

DIAGNOSIS SYSTEM

EG11Z-07

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 the later table (See page [EG-223](#)) the ECM detects system malfunctions relating to the sensors or actuators.

The self-diagnosis system has 2 modes, a normal mode and a test mode.

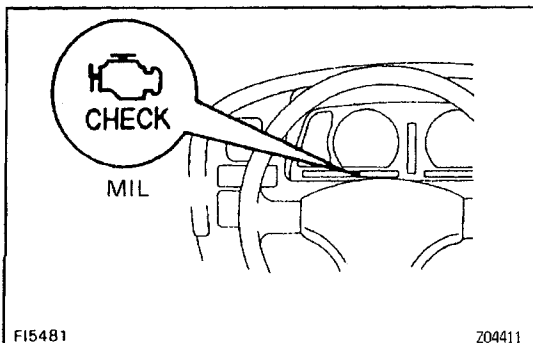
If a malfunction is detected when in the normal mode, the ECM lights up the malfunction indicator lamp to inform the driver of the occurrence of a malfunction. (For some codes the light does not come on.) The light goes off automatically when the malfunction has been repaired. But the diagnostic trouble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

The diagnostic trouble code 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.43, 51 and 53). In this case, TE2 and E1 terminals on the DLC1 should be connected as shown later. (See page [EG-220](#)).

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 to LOCK (except code Nos.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 contact, which are difficult to detect in the normal mode. This function fills up the self-diagnosis system. The test mode can be implemented by the technician following the appropriate procedures of check terminal connection and operation described later. (See page [EG-220](#))



EG121-02

MALFUNCTION INDICATOR LAMP (MIL)

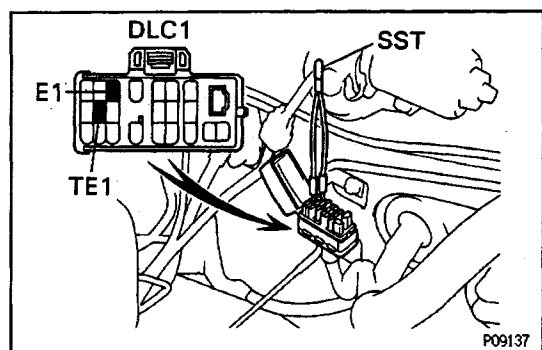
1. The malfunction indicator lamp will come on when the ignition switch is placed at ON and the engine is not running.
2. When the engine is started, the malfunction indicator lamp should go off.

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

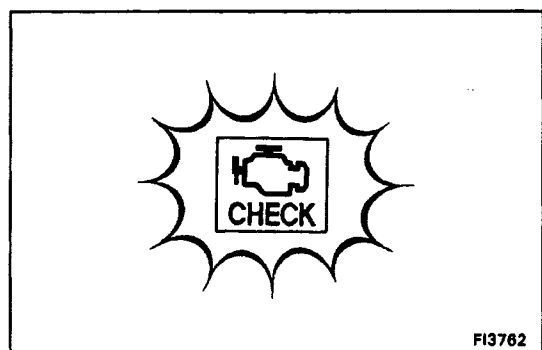
DIAGNOSTIC TROUBLE CODES OUTPUT Normal Mode

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

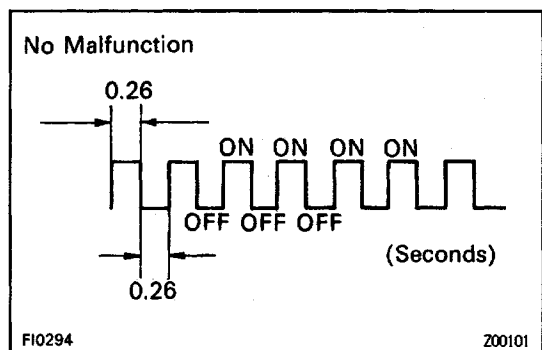
1. Initial conditions
 - (a) Battery voltage 11 V or more
 - (b) Throttle valve fully closed (throttle position sensor IDL points closed)
 - (c) Transmission in neutral position
 - (d) Accessories switched OFF
 - (e) Engine at normal operating temperature
2. Turn the ignition switch ON. Do not start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



