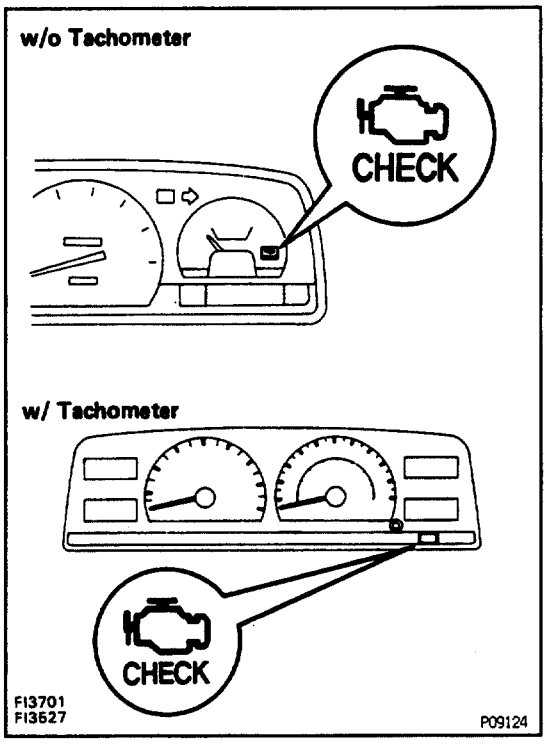
DIAGNOSIS SYSTEM

DESCRIPTION

The ECM contains a built–in self–diagnosis system which detects troubles within the engine signal network and flashes the Malfunction Indicator Lamp in the combination meter.

By analyzing various signals shown in the table (See pages EG1–118, EG1–119) the detects system malfunctions which are related to the various operating parameter sensors or to the actuator.

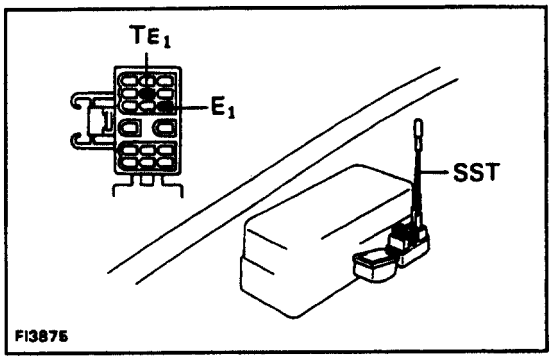
The ECM stores the failure code associated with the detected failure until the diagnosis system is cleared by removing the EFI fuse with the ignition switch off. The Malfunction Indicator Lamp in the combination meter informs the driver that a malfunction has been detected. The light goes automatically when the malfunction has been corrected.



MALFUNCTION INDICATOR LAMP

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.

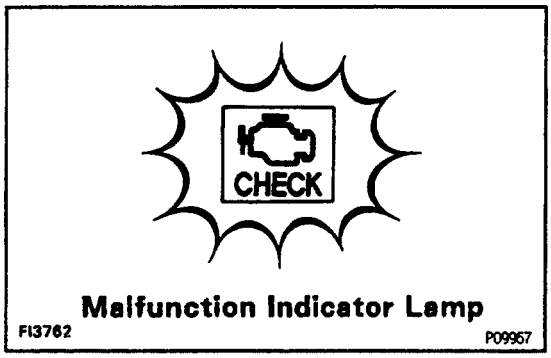
   If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.



