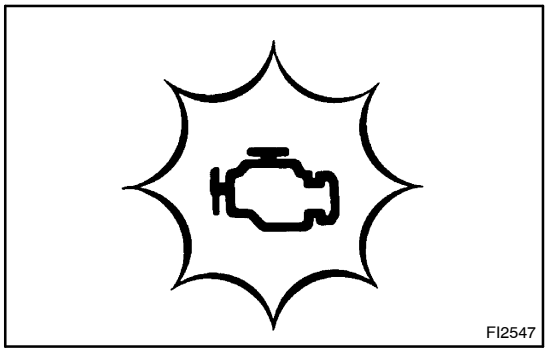
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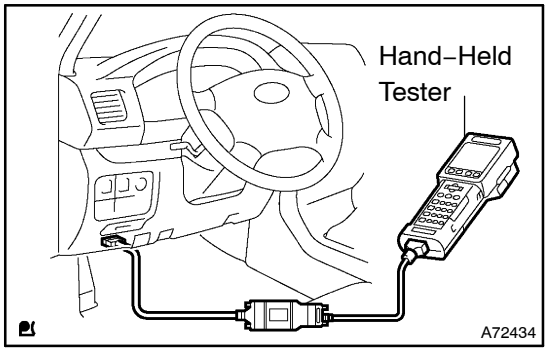
# PRE–CHECK




## 1. DIAGNOSIS SYSTEM

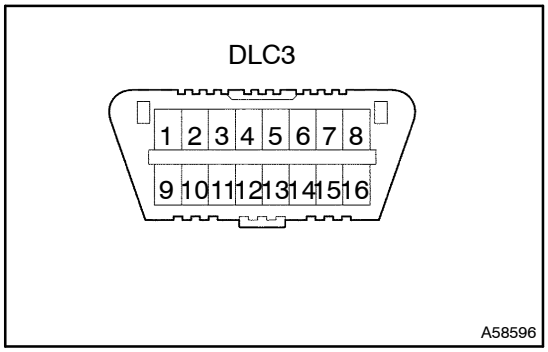
(a) Description for M–OBD

- 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 the 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 05–437). 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 the 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 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 temporarily 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:
  The freeze frame data records the engine conditions (fuel system, calculator load, water temperature, 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.

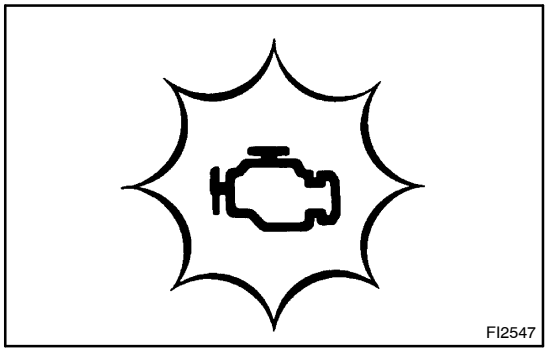



(b) Check the DLC3.
The vehicle's ECM uses the ISO 9141–2 (Euro–OBD)/ISO 14230 (M–OBD) communication protocol.
The terminal arrangement of DLC3 complies with ISO 15031–3 and matches the ISO 9141–2/ISO 14230 for mat.

| Terminal No. | Connection/Voltage or Resistance | 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 Department listed in the tool's instruction manual.




**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 freezed frame data recorded in the normal mode. So before switching modes, always check the DTCs and freeze frame data, and note them down.**

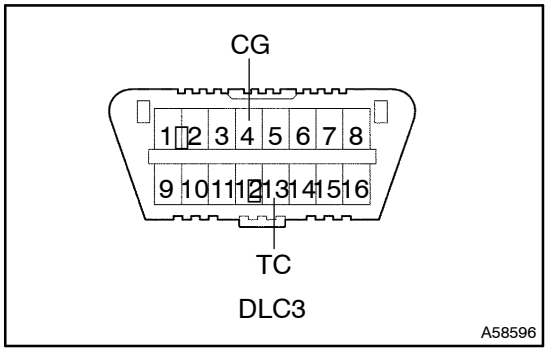
(1) Prepare the hand–held tester.

(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 05–437 to confirm the details of the DTCs.