3. Using SST, connect terminals TE1 and E1 of the DLC 1. SST 09843-18020

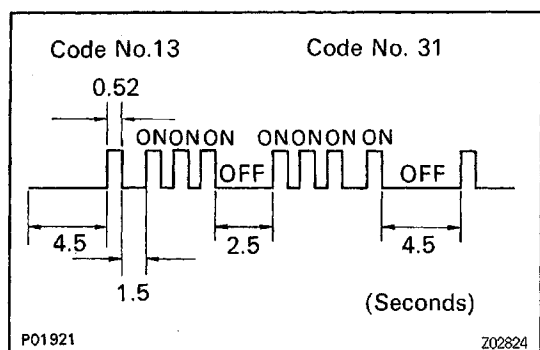


4. Read the diagnostic trouble code as indicated by the number of flashes of the malfunction indicator lamp



Diagnostic Trouble Codes (See page [EG-223](#))

- (a) Normal System Operation (no malfunction)
 - The light will alternately blink ON and OFF at 0.26 seconds intervals.

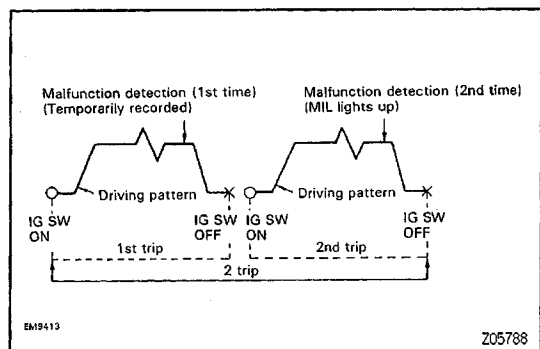


(b) Malfunction Code Indication

- In the event of a malfunction, the light will blink every 0.52 seconds. The first number of blinks will equal the first digit of a 2-digit diagnostic trouble code and, after a 1.5 seconds pause, the 2nd number of blinks will equal the 2nd. If there are 2 or more codes, there will be a 2.5 seconds pause between each code.

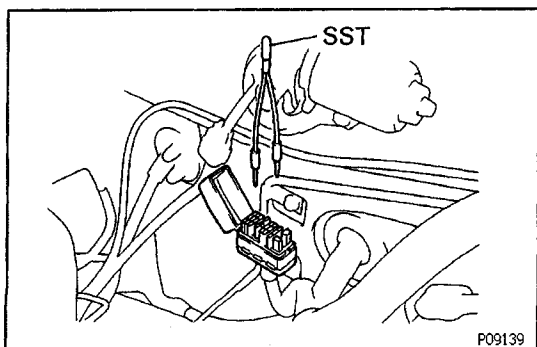
- After all the codes have been output, there will be a 4.5 seconds pause and they will all be repeated as long the terminals TE1 and E1 of the DLC1 are connected.

HINT: In the event of multiple trouble codes, indication will begin from the smaller value and continue to the larger.



(c) 2 Trip Detection Logic:

Diagnostic trouble code Nos. 25, 26 and 71 use "2 trip detection logic". With this logic, when a 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 ignition switch must be turned LOCK between the 1st time and 2nd time.) In the Test Mode, the malfunction indicator lamp lights up the 1st time a malfunction is detected.



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

Test Mode

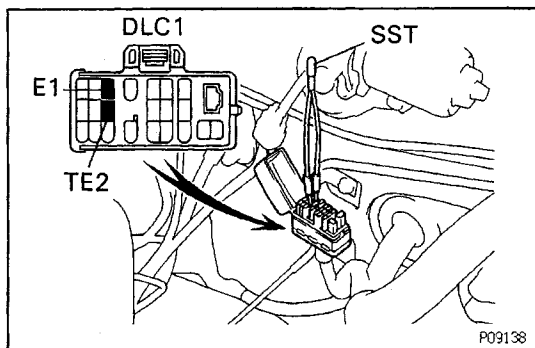
HINT:

- Compared to the normal mode, the test mode has high 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 the test mode.

