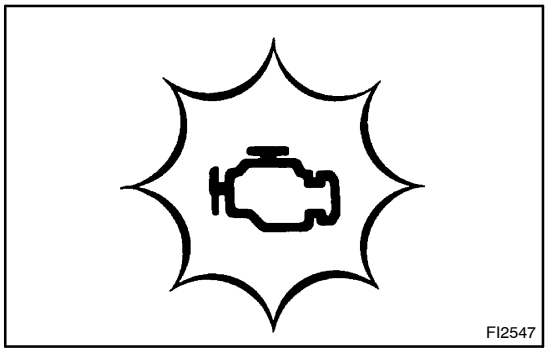
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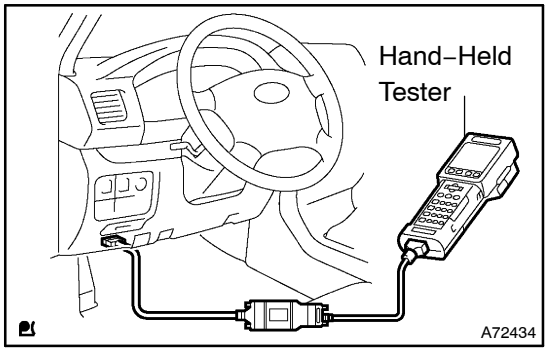
PRE–CHECK



1. DIAGNOSIS SYSTEM

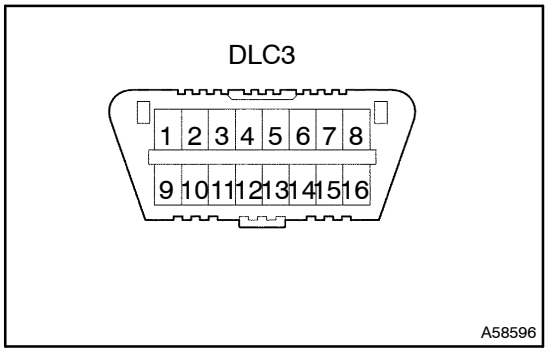
(a) Description for M–OBD

- When troubleshoot Multiplex OBD (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the hand–held tester to the vehicle, and read off various data output from the vehicle's ECM.
- The vehicle's on–board computer indicates the check engine warning light (CHK ENG) on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition to an indication of the CHK ENG when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTCs) are recorded in the ECM memory (See page 05–311). When the malfunction does not reoccur, the CHK ENG is indicated until the ignition switch is turned off, and then the CHK ENG is not indicated when the ignition switch is turned on but the DTCs remain recorded in the ECM memory.



- To check the DTC, connect the hand–held tester to the Data Link Connector 3 (DLC3) on the vehicle or read the number of blinks of the check engine warning light when the TC and CG terminals on the DLC3 are connected. The hand–held tester also enables you to erase the diagnostic trouble codes and activate the several actuators and check the freeze frame data and various forms of engine data. (for operating instructions, see the hand–held tester instruction book.)
- The diagnosis system operates in the normal mode during normal vehicle use. It also has a check (test) mode for technicians to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic* to prevent an erroneous detection, and ensure a thorough malfunction detection. By switching the ECM to the check (test) mode using hand–held tester when troubleshooting, a technician can cause the CHK ENG to light up for a malfunction that is only detected once or momentarily (Hand–held tester only) (See step 3).

- * 2 trip detection logic
  When a logic malfunction is first detected, the malfunction is temporally stored in the ECM memory (1st trip). If the same malfunction is detected again during the second drive test, this second detection causes the CHK ENG to light up. (However, the ignition switch must be turned OFF between the 1st trip and 2nd trip).
- Freeze frame data:
  Freeze frame data records the engine conditions (fuel system, calculator load, water temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

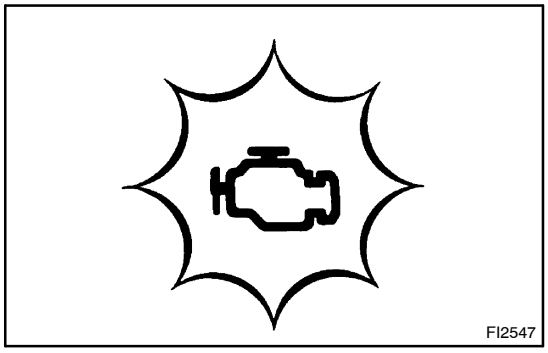


(b) Check the DLC3.
The vehicle's ECM uses the ISO 14230(M–OBD) communication protocol. The terminal arrangement of DLC3 complies with ISO 15031–03 and matches the ISO 14230 format.