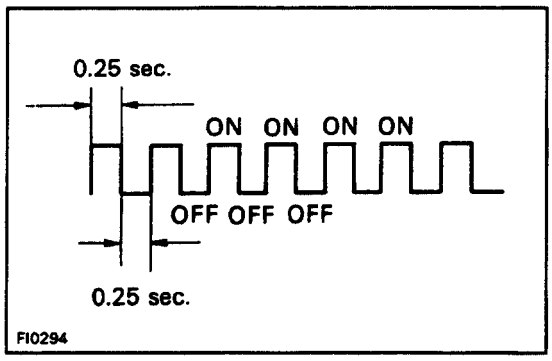
DIAGNOSTIC TROUBLE CODES OUTPUT

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

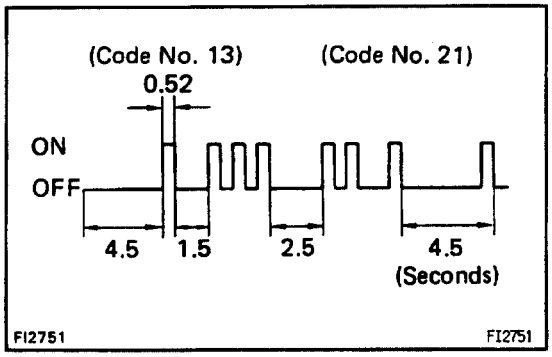
1. Initial conditions
(a) Battery voltage 11 volts or more.
(b) Throttle valve fully closed (throttle position sensor IDL points closed).
(c) Transmission in neutral range.
(d) Accessories switched OFF.
(e) Engine at normal operating temperature.
2. Turn the ignition switch ON. Do not start the engine.
3. Using SST, connect terminals TE_1 and E_1 of the DLC1.
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.
Diagnostic trouble code (See page EG1–118, EG1–119)



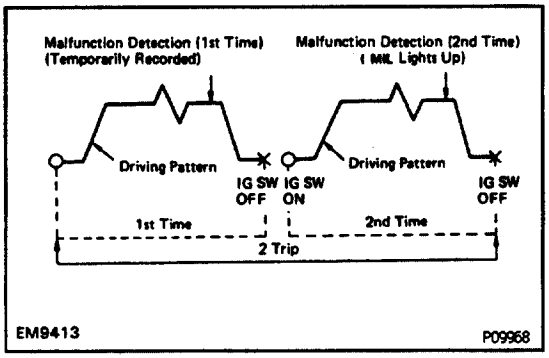
(a) Normal System Operation
- The lamp will blink 2 times per second.



(b) Malfunction Code Indication
- The lamp will blink a number of times equal to the malfunction code with pauses as follows:
  1. Between the first digit and second digit, 1.5 seconds.
  2. Between code and code, 2.5 seconds.
  3. Between all malfunction codes, 4.5 seconds.

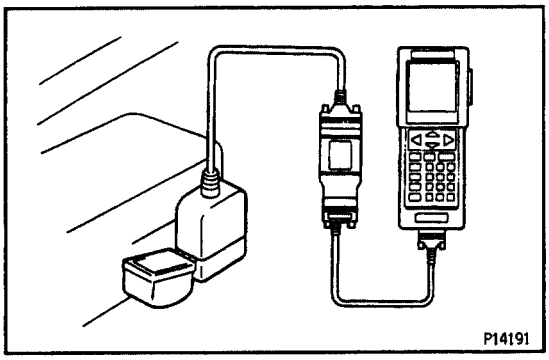
The diagnostic trouble code series will be repeated as long as the DLC1 terminals TE_1 and E_1 are connected.

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



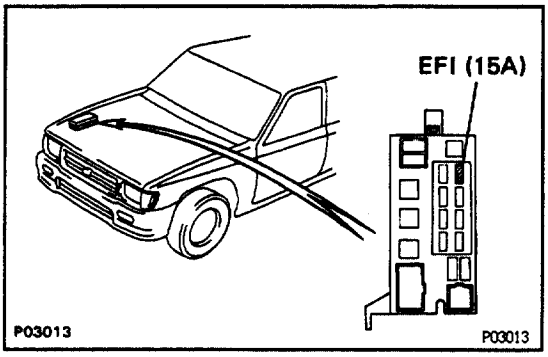
(c) 2 trip detection logic:
The diagnostic trouble codes 21, 25, 26, 27 and 71 use "2 trip detection logic". With this logic, when a logic malfunction is first detected, the malfunction is temporarily stored in the ECM memory. If the same case is detected again during the second drive test, this second 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 diagnostic check, remove SST.
SST 09843–18020



DIAGNOSTIC TROUBLE CODE CHECK BY 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.