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

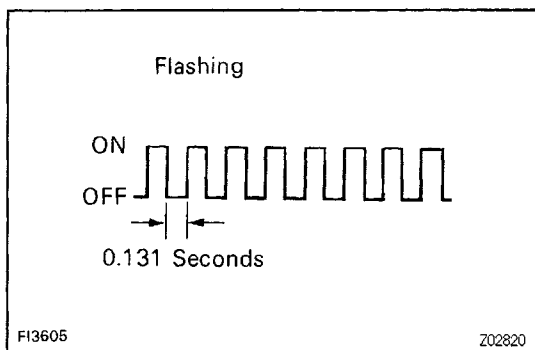
1. Initial conditions

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



2. First using SST, connect terminals TE2 and E 1 of the DLC 1.

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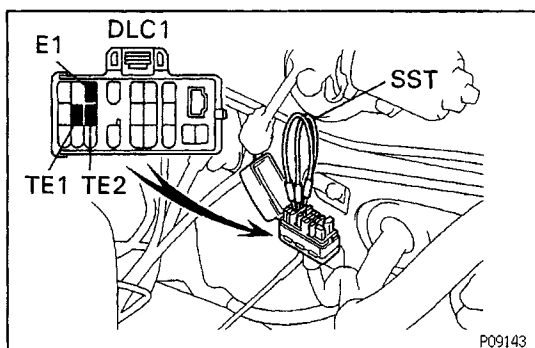


3. Turn the ignition switch ON.

HINT: To confirm that the test mode is operating, check that the malfunction indicator lamp flashes when the ignition switch is turned ON.

4. Start the engine and drive the vehicle at a speed of 10 km/h (6 mph) or higher.

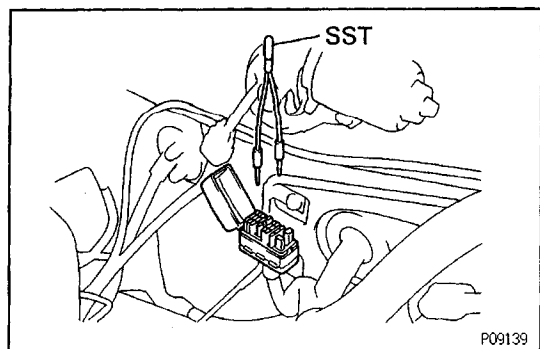
5. Simulate the conditions of the malfunction described by the customer.



6. Using SST, connect terminals TE1 and E1 of the DLC 1. SST 09843-18020

7. Read the diagnostic trouble code as indicated by the number of flashes of the malfunction indicator lamp.

(See page [EG-223](#))

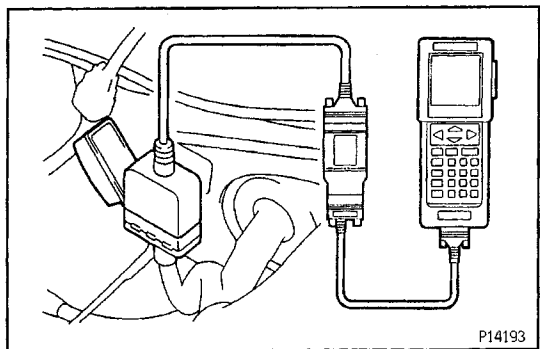


8. After the diagnosis check, remove SST.

SST 09843-18020

HINT:

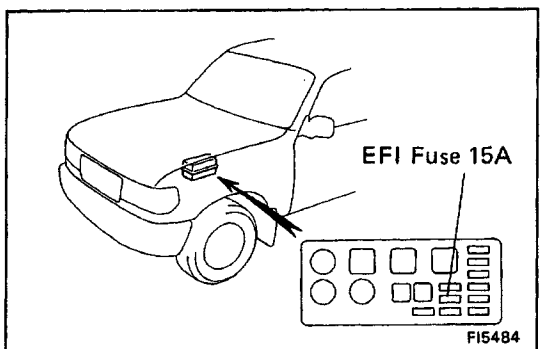
- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned ON.
- The starter signal and vehicle speed signal will be diagnosed by the ECM as malfunctions, and code Nos.42 and 43 will be output, if the operation in step 4 is not performed.
- When the automatic transmission shift lever is in the "D", "2", "L" or "R" shift position, or when the air conditioning is turn ON or when the accelerator-pedal is depressed, code No.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 repair of the trouble area, 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 to LOCK.

HINT:

- Cancellation can also be done by removing the battery negative (-) terminal, but in this case, other memory systems (clock, radio ETR 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 battery terminal, a check must first be made to see if a diagnostic trouble code has been recorded.

