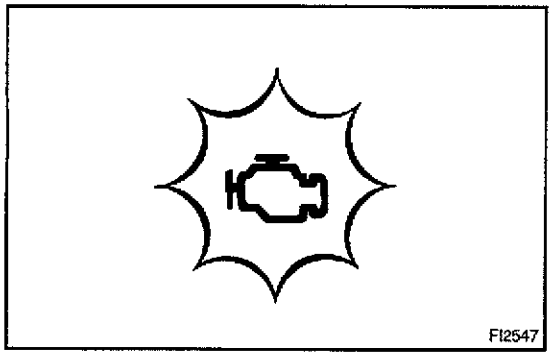
DIHI-01


FI2547

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–15) the Engine ECU detects system malfunctions relating to the sensors or actuators.

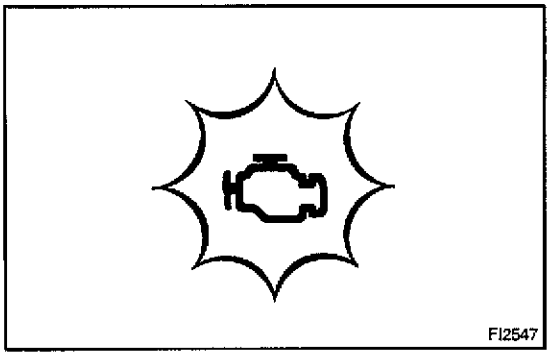
In the normal mode, the self–diagnosis system monitors 14 items, indicated by code No. as shown in DI–15. A check engine warning light informs the driver that a malfunction has been detected. The ECU stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch off.

The 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, 10 items, indicated by code No. as shown in DI–15 are monitored. If a malfunction is detected in any one of the systems indicated by code Nos. 13, 22, 24, 31, and 41 the 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 ECU memory even when the ignition switch is off. This also applies in 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)

DI


FI2547

2. DIAGNOSIS INSPECTION (Normal Mode)

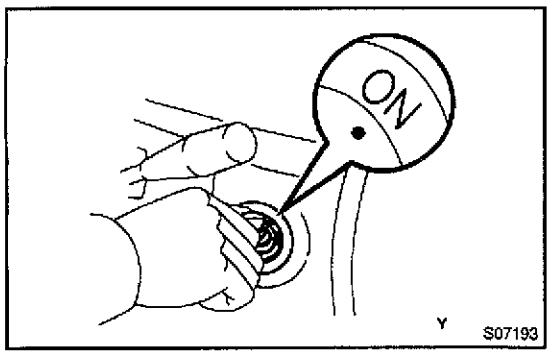
(a) Check Engine warning Light Check

(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.

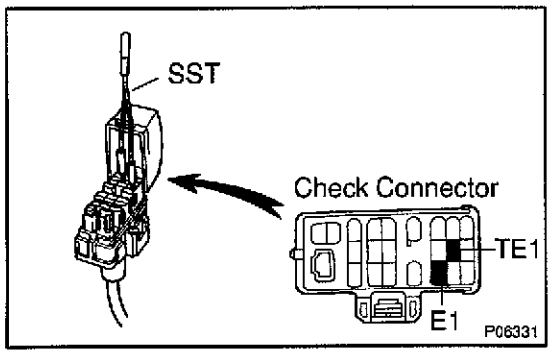
DI



S07193

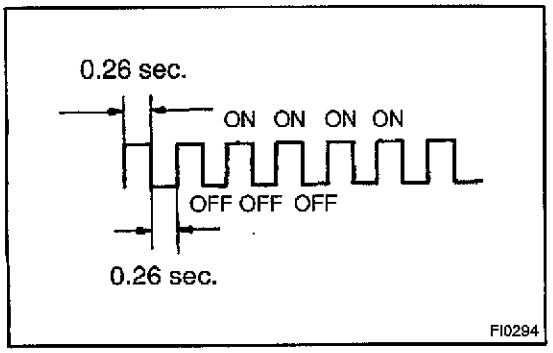
(b) Diagnostic Trouble Code Check

(1) Turn ignition switch ON.



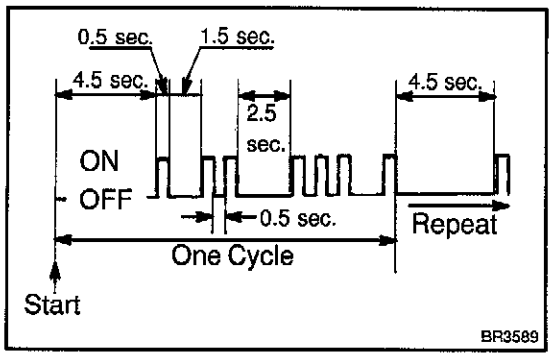
P06331

(2) Using SST, connect terminals between TE1 and E1 of check connector.
SST 09843–18020



FI0294

(3) Read the diagnostic trouble code 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 diagnostic trouble code is not output, check the TE1 terminal circuit (See Page DI–64).