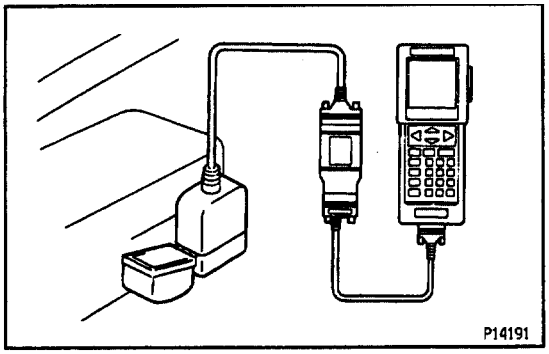


DIAGNOSTIC TROUBLE CODES CANCELLATION

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 off.
   HINT:
   - Cancellation can also be done by removing the negative (–) terminal cable of the battery, but in this case other memory systems (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 negative (–) terminal cable from the battery, check must first be made to see if a diagnostic trouble code has been recorded.
2. After cancellation, road test the vehicle, if necessary, confirm 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.

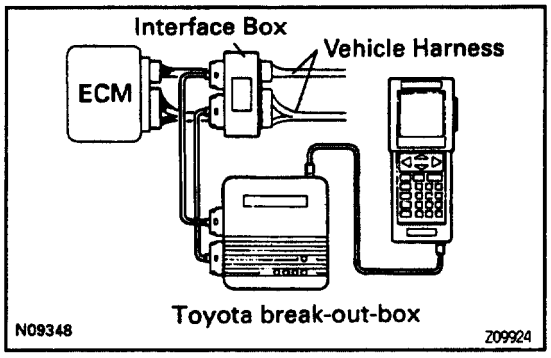
DIAGNOSIS INDICATION

(1) When 2 or more codes are indicated, 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 instrument panel will go off but the diagnostic trouble code (s) remain stored in ECM memory (except for code 51 and 53).



ECM DATA MONITOR USING TOYOTA HAND–HELD TESTER

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 USING TOYOTA BREAK–OUT–BOX 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

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	MIL	Diagnosis	Trouble Area	*2 Memory	See Page
–	 FI1401	Normal	–	No trouble code is recorded.	———	–	–
12	 FI1389	RPM Signal	ON	No NE signal is input to the ECM for 2 secs. or more after STA turns ON.	•Open or short in NE circuit •Distributor •Open or short in STA circuit •ECM	O	IG–4 EG1–136 EG1–154 EG1–172
13	 FI1390	RPM Signal	ON	NE signal is not input to ECM for 300 msecs. or more when engine speed is 1,500 rpm or more.	•Open or short in NE circuit •Distributor •ECM	O	IG–4
14	 FI1391	Ignition Signal	ON	IGF signal from igniter is not input to ECM for 4 consecutive ignitions.	•Open or short in IGF or IGT circuit from igniter to ECM •Igntier •ECM	O	EG1–138 EG1–156 EG1–174
21	FI1400	Heated Oxygen Sensor Signal	ON	(1) Open or short in heater circuit of heated oxygen sensor for 500 msec. or more. (HT) (2) At normal driving speed (below 50 mph and engine speed is above 1,700 rpm), amplitude of heated oxygen sensor signal (OX1) is reduced to between 0.35 – 0.70 V continuously for 60 secs. or more. *4 2 trip detection logic–(2)	•Open or short in heater circuit of main oxygen sensor •Heated oxygen sensor heater •ECM ——— •Open or short in main oxygen sensor circuit •Heated oxygen sensor •ECM	O	EG1–142 EG1–160 EG1–178
22	 FI1392	Engine Coolant Temp Sensor Signal	ON	Open or short in engine coolant temp. sensor circuit for 500 msec. or more. (THW)	•Open or short in engine coolant temp. sensor circuit •Engine coolant temp. sensor •ECM	O	EG1–135 EG1–153 EG1–171
24	 FI1611	Intake Air Temp. Sensor Signal	ON	Open or short in intake air temp. sensor circuit for 500 msec. or more. (THA)	•Open or short in intake air temp. circuit •Intake air temp. sensor •ECM	O	EG1–133 EG1–151 EG1–169
25	FI2562	Air–Fuel Ratio Lean Mal–function	ON	(1) Oxygen sensor output is less than 0.45 V for at least 90 secs. When oxygen sensor is warmed up (racing at 2,000 rpm) –Only for code 25 *4 (2) When the air–fuel compensation value flactuates more than 20% from the ECM set range within 60 secs period while driving at 15km/h (9mph) or more at collant temp. of 70°C (158°F) or above. *4 2 trip detection logic–(1) and (2)	•Engine ground bolt loose •Open in E1 circuit •Open in injector circuit •Fuel line pressure (injector blockage, ect.) •Open or short in heated oxygen sensor circuit. •Heated oxygen sensor •Ignition system •Engine coolant temp. sensor •Volume air flow meter (Air intake)* •ECM	O	EG1–142 EG1–160 EG1–178
26	FI2563	Air–Fuel Ratio Rich Mal-function	ON		•Engine ground bolt loose •Open in E1 circuit •Short in injector circuit •Fuel line pressure (injector leakage, ect.) •Open or short in cold start injector circuit. •Cold start sensor •Open or short in heated oxygen sensor circuit •Heated oxygen sensor •Engine coolant temp. sensor •Volume air flow meter •Compresssion pressure •ECM	O	EG1–140 EG1–158 EG1–176