2. After cancellation, perform road test of 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.

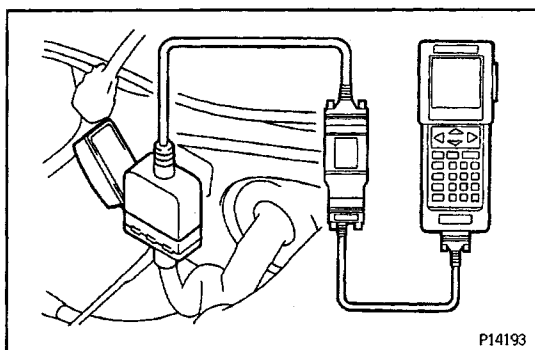
DIAGNOSIS INDICATION

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(1) When 2 or more codes are indicated, the lowest number (code) will appear first.

(2) All detected diagnostic trouble codes, except for code Nos.51 and 53 will be retained in memory by the ECM from the time of detection until canceled 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.43, 51 and 53).



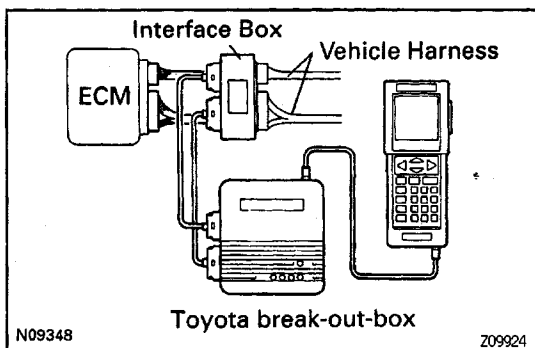
ECM DATA MONITOR USING TOYOTA HAND-HELD TESTER

EQ306-02

1. Hook up 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 BY USING MASTERLINK AND TOYOTA HAND-HELD TESTER

1. Hook up 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.





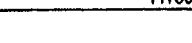


Please refer to the TOYOTA hand - held tester/ TOYOTA break-out-box operator's manual for further- details.

DIAGNOSTIC TROUBLE CODES



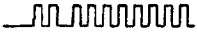







EG126-03

HINT:


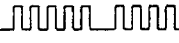

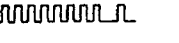
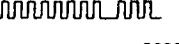
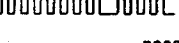
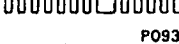

- If a malfunction is detected during the diagnostic trouble code check, refer to the circuit indicated in the table, and turn to the corresponding page.
- Your readings may vary from the parameters listed in the table, depending on the instruments used.

DTC No.	Number of Malfunction Indicator Lamp Blinks	System	Malfunction Indicator Lamp		Diagnosis	Trouble area	Memory ^{.2}
			Normal Mode	Test Mode			
—	 F11804	Normal	—	—	No malfunctions detected.	—	—
12	 F11806	RPM Signal	ON	N.A.	No "NE" or "G1", "G2" signal to ECM within 2 seconds after cranking the engine.	<ul style="list-style-type: none"> •Distributor circuit •Distributor •Starter signal circuit •ECM 	○
13	 F11807	RPM Signal	ON	ON	No "NE" signal is to ECM for 0.1 sec. and more when engine speed is above 1,000 rpm and start OFF.	<ul style="list-style-type: none"> •Distributor circuit •Distributor •ECM 	○
14	 F11808	Ignition Signal	ON	N.A.	No "IGF" signal to ECM 6 times in succession, and no signal input within 256 msec.	<ul style="list-style-type: none"> •Igniter and ignition coil circuit •Igniter and ignition coil •Starter signal circuit •ECM 	○
21	 F11809	No. 1 Heated Oxygen Sensor Signal	ON	ON	At normal driving speed (below 100 km/h and engine speed is above 1,700 rpm), amplitude of heated oxygen sensor signal (JOX 1) is reduced to between 0.35 - 0.70 V continuously for 60 seconds or more.	<ul style="list-style-type: none"> •Heated oxygen sensor circuit •Heated oxygen sensor •ECM 	○
		No. 1 Heated Oxygen Sensor Heater Signal			Open or short circuit in heated oxygen sensor heater. (HT 1)	<ul style="list-style-type: none"> •Heated oxygen sensor circuit •Heated oxygen sensor •ECM 	
22	 F11810	Engine Coolant Temp. Sensor Signal	ON	ON	Open or short circuit in engine coolant temp. sensor signal for 0.5 sec. or more. (THW)	<ul style="list-style-type: none"> •ECT sensor circuit •ECT sensor •ECM 	○
24	 F11811	Intake Air Temp. Sensor Signal	.3 ON	ON	Open or short circuit in Intake air temp. sensor signal for 0.5 sec. or more. (THA)	<ul style="list-style-type: none"> •IAT sensor circuit •IAT sensor •ECM 	○

