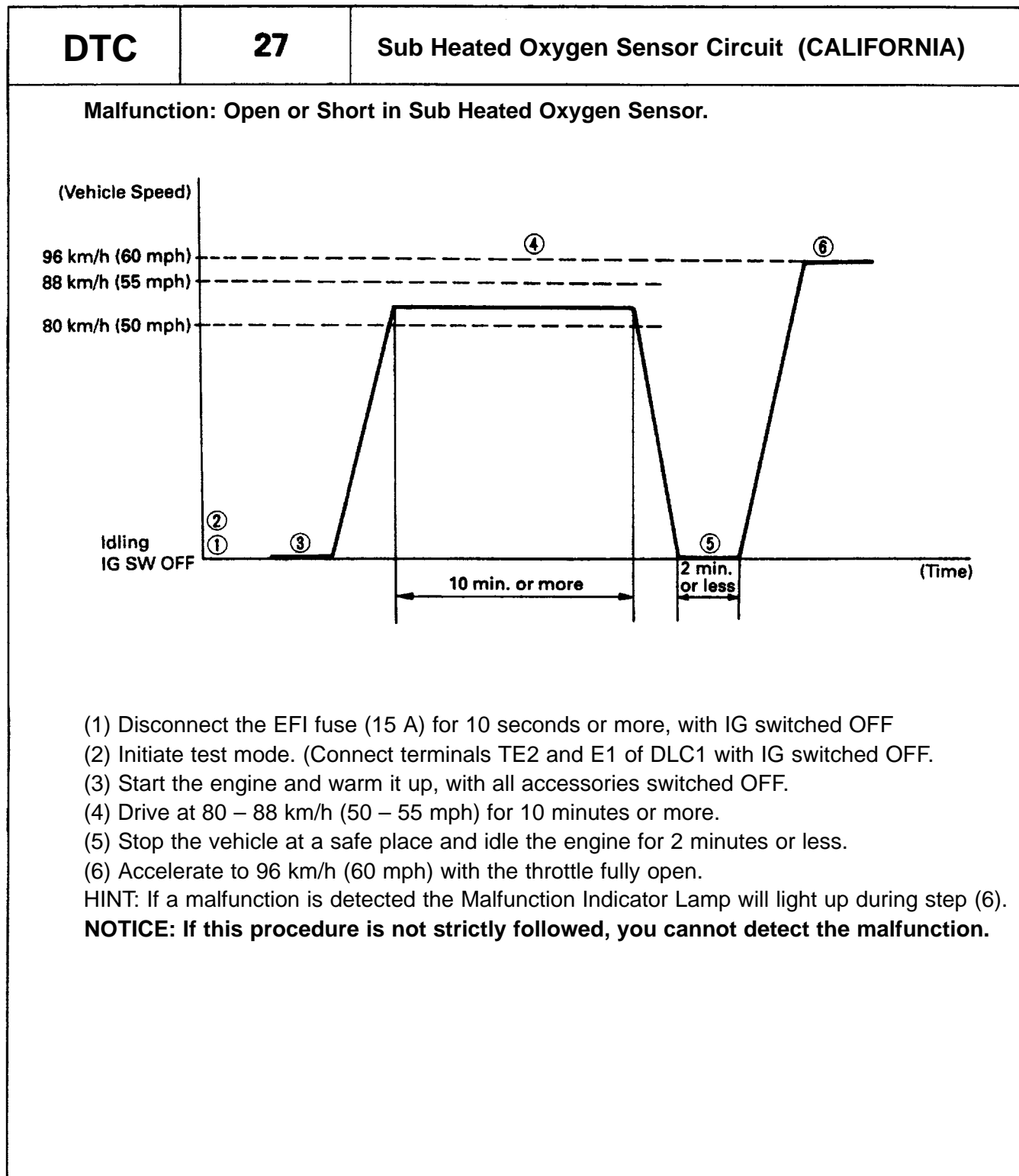
HINT If a malfunction is detected the Malfunction Indicator Lamp will light up during step (4).

NOTICE: If this procedure is not strictly followed, you cannot detect the malfunction.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

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 cleared once the repair is completed, confirming that diagnostic trouble code is no longer detected.



DIAGNOSTIC TROUBLE CODE. DETECTION DRIVING PATTERN (Cont'd)

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.

DTC	71	EGR System Malfunction
<p>Malfunction: Short in VSV Circuit for EGR, Loose EGR Hose, Valve Stuck</p> <div data-bbox="272 634 1172 1106" data-label="Figure"> </div> <p>P02545</p> <p>HINT: When start this test, engine coolant temperature is 40°C (104°F) or less.</p> <ul style="list-style-type: none"> (A) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switched OFF (B) Initiate test mode (Connect terminal TE2 and E1 of DLC1) with IG switched OFF (C) Start the engine and warm it up with all accessories switched OFF. (A) With the transmission in 4th gear ("D" position and O/D ON for A/T), drive 88–105 km/h (55 – 65 mph) for 4 min. <p>HINT: If a malfunction is detected the Malfunction Indicator Lamp will light up during step (4) .</p> <p>NOTICE: If this procedure is not strictly followed, you cannot detect the malfunction.</p>		

DIAGNOSIS CIRCUIT INSPECTION