DIAGNOSTIC TROUBLE CODES (Cont'd)

DTC No.	Number of blinks Malfunction Indicator Lamp	System	MIL	Diagnosis	Trouble Area	*2 Memory	See Page
*5 27	 FI3294	Sub Heated Oxygen Sensor Signal	ON	(1) When sub–oxygen sensor is warmed up and full acceleration continued for 2 seconds, output of main oxygen sensor is 0.45V or more (rich) and output of sub–oxygen sensor is 0.45V or less (lean. (OX2) (2) Open short detected continuously for 500 msec. or more in sub–oxygen sensor heater circuit. *4 2 trip detection logic–(2)	•Short or open in sub–heated oxygen sensor circuit •Sub–heated oxygen sensor •Open or short in sub–heated oxygen sensor heater •ECM	O	EG1–142 EG1–160 EG1–178
31	FI1394	Volume Air Flow Meter Signal	ON	Open or short detected continuously for 500 msec. or more in volume air flow meter circuit. •Open – VC or E2 •Short – VC – E2 or VS	•Open or short in volume air flow meter circuit •Volume air flow meter •ECM	O	EG1–133 EG1–151 EG1–169
41	FI1396	Throttle Position Sensor Signal	ON	Open or short detected in throttle position sensor signal (VTA) for 500 msec. or more.	•Open or short in throttle position sensor circuit •Throttle position sensor •ECM	O	EG1–132 EG1–150 EG1–168
42	 FI1397	Vehicle Speed Sensor Signal	OFF	SPD signal is not input to the ECM for at least 8 seconds during high load driving with engine speed between 2,200 rpm and 5,000 rpm	•Open or short in vehicle speed sensor circuit •Vehicle speed sensor •ECM	O	–
43	 FI1398	Starter Signal	OFF	Starter singal (STA) is not input to ECM even once until engine reaches 800 rpm or more when cranking.	•Open or short in starter signal circuit •Open or short in IG SW or main relay circuit •ECM	O	EG1–136 EG1–154 EG1–172
52	 FI1618	Knock Sensor Signal	ON	With engine speed 2,000 rpm or more signal from knock sensor is not input to ECM for 25 revolution. (KNK)	•Open or short in knock sensor circuit •Knock sensor (looseness, ect.) •ECM	O	–
53	 FI1619	Knock Control Signal	ON	The engine control computer (for knock control) malfunction is detected.	•ECM	x	–
71	FI2622	EGR System Mal–function	ON	With the coolant temp. at 65°C (149°F) or more, 60 seconds from start of EGR operation. The EGR gas temp. is less than 70°C (158°F) and the EGR gas temp. has risen less than 3°C during the 50 seconds. *4 2 trip detection logic	•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	EG1–144 EG1–162 EG1–180
51	 FI1399	Switch Condition Signal	OFF	Displayed when IDL contact OFF or shift position is "R", "D", "2", or "1" ranges with the check terminals E1 and TE1 connected.	•Throttle position sensor IDL circuit •PNP switch circuit •Accelerator pedal, cable •ECM	x	EG1–131 EG1–149 EG1–167

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 MIL does not light up during malfunction diagnosis, even if a malfunction is detected.