(4) Check the details of the malfunction using the diagnostic trouble code chart on page DI–15.

(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 and continue in order to the largest.

DI

3. DIAGNOSIS INSPECTION (Test Mode)

HINT:

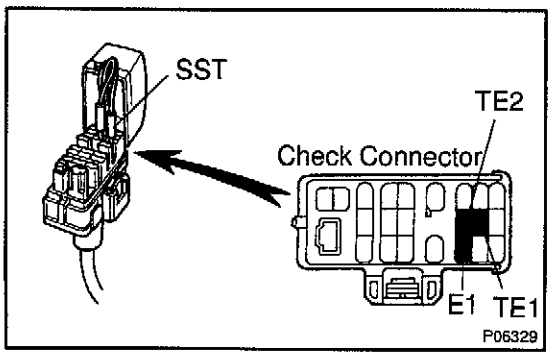
Compared to the normal mode, the test mode has an increased sensing ability to detect malfunctions.

The same diagnostic items which are detected in the normal mode can also be detected in the test mode.

(a) Diagnostic Trouble Code Check

(1) Initial conditions.

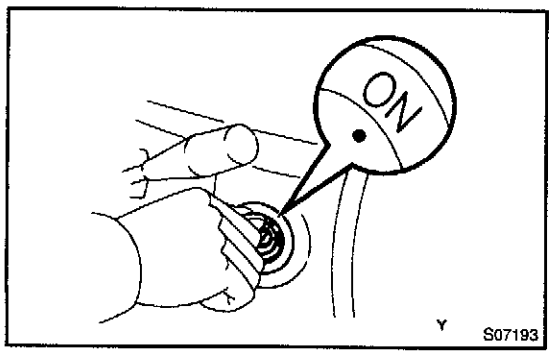
- Battery positive voltage 11 V or more.
- Throttle valve fully closed.
- Air conditioning switched OFF.



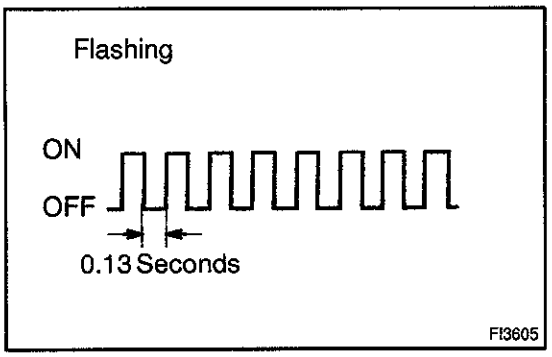
(2) Turn ignition switch OFF.

(3) Using SST, connect terminals TE2 and E1 of check connector.

SST 09843–18020



(4) Turn ignition switch ON.



HINT:

- To confirm that the test mode is operating, check that the check engine warning light flashes when the ignition switch turned ON.
- If the check engine warning light does not flash, refer to diagnostic chart for the TE2 terminal circuit on page DI–64.

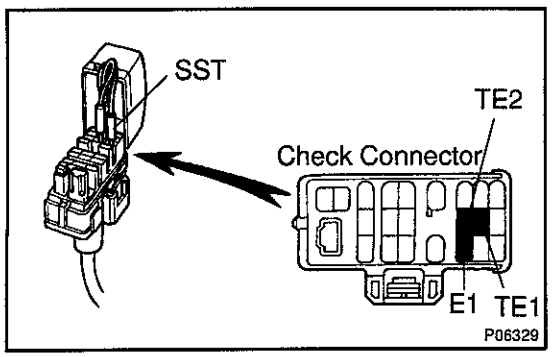
(5) Start the engine.

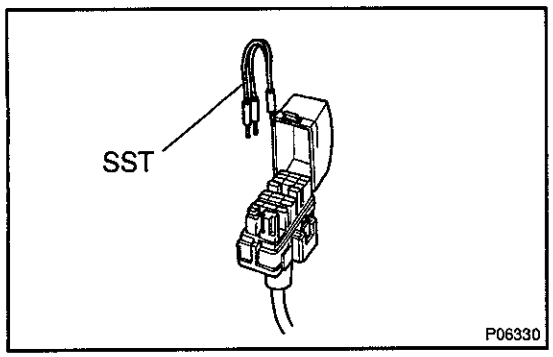
(6) Simulate the conditions of the malfunction described by the customer.