DIAGNOSTIC TROUBLE CODES (Cont'd)

DTC No.	Number of Malfunction Indicator Lamp Blinks	system	Malfunction Indicator Lamp		Diagnosis	Trouble area	Memory
			Normal Mode	Test Mode			
25	 FI2582	Air-Fuel Ratio Lean Malfunction	ON	ON	(1) Heated oxygen sensor output at 2,000 rpm is less than 0.45 V for at least 90 seconds when warmed up. Applies only to code 25 and for California models, excepting high-altitude areas. (2) When the engine speed varies by more than 15 rpm over the preceding crank angle period during a period of 30 seconds during idling with the intake air temp. 0°C (32°F) or above. (3) When the difference between the air-fuel ratio feed back compensation value of the front and rear exceeds 15% of the two values in a period of 10 seconds while the engine speed is 2,000 rpm or more and the engine coolant temp. is between 70°C (158°F) and 95°C (203°F) *6 (2 trip detection logic) (1) - (3)	<ul style="list-style-type: none"> •Engine ground bolt loose •Open in E11 circuit •Injector circuit •Injector •Fuel line pressure •VAF meter •PAIR system •Heated oxygen sensor circuits •Heated oxygen sensors •Ignition system •ECM 	○
26	 FI2563	Air-Fuel Ratio Rich Malfunction	ON	ON		<ul style="list-style-type: none"> •Engine ground bolt loose •Open in E 1 circuit •Injector circuit •Injector •Fuel line pressure •ECT sensor •Compression pressure •ECM 	○
28	 FI2698	No.2 Heated Oxygen Sensor Signal	ON	ON	At normal driving speed (below 100 km/h and engine speed is above 1,700 rpm), amplitude of heated oxygen sensor signal (OX2) is reduced to between 0.35 - 0.70 V continuously for 60 seconds or more.	<ul style="list-style-type: none"> •Heated oxygen sensor circuit •Heated oxygen sensor •ECM 	○
		No.2 Heated Oxygen Sensor Heater Signal			Open or short circuit in heated oxygen sensor heater. (HT2)	<ul style="list-style-type: none"> •Heated oxygen sensor circuit •Heated oxygen sensor •ECM 	
31	 FI1612	Volume Air Flow Meter Signal	ON	ON	When idle contacts are closed and engine speed is 1,500 rpm or less, there is an open circuit in VC and VS signal or a short circuit between VS and E2.	<ul style="list-style-type: none"> •VAF meter circuit •VAF meter •EC YA 	○
32	 FI1613	Volume Air Flow Meter Signal	ON	ON	Open circuit in E2 or short circuit between VC and VS.	<ul style="list-style-type: none"> •VAF meter circuit •VAF meter •ECM 	○
35	 FI2699	BARO Sensor Signal	ON	ON	Open or short circuit in BARO sensor signal for 0.5 sec. or more.	•ECM	○
41	 FI1614	Throttle Position Sensor Signal	ON	ON	Open or short circuit in throttle position sensor signal for 0.5 sec. or more.	<ul style="list-style-type: none"> •TP sensor circuit •TP sensor •ECM 	○
42	 FI1615	Vehicle Speed Sensor Signal	OFF	OFF	No "SPD" signal for 8 seconds, when engine speed 2,700 rpm or more and with vehicle not moving and Break OFF.	<ul style="list-style-type: none"> •Vehicle speed sensor circuit •Vehicle speed sensor •ECM 	○
43	 FI1616	Starter Signal	N.A.	OFF	No "STA" signal to ECM until engine speed reaches 800 rpm with vehicle not moving.	<ul style="list-style-type: none"> •Ignition switch circuit •Ignition switch •ECM 	×
52	 BE3835	No. 1 Knock Sensor Signal (front side)	ON	N.A.	No No. 1 knock sensor signal to ECM for 6 crank revolutions with engine speed between 1,800 rpm and 5,200 rpm.	<ul style="list-style-type: none"> •Open or short in No. 1 knock sensor circuit. •No.1 knock sensor (looseness) •ECM 	○

DIAGNOSTIC TROUBLE CODES (Cont'd)