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

*4: "2 trip detection logic" (See page EG–)

*5: Only for California specification vehicles.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

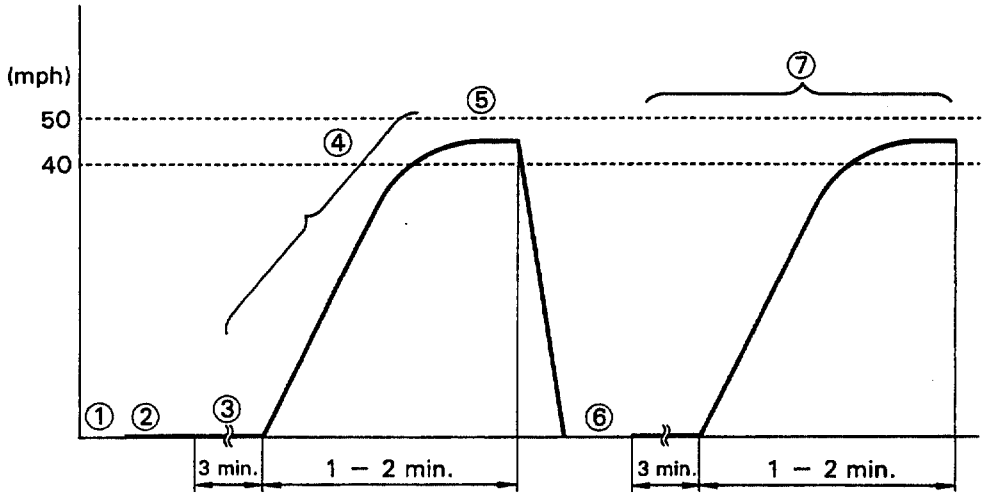
Purpose of the driving pattern.

(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



P02539

(1) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switch OFF.

(2) Start the engine and warm the engine up with all ACC switched OFF.

(3) After the engine is warmed up, let it idle for 3 min.

(4) Accelerated graually and maintain at approximately 1,500 rpm. or within the 1,300 to 1700 rpm range. Turn the A/C on, ang drive in "D" for automatic, or in case of manual transmission, upshift appropriately. Shift carefully so that the engine speed would not fall below 1,200 rpm. Depress the accelerator pedal gradually and maintain a steady speed to avoid engine braking.

(5) Maintain the vehicle speed at 40 – 50 mph.
Keep the vehicle running for 1 – 2 min. after starting acceleration.

(6) After driving, stop at a safe place and turn the IG switch OFF for 3 sec. or more.

(7) Start the engine and perform steps (3), (4) and (5) again.

HINT: If a malfunction is detected, the Malfunction Indicator Lamp will light up during step (7).

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

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

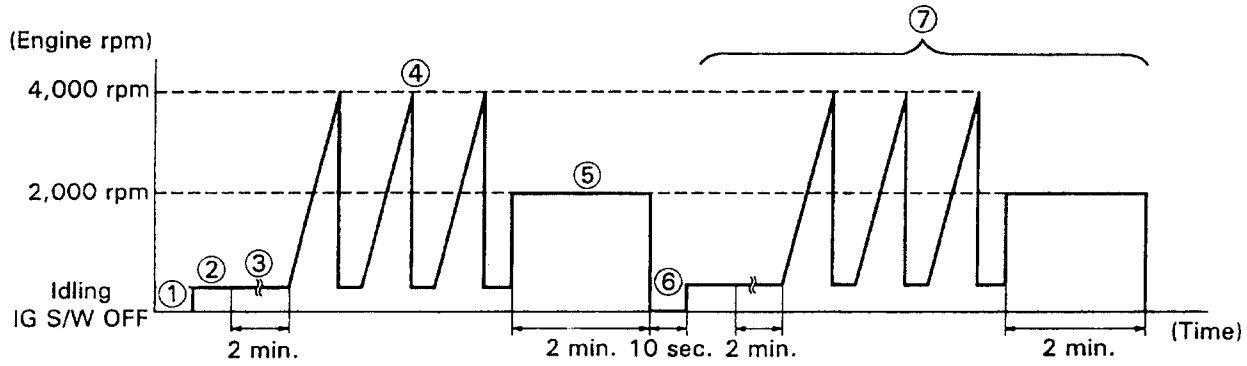
Purpose of the driving pattern.