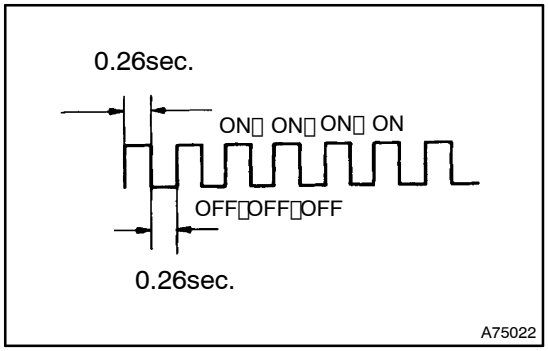



(c) If you have no hand–held tester, perform the following step (1) to (6).

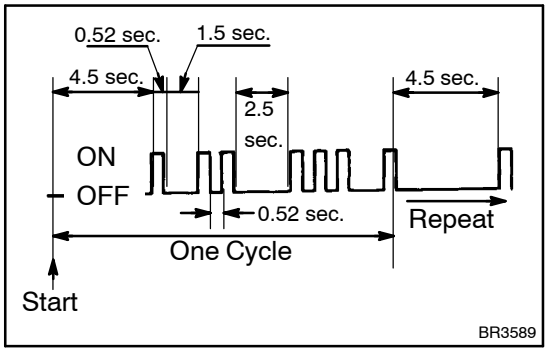
(1) Turn the ignition switch ON.

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

SST 09843–18040




(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 05–437.
(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 codes, the indication will begin from the smaller numbered code to the larger in order.

**NOTICE:**

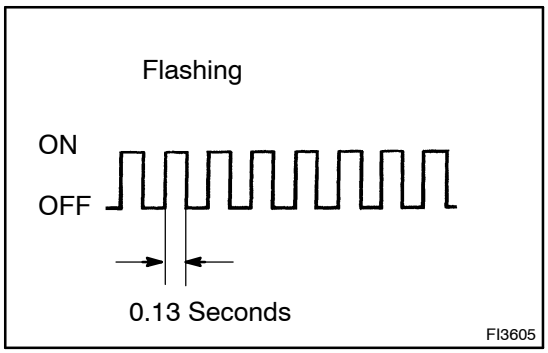
- **When simulating a symptom without a hand–held tester to check the DTCs, use the normal mode. For code on the DTC chart subject to "2 trip detection logic", turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again. When the problem has been 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 11 V or more
- Throttle valve fully closed
- Transmission in "P" or "N" position
- Air conditioning switched OFF.

(2) Turn the 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 form 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 starts.)

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

**NOTICE:**

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

(9) After simulating the malfunction conditions, use the hand–held tester diagnosis selector to check the DTCs and freezed 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 freezed 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 terminals or the EFI fuse.

## 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 | Out put limit | Return to normal condition |
| 15 | Out put limit | +B OFF |
| 19 (1) | Out put limit | +B OFF |
| 22 | Engine coolant temp. is fixed at 107°C (224.6°F) | Return to normal condition |
| 23 | Intake air temp. is fixed at 80°C (176°F) | Return to normal condition |
| 32 | Compensation value is set at fixed value | Return to normal condition |
| 35 | Turbo pressure is set at 101 kPa or PIM voltage is fixed at 2.28 V | Return to normal condition |
| 39 | Fuel temp. is fixed at 40°C (104.0°F) | Return to normal condition |
| 42 | Vehicle speed is fixed at 0 km/h (0 mph) | Vehicle speed > 10 km/h (6 mph) |
| 49 | Out put limit | +B OFF |
| 78 (1) | Fuel cut | +B OFF |
| 78 (3) | Out put limit | +B OFF |
| 97 | Fuel cut<br>Out put limit | IG OFF→ON or Starter ON |

## 5. CHECK FOR INTERMITTENT PROBLEMS

HINT:

HAND–HELD TESTER ONLY:

By putting the vehicle's ECM in the check (test) mode, 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* | 3 – 10 $mm^3$/st |
| | Engine racing at 2,000 rpm* | 5 – 12 $mm^3$/st |
| | Engine racing at 3,000 rpm* | 7 – 14 $mm^3$/st |
| INJECTION TIMING | Engine at idling* | –7°CA |
| | Engine racing at 2,000 rpm* | –7 – –4°CA |
| | Engine racing at 3,000 rpm* | 2 – 5°CA |
| ENGINE SPD | RPM kept stable (Comparison with tachometer) | No great changes |
| MAF | Air Flow Rate Through Air Flow Meter at idling | 5 – 10 g/s |
| PIM | Engine at idling* | 90 – 100 kPa |
| | Engine racing at 2,000 rpm* | 95 – 115 kPa |
| | Engine racing at 3,000 rpm* | 100 – 120 kPa |
| COOLANT TEMP | Engine at idling* | 70 – 90°C |
| INTAKE AIR | Engine at idling* | 40 – 80°C |
| FUEL TEMP | Engine at idling* | 20 – 50°C |
| IDL SIG | Accelerator pedal full closed | 650 – 750 rpm |
| STARTER SIG | During cracking | ON |
| ACCELE CLOSE SW | Accelerator pedal full closed | ON |
| VEHICLE SPD | Vehicle is not stop | SPD > 0 km/h (0 mph) |
| ACCEL POS #1 | Accelerator pedal released | 0.5 – 1.1 V |
| | Accelerator pedal depressed | 3.0 – 4.6 V |
| ACCEL POS #2 | Accelerator pedal released | 0.9 – 2.3 V |
| | Accelerator pedal depressed | 3.4 – 5.0 V |
| A/C SIG | A/C switch ON | ON |
| STARTER SIG | During cranking | ON |
| A/C CUT SIG | A/C switch OFF | ON |
| EGR SYSTEM | Idling | ON |
| ACCEL OPEN SW | Accelerator pedal fully opened | ON |
| THROTTLE POS | Engine at idling* | 150 – 175 step |
| COMN RAIL PRESS | Engine at idling* | 30 – 40 Mpa |
| AMBI TEMP SENS | Engine coolant is cold | About noon temp |
| INJ VOL FB #1 | Engine at idling* | –5.0 – 5.0 $mm^3$/st |
| INJ VOL FB #2 | Engine at idling* | –5.0 – 5.0 $mm^3$/st |
| INJ VOL FB #3 | Engine at idling* | –5.0 – 5.0 $mm^3$/st |
| INJ VOL FB #4 | Engine at idling* | –5.0 – 5.0 $mm^3$/st |

| Item | Inspection Condition | Reference Value |
|---|---|---|
| PUMP VCM ANGLE | Engine at idling* | 70 – 90° CA |
| M – INJ/PILOT ON | Engine at idling* | 700 – 900 μs |
| M – INJ/PILOT OFF | Engine at idling* | 0 μs |
| PILOT – INJ | Engine at idling* | 500 – 600 μs |

HINT:
*: Complete warming–up, shift lever to "N" position, all accesorise and A/C are switched OFF.

## 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 engine troubleshooting.

**1 CHECK BATTERY 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**

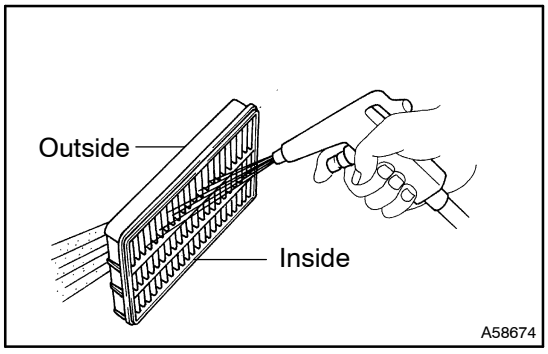
**OK**

**2 CHECK IF ENGINE IS CRANKED**

**NG → PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–443**

**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 filter.**

**NG → CLEAN 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 17–55) |

NG → ADD OR REPLACE

OK

| | |
|---|---|
| 6 | CHECK COOLANT (See page 16–50) |

NG → REPLACE COOLANT (See page 16–50)

OK

| | |
|---|---|
| 7 | CHECK IDLE SPEED AND MAXIMUM SPEED (See page 14–136) |

NG → REPAIR OR REPLACE INJECTION PUMP (See page 11–117)

OK

| | |
|---|---|
| 8 | CHECK DIAGNOSTIC CIRCUIT (See page 05–558) |

NG → REPAIR OR REPLACE

OK

| | |
|---|---|
| 9 | CHECK VACUUM PUMP |

NG → REPAIR OR REPLACE VACUUM PUMP

OK

PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE (See page 05–443)