DTC No.	Number of Malfunction Indicator Lamp Blinks	System	*1 Malfunction Indicator for Lamp		Diagnosis	Trouble area	Memory
			Normal Mode	Test Mode			
53	 BF3935	Knock Control Signal	ON	N.A.	No knock control signal to ECM for 12 crank revolutions with engine speed between 1,800 rpm and 5,200 rpm.	•ECM	×
55	 BF3935	No.2 Knock Sensor Signal (rear side)	ON	N.A.	No No. 2 knock sensor signal to ECM for 6 crank revolutions with engine speed between 1,800 rpm and 5,200 rpm.	•Open or short in No. 2 knock sensor circuit •No.2 knock sensor (looseness) •ECM	○
71	 FI2622	EGFi System Malfunction	ON	ON	60 seconds after start of EGR operation, EGR gas temp. is less than 70°C (158°F) and the following in (a)-(c) conditions also occurs: (a) Engine coolant temp.: 53°C (127°F) or more (b) Engine speed: 1,200 rpm or more (c) Intake air temp.: 0 °C (32 ° F) or more *6 (2 trip detection logic).	•EGR valve •EG R hose •EGR gas temp. sensor circuit •EGR gas temp. sensor •VSV for EGR •VSV circuit for EGR •ECM	○
81	 P09304	TCM Communication	ON	N.A.	Open in ECT 1 circuit for 2 sec. or more.	• ECT 1 circuit	○
83	 P09304	TCM Communication	ON	N.A.	Open in ESA 1 circuit for 0.5 sec., after 0.5 sec. at idle or idle signal faulty.	• ESA 1 circuit	○
84	 P09304	TCM Communication	ON	N.A.	Open in ESA2 circuit for 0.5 sec., after 0.5 sec. at idle or idle signal faulty.	• ESA2 circuit	○
85	 P09304	TCM Communication	ON	N.A.	Open in ESA3 circuit for 0.5 sec., after 0.5 sec. at idle or idle signal faulty.	• ESA3 circuit	○
51	 FI1617	Switch Condition Signal	N.A.	OFF	No "IDL" signal, "NSW" signal or "A/C" signal to ECM, with the DLC 1 terminals E 1 and TE 1 connected and starter OFF.	•A/C switch circuit •A/C switch •A/C amplifier •TP sensor IOL circuit •PNP switch circuit •PNP switch •Acceleration pedal and cable •ECM	×

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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 is detected.

2: "0" 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.

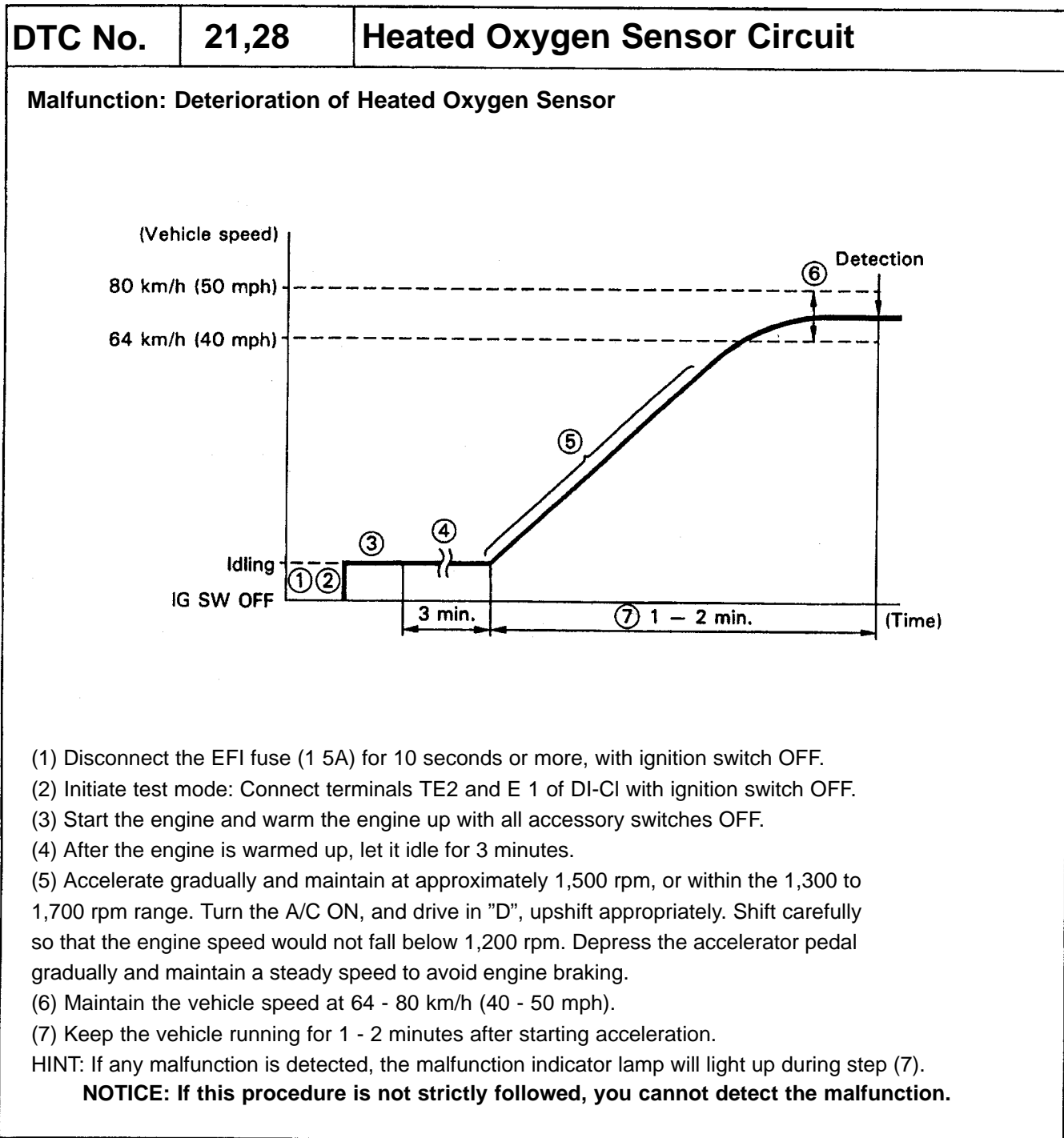
Accordingly, output of diagnostic results is performed with the ignition switch ON.

