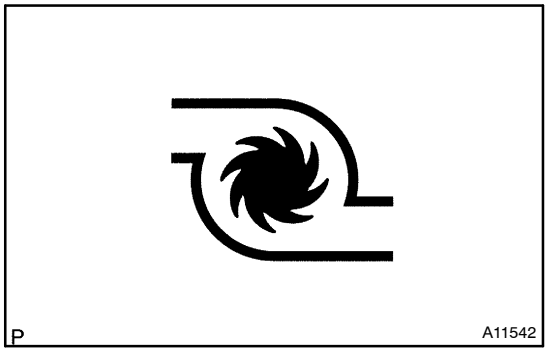


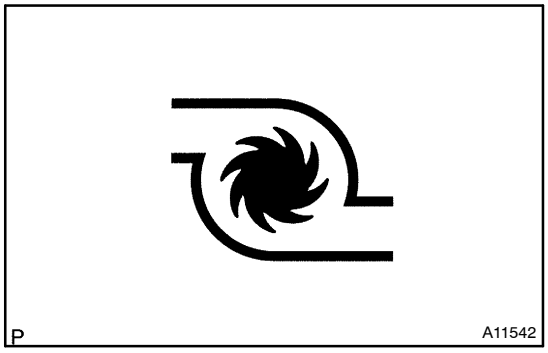
DI6JW–01

PRE–CHECK

1. DIAGNOSIS SYSTEM

(a) Description

- The engine ECU contains a built–in self–diagnosis system by which troubles with the engine signal network are detected and a check engine warning light in the combination meter lights up.
- By analyzing various signals as shown in the later table (See page DI–12) the engine ECU detects system malfunctions relating to the sensors or actuators.
- In the normal mode, the self–diagnosis system monitors 9 items, indicated by code No. as shown in DI–12. A check engine warning light informs the driver that a malfunction has been detected. The engine ECU stores the code(s) until it is cleared by removing the F–HTR fuse with the ignition switch off.
- The DTC (diagnostic trouble code) can be read by the number of blinks of the check engine warning light when TE1 and E1 terminals on the check connector are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.
- In the test mode, 5 items, indicated by code No. as shown in DI–12 are monitored. If a malfunction is detected in any one of the systems indicated by code Nos. 22, 24, 35 and 41 the engine ECU lights the check engine warning light to warn the technician that malfunction has been detected. In this case, TE2 and E1 terminals on the check connector should be connected as shown later (See page DI–3).
- In the test mode, even if the malfunction is corrected, the malfunction code is stored in the engine ECU memory even when the ignition switch is off. This also applies to the normal mode. The diagnostic mode (normal or test) and the output of the check engine warning light can be selected by connecting the TE1, TE2, and E1 terminals on the check connector, 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 DI–3).



2. DIAGNOSIS INSPECTION (Normal Mode)

(a) Check the check engine warning light.

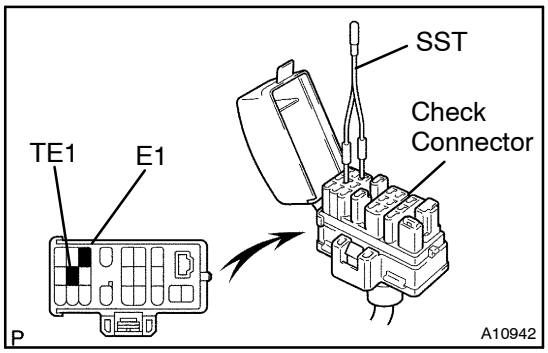
(1) The check engine warning light will light up when the ignition switch is turned ON and the engine is not running.

HINT:
If the check engine warning light does not light up, proceed to troubleshooting of the combination meter.