(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

Malfunction: Open or short in Heated Oxygen Sensor



(1) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switch OFF.

(2) Start the engine and warm the engine up.

(3) After the engine is warmed up, let it idle for 2 min.

(4) After performing the idling in (3), perform sudden racing to 4,000 rpm three times.

(5) After performing the sudden racing in (4), perform racing at 2,000 rpm for 2 min.

(6) After performing the racing in (5), turn the IG switch OFF for 10 sec.

(7) Start the engine and perform steps (2), (3), (4) and (5) again.

HINT: If a malfunction is detected, the Malfunction Indicator Lamp will light up during step (7).

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

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

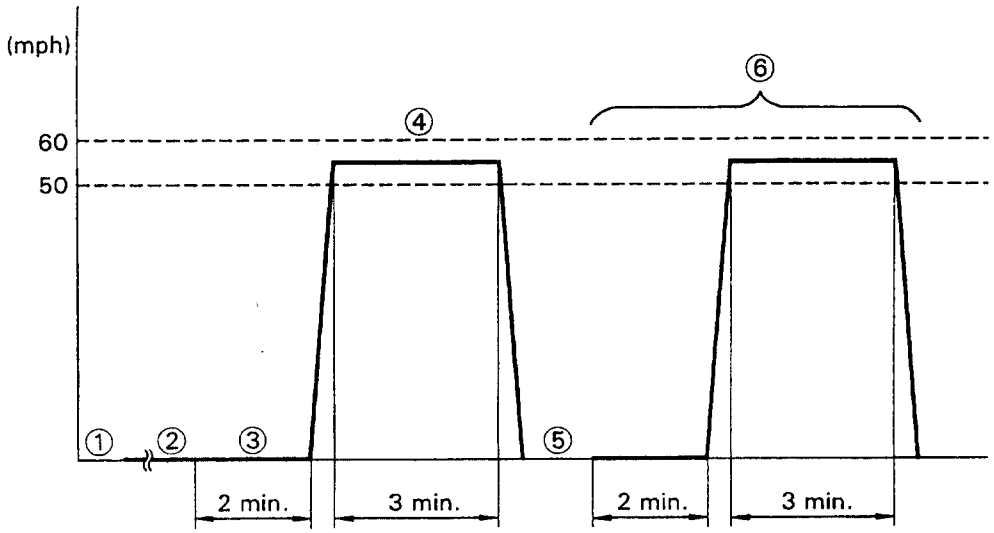
Purpose of the driving pattern.

(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 Oxygen Sensor, Open or Short in Injector Leak, Blockage



P02538

(1) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switch OFF.

(2) Start the engine and warm the engine up with all ACC switched OFF.

(3) After the engine is warmed up, let it idle for 2 min.

(4) With transmission in 5th gear ("D" range for A/T) drive at 50 – 60 mph for 3 min.

(5) After driving, stop at a safe place and turn the IG switch OFF for 3 – 10 sec.

(6) Start the engine and perform steps (3) and (4) again.