3: "2 trip detection logic" (See page [EG-219](#))

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.



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 No.	25	Air-Fuel Ratio Lean Malfunction
	26	Air-Fuel Ratio Rich Malfunction
<p>Malfunction: Open or Short in Heated Oxygen Sensor</p> <p>(1) Disconnect the EFI fuse (15 A) for 10 seconds or more, with ignition switch OFF.</p> <p>(2) Initial test mode: Connect terminal TE2 and E 1 of DLC 1 with ignition switch OFF.</p> <p>(3) Start the engine and warm the engine up, with all accessory switches OFF.</p> <p>(4) After the engine is warmed up, let it idle for 3 minutes.</p> <p>(5) Accelerate rapidly to 4,000 rpm 3 times.</p> <p>(6) Maintain 2,000 rpm for 90 seconds.</p> <p>HINT: If a malfunction is detected, the malfunction indicator lamp will light up during step (6).</p> <p>NOTICE: If this procedure is not strictly followed, you cannot detect the malfunction.</p>		

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 No.	25	Air-Fuel Ratio Lean Malfunction
	26	Air-Fuel Ratio Rich Malfunction
Malfunction: Open or Short in Heated Oxygen Sensor, Open or Short in Injector Leak, Blockage, Loose Engine Ground Bolt		
<div style="text-align: center;"> <p>The graph illustrates the driving pattern for detecting an Air-Fuel Ratio Lean or Rich Malfunction. The left y-axis represents Engine speed in rpm, with markers for Idling and 2,000 – 2,300 rpm. The right y-axis represents Vehicle speed in km/h, with a marker for 88 – 95 km/h (55 – 59 mph). The x-axis represents Time. The sequence of steps is as follows:</p> <ul style="list-style-type: none"> ① IG SW OFF ② Idling ③ Idling (3 min) ④ Idling ⑤ 2,000 – 2,300 rpm (2 min) ⑥ 88 – 95 km/h (55 – 59 mph) (2 min) ⑦ Idling (2 min) ⑧ 2,000 – 2,300 rpm (2 min) </div>		
<p>HINT: Before this test, check the feedback voltage for heated oxygen sensor.</p> <p>(1) Disconnect the EFI fuse (15A) for 10 seconds or more, with ignition switch OFF.</p> <p>(2) Initiate test mode: Connect terminals TE2 and EI of DLC1 with ignition switch OFF.</p> <p>(3) Start and warm up the engine.</p> <p>(4) After the engine is warmed up, let it idle for 3 minutes.</p> <p>(After the engine has started, do not depress the accelerator pedal.)</p> <p>(5) Accelerate and maintain at 2,000 to 2,300 rpm for 2 minutes.</p> <p>(6) Drive the vehicle at 88 - 95 km/h (55 to 59 mph) for 2 minutes.</p> <p>(7) Stop at a safe place and idle for 2 minutes.</p> <p>(8) Accelerate and maintain at 2,000 to 2,300 rpm for 2 minutes.</p> <p>HINT: If a malfunction is detected, the malfunction indicator lamp will light up during step (8).</p> <p>NOTICE: If this procedure is not strictly followed, you cannot detect the malfunction.</p>		