Terminal No.	Connection / Voltage or Residence	Condition
7	Bus + Line / Pulse generation+	During transmission
4	Chassis Ground ↔ Body Ground / 1 Ω or less	Always
16	Battery Positive ↔ Body Ground / 9 – 14 V	Always

HINT:
If the display shows "UNABLE TO CONNECT TO VEHICLE" when you have connected the cable of the hand–held tester to the DLC3, turned the ignition switch ON and operated the hand–held tester, there is a problem on the vehicle side or tool side.

- If communication is normal when the tool is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still not possible is when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service Debarment listed in the tool's instruction manual.


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2. INSPECT DIAGNOSIS (Normal Mode)

(a) Check the check engine warning light.

(1) The check engine warning (CHK ENG) comes on when the ignition switch is turned ON and the engine is not running.

HINT:

If the check engine warning (CHK ENG) does not light up, troubleshoot the combination meter.

(2) When the engine is started, the check engine warning light should go off. If the lamp remains on, the diagnosis system has detected a malfunction or abnormality in the system.

(b) Check the DTC, using hand–held tester.

NOTICE:

Hand–held tester only:

When the diagnosis system is switched from the normal mode to the check (test) mode, it erases all DTCs and freeze frame data recorded in the normal mode. So before switching modes, always check the DTCs and freeze frame data, and note them down.

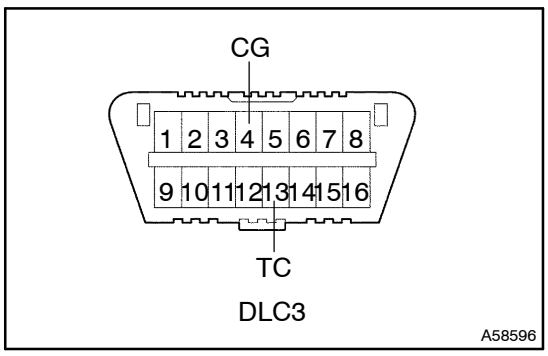
(1) Prepare the hand–held tester.

(2) Connect the hand–held tester to the DLC3.

(3) Turn the ignition switch ON and switch the hand–held tester main switch ON.

(4) Use the hand–held tester to check the DTCs and freeze frame data; note them down. (for operating instructions, see the hand–held tester's instruction book.)

(5) See page 05–311 to confirm the details of the DTCs.



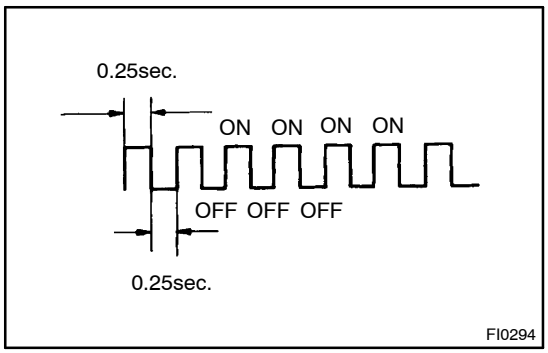
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(c) If you have no hand–held tester, perform the following step (1) to (6).

(1) Turn the ignition switch ON.

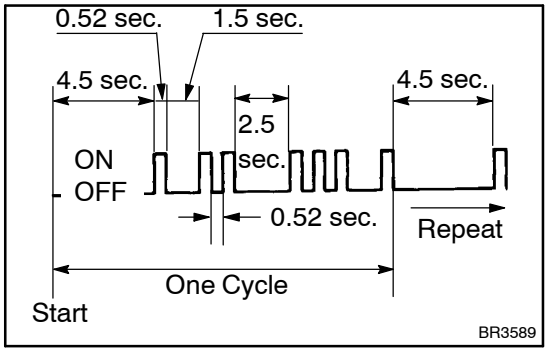
(2) Using SST, connect between terminals 13 (TC) and 4 (CG) of the DLC3.

SST 09843 – 18040



FI0294

(3) Read the DTC from the check engine warning light (CHK ENG).



(4) As an example, the blinking patterns for codes, normal, 12 and 31 are as shown on the illustration.

(5) Check the details of the malfunction using the DTC chart on page 05–311.

(6) After completing the check, disconnect terminals 13 (TC) and 4 (CG) and turn off the display.

HINT:

In the event of 2 or more malfunction cords, indication will begin from the smaller numbered code and continue in order to the larger.

NOTICE:

- **When simulating a symptom without a hand–held tester to check the DTCs, use the normal mode. For code on the DTC chart subject to ”2 trip detection logic”, turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again. When the problem has been simulated twice, the check engine warning light (CHK ENG) lights up and the DTCs are recorded in the ECM.**
- **Check the 1st trip DTC using Mode 7 for ISO 15031. (Continuous Test Results of Euro–OBD function in hand–held tester)**

3. INSPECT DIAGNOSIS (Check (Test) Mode)

HINT:

Hand–held tester only:

Compared to the normal mode, the check mode has an increased sensitivity to detect malfunctions.

Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check (test) mode.

(a) Check the DTC.

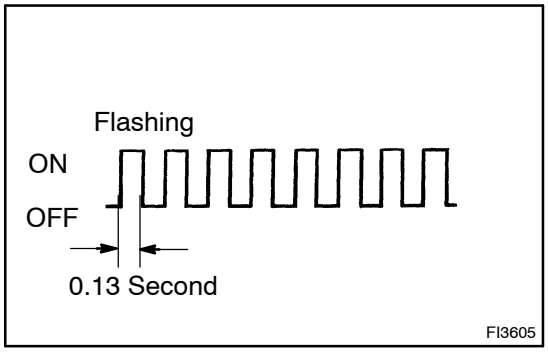
(1) Initial conditions
- Battery positive voltage 11V or more.
- Throttle valve fully closed.
- Transmission in ”P” or ”N” position.
- Air conditioning switched OFF.

(2) Turn ignition switch OFF.

(3) Prepare the hand–held tester.

(4) Connect the hand–held tester to the DLC3 on the at the lower left/right of the instrument panel.

(5) Turn the ignition switch ON and switch the hand–held tester main switch ON.



(6) Switch the hand–held tester from the normal mode to the check (test) mode. (check that the check engine warning light (CHK ENG) flashes.)

NOTICE:

If the hand–held tester switches the ECM from the normal mode to the check mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during the check mode, the DTC and freeze frame data will be erased.

(7) Start the engine. (The check engine warning light (CHK ENG) goes out after the engine start.)

(8) Simulate the conditions of the malfunction described by the customer.

NOTICE:

Leave the ignition switch ON until you have checked the DTC, etc.

(9) After simulating the malfunction conditions, use the hand–held tester diagnosis selector to check the DTCs and freeze frame data, etc.

HINT:

Be careful not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from the check mode to the normal mode, so all the DTCs, etc. are erased.

(10) After checking the DTCs, inspect the applicable circuit.

(b) Clear the DTC.

The following actions will erase the DTCs and freeze frame data.

- Operating the hand–held tester to erase the codes. (See the hand–held tester's instruction book for operating instructions.)
- Disconnecting the battery terminal or remove the ECD fuse more than 60 sec.

4. FAIL–SAFE CHART

If any of the following codes is recorded, the ECM enters fail–safe mode.

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
12	TCV duty is fixed at 35 %	2 of more TDC signals are detected for 4 engine revolution
13	• Fuel cut • TCV duty is fixed at 0 % • Close diesel throttle valve	2 of more NE signals are detected 0.5 sec.
15	• IDL SW ON : Diesel throttle is fixed at idle position • IDL SW OFF : Diesel throttle valve is fully open • Accelerator pedal position below 24 %	IG switch OFF
18	• Fuel cut • Close diesel throttle valve	IG switch OFF or starter ON from OFF
19 (1)	Output limit	IG switch OFF
19 (2)	Output limit	IG switch OFF
	Accelerator pedal position below 22 %	IG switch OFF
22	Engine coolant temp. is fixed at 60 °C (140 °F)	Return to normal condition
23	Intake air temp. is fixed at 140 °C (284 °F)	Return to normal condition
35	Intake air pressure is fixed at 101.3 kpa (760 mmHg, 30 in. HG)	Return to normal condition

39	Fuel temp. is fixed at 40 °C(104 °F)	Return to normal condition
42	Vehicle speed is fixed at 0 km/h (0 mile)	Vehicle speed > 10 km/h (6 mile)

5. CHECK FOR INTERMITTENT PROBLEMS

HINT:

HAND–HELD TESTER only:

By putting the vehicle's ECM in the check (test) mode, the 1 trip detection logic is possible instead of the 2 trip detection logic and the sensitivity to detect open circuits is increased. This makes it easier to detect intermittent problems.

(a) Clear the DTC (See step 3).
(b) Set the check (test) mode (See step 3).
(c) Perform a simulation test (See page 01–26).
(d) Check the connector and terminal (See page 01–36).
(e) Handle the connector (See page 01–36).

6. REFERENCE VALUE OF ECM DATA

NOTICE:

The values given below for "Normal Condition" are representative values. So, a vehicle may still be normal even if its value differs from those listed here. So, do not solely depend on the "Normal Condition" here when deciding whether a part is faulty or not.

HINT:

The ECM data can be monitored by hand–held tester.