(7) After the road test, using SST, connect terminals TE1 and E1 of check connector.

SST 09843–18020

(8) Read the diagnostic trouble code on check engine warning light in the combination meter .

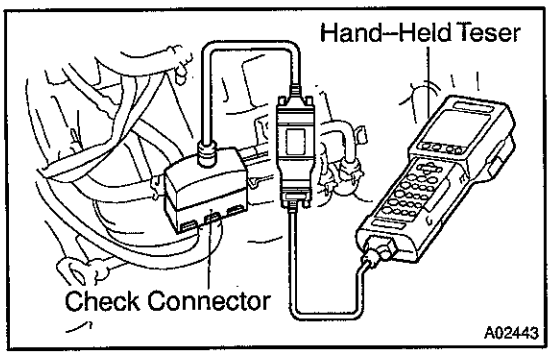




(9) After completing the check, disconnect the SST from terminals TE1, TE2 and E1, and turn off the display.

HINT:

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



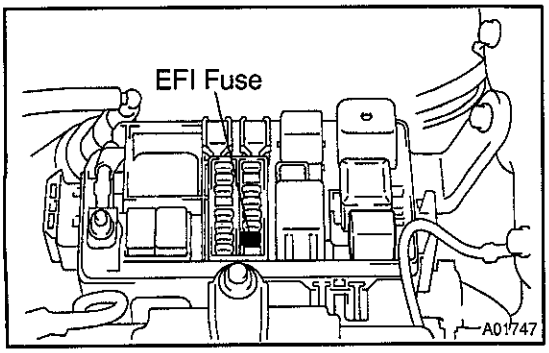
(b) Diagnostic Trouble Code Check Using Hand–Held Tester

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

(2) Read the diagnostic trouble codes by following the prompts on the tester screen.

HINT:

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



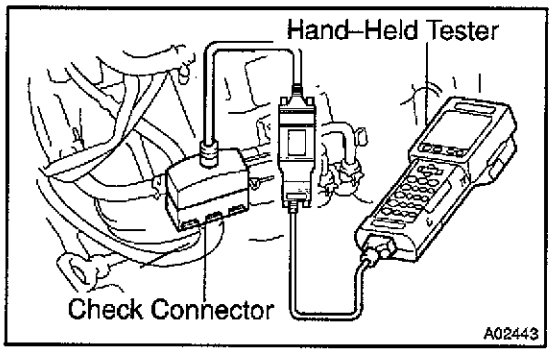
(c) Diagnostic Trouble Code Clearance

(1) After repair the trouble areas, the diagnostic trouble code retained in the ECU memory must be cleared out by removing the EFI fuse (15 A) from engine room J/B for 10 seconds or more, with the ignition switch OFF.

HINT:

- Cancellation can also be done by removing the negative (–) terminal cable from the battery, but 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 diagnostic trouble code 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 diagnostic trouble code(s) appears, it indicates that the trouble area has not been repaired throughly.



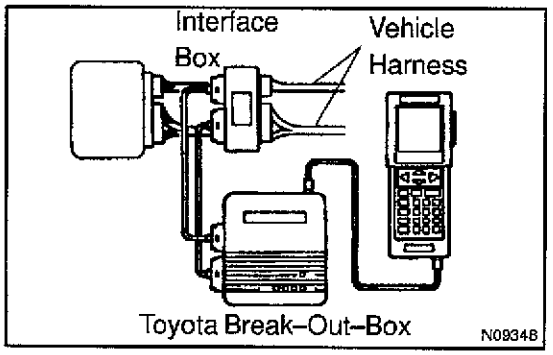
(d) ECU Data Monitor Using Hand–Held Tester

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

(2) Monitor the 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) 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 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 ECU enters fail–safe mode.

Trouble Code No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
14	Fuel cut	1 IGF detected in consecutive 2 ignitions
22	Engine coolant temp. is fixed at 80°C (176°F)	Returned to normal condition
24	Intake air temperature is fixed at 20°C (68°F)	Returned to normal condition
31	• Ignition timing fixed at 5° BTDC • Manifold absolute pressure is fixed at 46.7 kPa (350 mmHg, 13.8 in. Hg)	Returned to normal condition
41	Throttle position is fixed at 0°	The following must each be repeated at least 2 times consecutively • 0.1 V ≦ VTA and 0.95 V

DTC	Circuit
13	NE signal circuit
22	Water temp. sensor circuit
24	Intake air temp. sensor circuit
31	Vacuum sensor circuit
41	Throttle position sensor circuit

5. CHECK FOR INTERMITTENT PROBLEMS

As previously described , abnormality detection ability in the test mode is increased compared to that in the normal mode, so that when intermittent problems occur in the ECU signal circuits (NE, THW, THA, PIM, VTA) shown in the table opposite, the appropriate diagnostic trouble code is output.