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

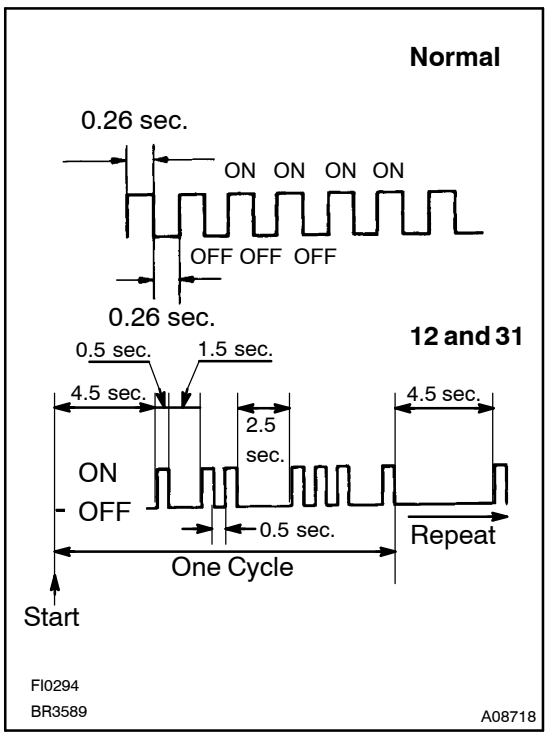
(b) Check the DTC.

(1) Turn the ignition switch ON.



(2) Using SST, connect terminals between TE1 and E1 of the check connector.

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(3) Read the DTC from check engine warning light.
As an example, the blinking patterns for codes; normal, 12 and 31 are as shown on the illustration.

HINT:
If a DTC is not output, check the TE1 terminal circuit (See Page DI–53).

(4) Check the details of the malfunction using the DTC chart on page DI–12.

(5) After completing the check, disconnect the SST from terminals TE1 and E1, and turn off the display.

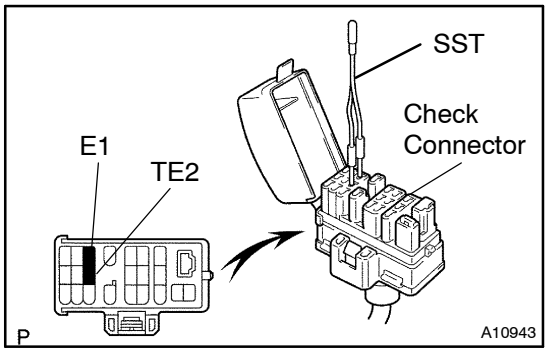
HINT:
If the event of 2 or more malfunction codes, indication will begin from the smallest numbered code to the largest.

3. DIAGNOSIS INSPECTION (Test Mode)

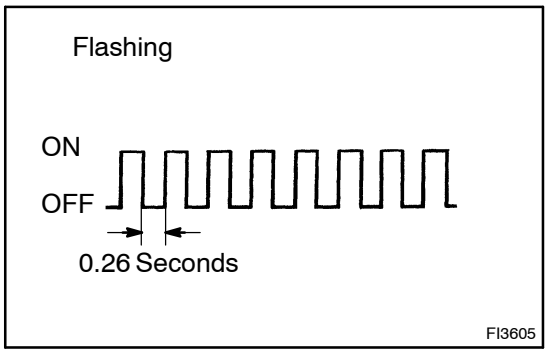
HINT:
Compared to the normal mode, the test mode has an increased sensing ability to detect malfunctions.
The same diagnostic items which are detected in the normal mode can also be detected in the test mode.

(a) Check the DTC.
(1) Initial conditions.
- Battery positive voltage 11 V or more.
- Throttle valve fully closed.
- A/C switched OFF.

(2) Turn ignition switch OFF.

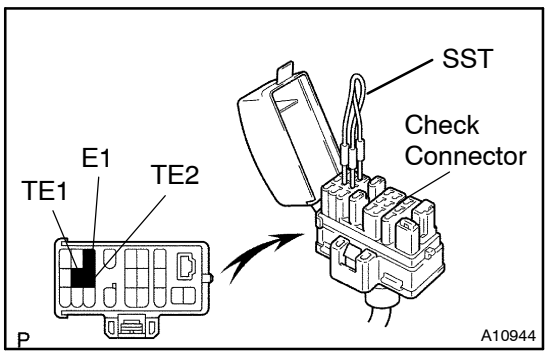


(3) Using SST, connect terminals TE2 and E1 of the check connector.
SST 09843–18020
(4) Turn the ignition switch ON.