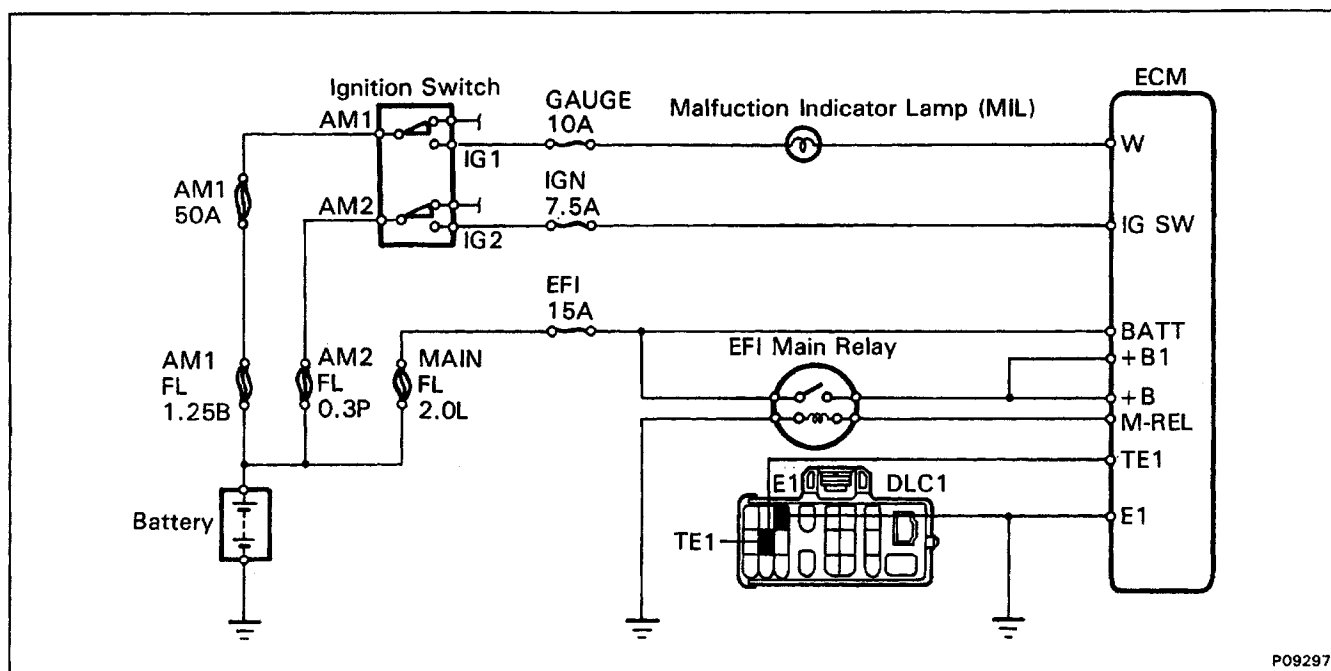
DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

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 No.	71	EGR System Malfunction
<p>Malfunction: Short in VSV Circuit for EGR, Loose EGR Hose, Valve Stuck</p>		
<p>(Vehicle speed)</p> <p>105 km/h (65 mph)</p> <p>88 km/h (55 mph)</p> <p>Idling</p> <p>IG SW OFF</p> <p>① ② ③ ④</p> <p>5 min.</p> <p>(Time)</p>		
<p>(1) Disconnect the EFI fuse (15 A) for 10 seconds or more, with ignition switch OFF.</p> <p>(2) Initiate test mode: Connect terminals TE2 and E 1 of DLC 1 with ignition switch OFF.</p> <p>(3) Start and warm up the engine.</p> <p>(4) With the transmission in "D" position and A/C OFF, drive at 88 - 105 km/h (55 - 65 mph) for 5 minutes.</p> <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



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