Accordingly, when the diagnostic trouble codes shown in the table opposite (13, 22, 24, 31, 41) are output during the diagnostic trouble code check, and inspection of the appropriate circuits reveals no abnormality, check for intermittent problems as described below.

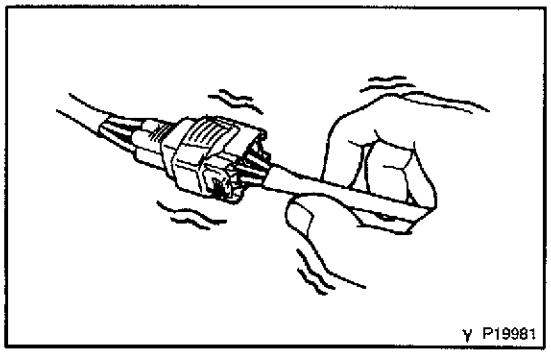
By check for intermittent problems, the place where intermittent problems are occurring due to poor contacts can be isolated.

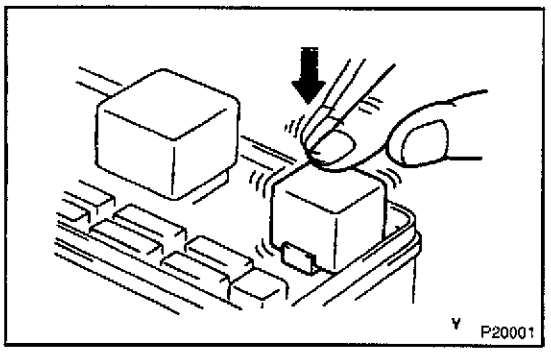
(1) Clear Diagnostic Trouble Codes
(See step 3.)

(2) Set Test Mode
- With the ignition switch OFF, using SST, connect the terminals TE2 and E1 of the check connector.

SST 09843–18020

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





(3) Perform a Simulation Test
Using the symptom simulation
(See page IN–9), apply vibration to 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 that point for loose connections, dirt on the terminals, poor fit or other problems and repair as necessary.

HINT:
After cancelling out the diagnostic trouble code 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 ECU.

6. BASIC INSPECTION

When the normal code is displayed in the diagnostic trouble code check, troubleshooting should be performed 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.

DI

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

NO → **Charge or replace battery.**

YES

2	**Does engine crank ?**

NO → **Proceed to problem symptoms table on page DI–18.**

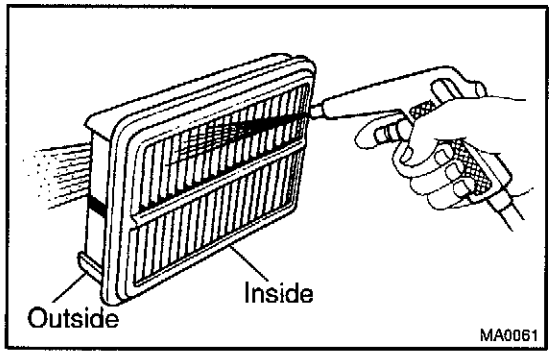
YES

3	**Does engine start ?**

NO → **Go to step 7.**

YES

4	Check air filter.

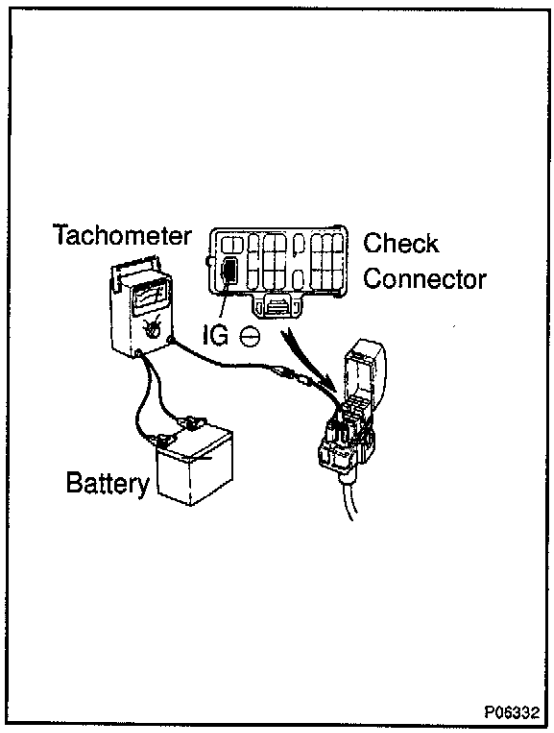


PREPARATION:
Remove air filter.
CHECK:
Visually check that the air filter is not excessively dirty or oily.
HINT:
If necessary, clean the air filter with compressed air. First blow from inside thoroughly, then blow from outside of the air filter.