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 malfunctions.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

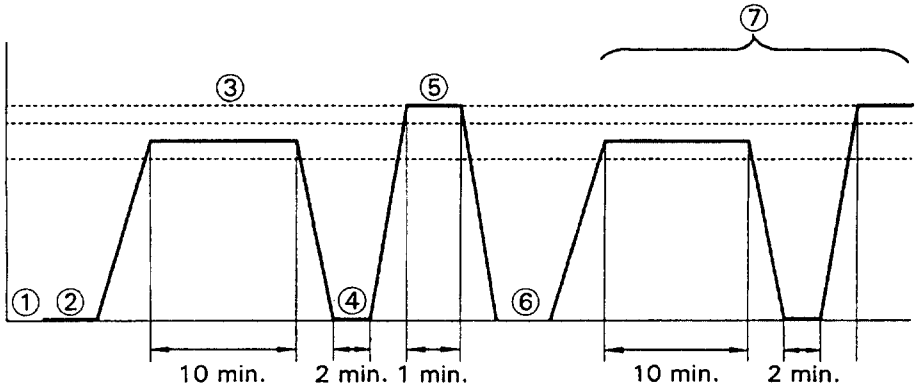
Purpose of the driving pattern.

(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	27	Sub Oxygen Sensor Circuit (CALIFORNIA)

Malfunction: Open or short in Sub Oxygen Sensor



(1) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switch OFF.

(2) Start the engine and warm the engine up with all ACC switched OFF.

(3) After the engine is warmed up, let it drive at 50–55 mph for 10 min. or more.

(4) After driving, stop at a safe place and perform idling for 2 min. or less.

(5) After performing the idling in (4), perform acceleration to 60 mph with the throttle fully open and drive at 60 mph for 1 min.

(6) After driving stop at a safe place and turn the IG switch OFF for 3 sec. or more.

(7) Start the engine and perform steps (3), (4), and (5) again.

HINT: If a malfunction is detected, the Malfunction Indicator Lamp will light up during step (7).

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

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

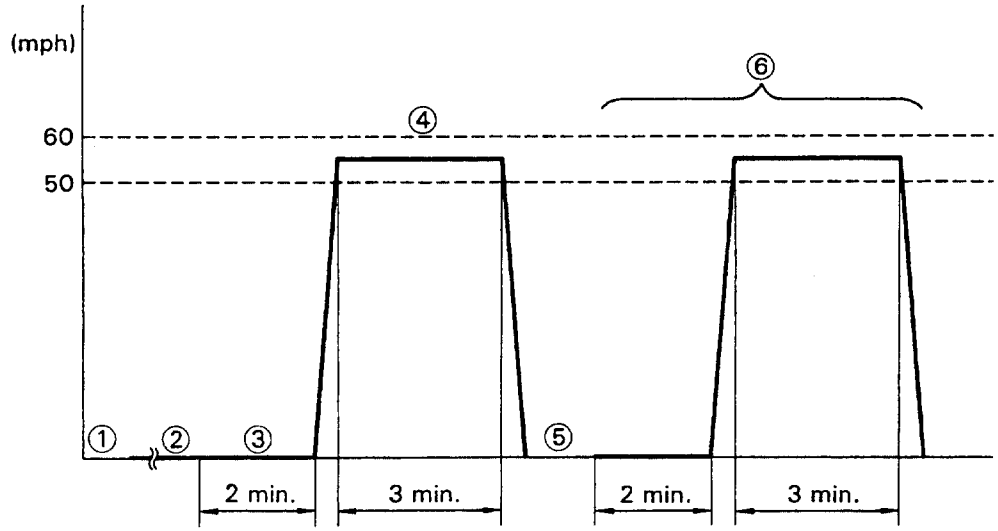
Purpose of the driving pattern.

(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

Malfunction: Short in VSV Circuit for EGR, Loose EGR Hose, Valve Stuck



P02538

(1) Disconnect the fuse EFI (15 A) for 10 sec. or more, with IG switch OFF.

(2) Start the engine and warm the engine up with all ACC switched OFF.

(3) After the engine is warmed up, let it idle for 2 min.

(4) With transmission in 5th gear ("D" range for A/T) drive at 50 – 60 mph for 3 min.