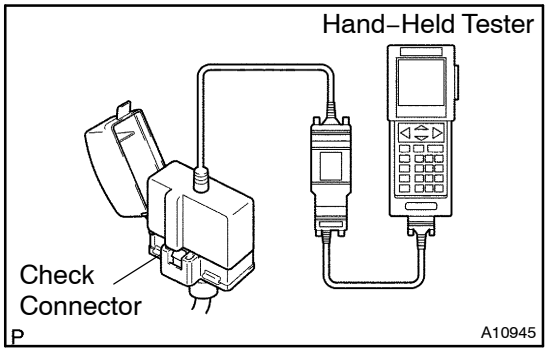
HINT:
- To confirm that the test mode is operating, check that the check engine warning light flashes when the ignition switch is turned ON.
- If the check engine warning light does not flash, refer to DTC chart for the TE2 terminal circuit on page DI–53.

(5) Start the engine.
(6) Simulate the conditions of the malfunction described by the customer.



(7) After the road test, using SST, connect terminals TE1 and E1 of the check connector.
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(8) Read the DTC on check engine warning light in the combination meter (See page DI–3).
(9) After completing the check, disconnect the SST from terminals TE1, TE2 and E1, and turn off the display.

HINT:
- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned ON.
- When vehicle speed is 5 km/h (3 mph) or below, DTC 42 is output, but this is not abnormal.



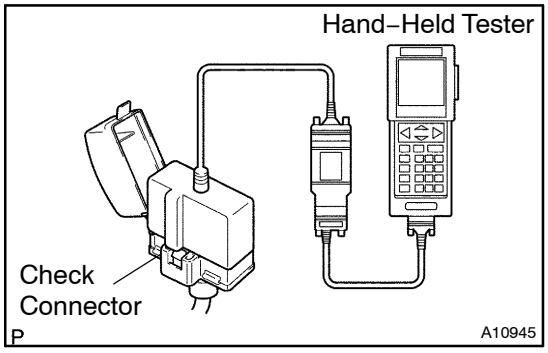
(b) Check the DTC using hand–held tester.
  (1) Hook up the hand–held tester to the check connector.
  (2) Read the DTCs by following the prompts on the tester screen.

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

(c) Clear the DTC.
  (1) After repairing the trouble areas, the DTC retained in the engine ECU memory must be cleared out by removing the negative (–) terminal cable from the battery for 10 seconds or more with the ignition switch turned OFF.

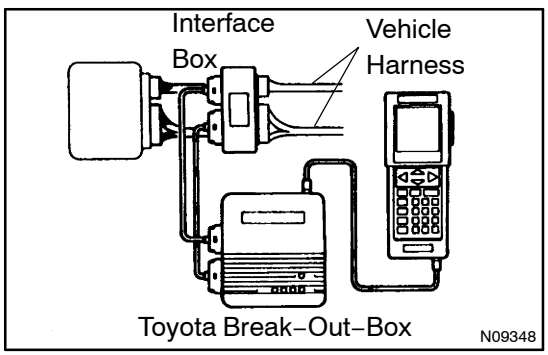
HINT:
- In this case, other memory systems (clock, etc.) will also be cancelled out.
- If it is necessary to work on engine components requiring removal of the negative (–) terminal cable from the battery, a check must first be made to see if a DTC has been recorded.

  (2) After cancellation, road test the vehicle to check that a normal code is now read on the check engine warning light.
  If the same DTC appears, it indicates that the trouble area has not been repaired throughly.



(d) Engine ECU data monitor using hand–held tester
  (1) Hook up the hand–held tester to the check connector.
  (2) Monitor the engine ECU data by following the prompts on the tester screen.

HINT:
- Hand–held tester has a "Snapshot" function which records the monitored data.
- Please refer to the hand–held tester operator's manual for further details.



(e) Engine ECU terminal values measurement using break–out–box and hand–held tester
  (1) Hook up the break–out–box and hand–held tester to the vehicle.
  (2) Read the engine ECU input/output values by following the prompts on the tester screen.

HINT:
- 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 hand–held tester/break–out–box operator's manual for further details.