(a) Connect the hand–held tester to the DLC3.
(b) Monitor the ECM data by following the prompts on the tester screen. Please refer to the hand–held tester operator's manual for further detail.
(c) Reference Value

Item	Inspection Condition	Reference Value
INJECTION VOLUME	Engine at idling *1	5 – 12 mm^3/st
	Engine racing at 2,000 rpm *1	8 – 15 mm^3/st
	Engine racing at 3,000 rpm 1*	12 – 20 mm^3/st
INJECTION TIMING	Engine at idling *1	13 – 15 °CA
	Engine racing at 2,000 rpm *1	18.8 – 20.2 °CA
	Engine racing at 3,000 rpm *1	22.4 – 24.0 °CA
ENGINE SPD	RPM kept stable (Comparison with tachometer)	No great changes
PIM	Engine at idling *1	w/ EGR: 92 – 98 kPa w/o EGR: 83 – 90 kPa
	Engine racing at 2,000 rpm *1	101 – 111 kPa
	Engine racing at 3,000 rpm *1	126 – 141 kPa
COOLANT TEMP	Engine at normal operating temp	69 – 89°C (156 – 192°F) *2
INTAKE AIR	Engine at normal operating temp	Ambient temp. –100°C
FUEL TEMP	Engine at normal operating temp	Ambient temp. –90°C
VEHICLE SPD	During driving (Comparison with speed meter)	No large difference
ACCEL POS #1	Accelerator pedal released	0.6 – 1.3 V
	Accelerator pedal depressed	2.8 – 4.5 V
ACCEL POS #2	Accelerator pedal released	1.4 – 2.1 V
	Accelerator pedal depressed	3.6 – 4.5 V
A/C SIG	A/C switch ON	ON
IDL SIG	Accelerator pedal full closed	ON
STARTER SIG	During cranking	ON
A/C CUT SIG	A/C switch OFF	ON
EGR SYSTEM	Idling	ON
NSW*3	Neutral start switch signal	P or N position: ON

Item	Inspection Condition	Reference Value
PS OIL PRESS SW	Power steering oil pressure switch signal	Turn steering wheel: ON
ACCEL CLOSE SW	Accelerator pedal fully closed	ON

*1:Complete warming–up, shift lever to ”N” position, all accessories and A/C are switched OFF.
*2: If the engine coolant temp. sensor circuit is open or shorted, the ECM.
*3: Only for A/T.

BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshooting should be carried out in all the possible circuits considered as causes of the problems. In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, using this check is essential in the engine troubleshooting.

1 CHECK BATTERY POSITIVE VOLTAGE

NOTICE:
Carry out this check under the engine stoppage condition.

	OK	NG
Voltage	11 V or more	Less than 11 V

NG → **CHARGE OR REPLACE BATTERY**

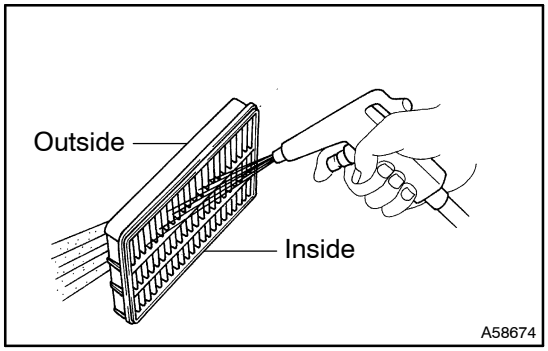
OK

2 CHECK IF ENGINE IS CRANKED

NG → **PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–316**

OK

3 CHECK AIR FILTER



(a) Visually check that the air filter is not excessively dirty or oily.

NOTICE:
If necessary, clean the filter with compressed air. First blow from inside thoroughly, the blow from the outside of the filter.

NG → **REPAIR OR REPLACE**

OK

4	CHECK FUEL QUALITY

(a) Check that use only diesel fuel.
(b) Check that the fuel does not contain any impurity.

NG → REPLACE FUEL

OK

5	CHECK ENGINE OIL (See page 17–27)

NG → ADD OR REPLACE

OK

6	CHECK COOLANT (See page 16–22)

NG → REPLACE COOLANT (See page 16–34)

OK

7	CHECK INJECTION TIMING (See page 14–123)

NG → ADJUST INJECTION TIMING (See page 14–123)

OK

8	CHECK IDLE SPEED AND MAXIMUM SPEED (See page 14–123)

NG → REPAIR OR REPLACE INJECTION PUMP (See page 11–81)

OK

9	CHECK DIAGNOSIS CIRCUIT (See page 05–403)

NG → REPAIR OR REPLACE

OK

10	CHECK VACUUM PUMP

NG → REPAIR OR REPLACE VACUUM PUMP

OK

PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–316