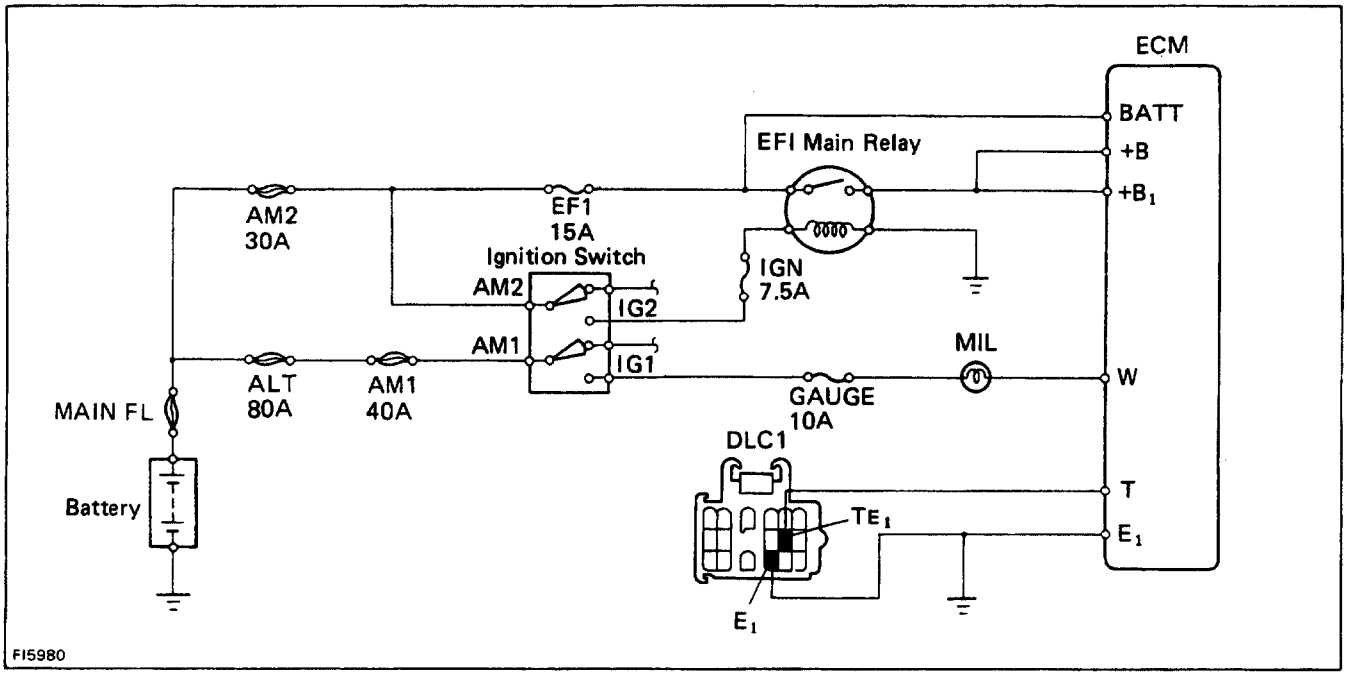
(5) After driving, stop at a safe place and turn the IG switch OFF for 3 – 10 sec.

(6) Start the engine and perform steps (3) and (4) again.

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 malfunctions.

INSPECTION OF DIAGNOSIS CIRCUIT



1. Does Malfunction Indicator Lamp come on when ignition switch is at ON?
   - YES → System Normal
   - NO → Does MIL come on when ECM terminal W is grounded to the body?
     - YES → Check wiring between ECM terminal E_1 and body ground.
       - OK → Try another ECM.
       - BAD → Repair or replace.
     - NO → Check bulb, fuse and wiring between ECM and ignition switch.
       - BAD → Repair or replace.

2. Does MIL go off when the engine is started?
   - YES → System Normal
   - NO → Check wiring between ECM and MIL.
     - BAD → Repair.
     - OK → Is there diagnostic trouble code output when DLC1 terminals TE_1 and E_1 are connected?
       - NO → Check wiring between ECM terminal T and DLC1 terminal TE_1, and ECM terminal E_1 and terminal E_1.
         - OK → Try another ECM.
       - YES → Does MIL go off after repair according to malfunction code?
         - NO → Further repair required.
         - YES → System OK → Cancel out diagnostic trouble code.