4. FAIL–SAFE CHART

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

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
12	• TCV duty is 19.5 %	Returned to normal condition
13	• Engine speed 0 RPM • TCV duty is 6 % • Throttle valve position is fixed at 50% • Spill control valve is cut	Returned to normal condition
22	• Water temp. is fixed at 60°C(140°F)	Returned to normal condition
24	• Air temp. is fixed at 40°C(104°F)	Returned to normal condition
32	• Injection volume compensentation volume is fixed at settled value	Returned to normal condition
39	• Fuel temp is fixed at 40°C(104°F)	Returned to normal condition
41	• Accelerator pedal position is fixed at settled value	Following condition must be repeated at least 2 times consecutively When closed throttle position switch is ON: 0.1 V ≦ VA ≦ 4.0 V
42	• Do not operation A/C cut	Returned to normal condition
43	• Starter OFF	Returned to normal condition

DTC	Circuit
12	TDC signal circuit
13	NE signal circuit
22	Water temp. sensor circuit
24	Intake air temp. sensor circuit
32	Correction resistors circuit
35	Intake air pressure sensor circuit
39	Fuel temp. sensor circuit
41	Throttle position sensor circuit

5. CHECK FOR INTERMITTENT PROBLEMS

As previously described on page DI–3, abnormality detection ability in the test mode is increased compared to that in the normal mode, so that when intermittent problems occur in the engine ECU signal circuits (TDC, NE, THW, THA, VRP, VRT, PIM, THF, VA) shown in the table opposite, the appropriate DTC is output.

Accordingly, when the DTC shown in the table left (12, 13, 22, 24, 32, 35, 39, 41) are output during the DTC check, and inspection of the appropriate circuits reveals no abnormality, check for intermittent problems as described below.

By check for intermittent problems, the place where intermittent problems are occurring due to poor contacts can be isolated.

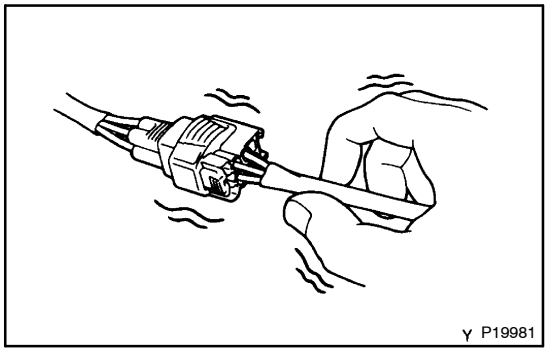
(1) Clear DTC (See page DI–3).

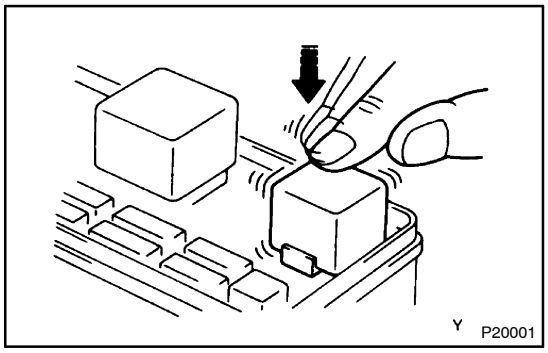
(2) Set the test mode.

- With the ignition switch turned OFF, using SST, connect terminals TE2 and E1 of the check connector.

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- Start the engine and check to see if the check engine warning light goes off.





(3) Perform a Simulation Test
Using the symptom simulation (See page IN–10), apply vibration and pull lightly on the wire harness, connector or terminals in the circuit indicated by the malfunction code.
In this test, if the check engine warning light lights up, it indicates that the place where the wire harness, connector or terminals being pulled or vibrated has faulty contact. Check point for loose connections, dirt on the terminals, poor fit or other problems and repair as necessary.

HINT:
After cancelling out the DTC in memory and set the test mode, if the check engine warning light does not go off after the engine is started, check thoroughly for faulty contact, etc., then try the check again. If the check engine warning light still does not go off, check and replace engine ECU.

6. BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshooting should be carried out in the order for all possible circuits to be considered as the 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, use of this check is essential in engine troubleshooting.

1	**Is battery positive voltage 11 V or more when engine is stopped?**

NO → **Charge or replace battery.**

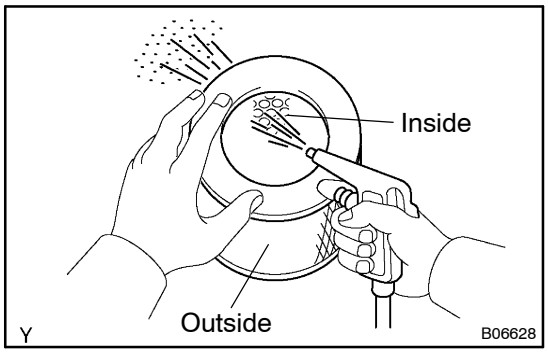
YES

2	**Is engine cranked?**

NO → **Proceed to problem symptoms table on page DI–17.**

YES

3	**Check air filter.**



PREPARATION:
Remove air filter.
CHECK:
Visually check that the air filter is not excessively dirty or oily.
HINT:
If necessary, clean the air filter with compressed air. First blow from inside thoroughly, then blow from outside of the air filter.

NG → **Repair or replace.**

OK

4	**Check fuel quality.**

CHECK:
- Check that use only diesel fuel.
- Check that the fuel does not contain any impurity.

NG → **Replace fuel.**

OK

5	**Check engine oil (See page LU–1).**

NG → **Repair or replace.**

OK

6	**Check coolant (See page CO–1).**

NG → **Replace coolant.**

OK

7	**Check injection timing (See page EM–8).**

NG → **Adjusting injection timing.**

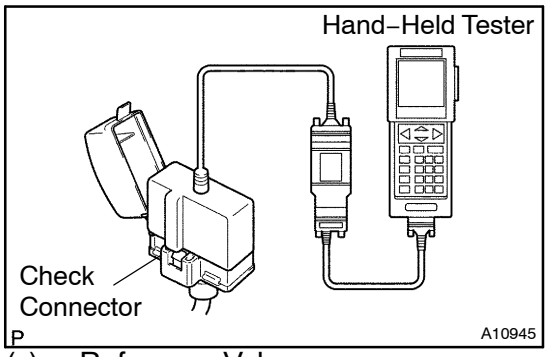
OK

8	**Check idle speed and maximum speed (See page EM–9).**

NG → **Repair or replace injection pump.**

OK

Proceed to problem symptoms table on page DI–17.



7. REFERENCE VALUE OF ENGINE ECU DATA

HINT:

Engine ECU data can be monitored by hand–held tester.

(a) Hook up the hand–held tester to the check connector.

(b) Monitor engine ECU 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
INJECTOR	Engine at idling*1	46 ~ 51 °CA
	Engine racing at 2,000 rpm*1	40 ~ 45 °CA
	Engine racing at 3,000 rpm*1	33 ~ 38 °CA
INJ. TIMING	Engine at idling	9 ~ 14 °CA
	Engine racing at 2,000 rpm	13 ~ 18 °CA
	Engine racing at 3,000 rpm	18 ~ 23 °CA
ENGINE SPD	RPM kept stable (Comparison with tachometer)	No great changes
INTAKE MAN.	Engine at idling*1	1.3 ~ 1.5 V
	Engine racing at 2,000 rpm*1	1.3 ~ 1.5 V
	Engine racing at 3,000 rpm*1	1.3 ~ 1.5 V
COOLANT	Engine at normal operating temp.	75 – 95°C (185 – 203°F)*2
THROTTLE	Closed throttle position	Below 1.0 V
	Throttle fully opened	Above 2.5 V
	From closed throttle position to wide open throttle	Gradually increases

VEHICLE SPD	During driving (Comparison with speedometer)	No large differences
EGR	Engine idling at normal operating temp.	ON
	Engine at idling	ON
	At accelerator pedal fully opened	OFF
GROW PLUG	At IG SW LOCK→ON	ON
	During cranking	ON
STA SIGNAL	During cranking	ON
IDL SIGNAL	Closed throttle position	ON
A/C SIGNAL	A/C SW ON	ON

HINT:

*1: All accessories and A/C are switched OFF.

*2: If the water temperature sensor circuit is open or shorted, the engine ECU assumes an engine coolant temperature value of 80˚C (176˚F).