NG → **Repair or replace.**

OK

5	Check idle speed.



PREPARATION:
(a) Shift transmission into neutral.
(b) Warm up engine to normal operating temperature.
(c) Switch off all accessories.
(d) Switch off air conditioning.
(e) Connect tachometer test probe to terminal IG⊖ of check connector and set the tachometer to the 4–cylinder range.

CHECK:
Check idle speed.

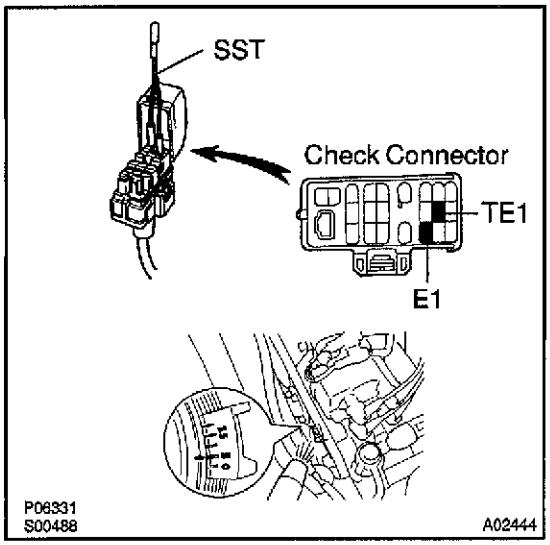
OK:
Idle speed: 700 – 800 rpm

CAUTION:
- **Never allow tachometer test probe to touch ground as it could result in damage to igniter and/or ignition coil.**
- **As some tachometers are not compatible with this ignition system, confirm the compatibility of your unit before use.**

NG → **Proceed to problem symptoms table on page DI–18.**

OK

6	Check ignition timing.



PREPARATION:
(a) Shift transmission into "N" position or neutral.
(b) Warm up engine to normal operating temperature.
(c) Keep the engine speed at idle.
(d) Using SST, connect terminals TE1 and E1 of check connector.
SST 09843–18020
(e) Connect a timing light probe to No.1 high–tension cord.

CHECK:
Check ignition timing.

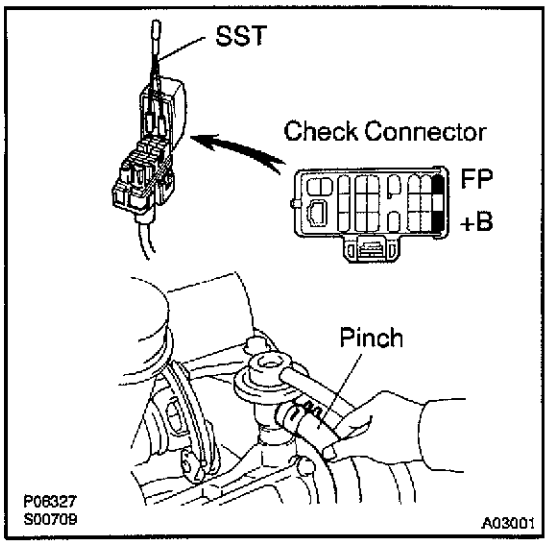
OK:
Ignition timing: 5° BTDC at idle

NG → **Proceed to page EM–14 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–18.

7	Check fuel pressure.



PREPARATION:
(a) Be sure that there is enough fuel in the tank.
(b) Turn ignition switch ON.
(c) Using SST, connect terminals FP and +B of check connector.
SST 09843–18020

CHECK:
Check the fuel pressure by pinching the fuel return hose.
HINT:
At this time, you will hear fuel return noise.

NOTICE:
Never make a mistake with the terminal connecting position as this will cause a malfunction.

NG → **Proceed to page FI–1 and continue to troubleshoot.**

OK

8	**Check for spark.**

CHECK:

Disconnect the high–tension cord from the distributor and hold the end about 12.5 mm (1/2") from the ground. See if spark occurs while the engine is being cranked.

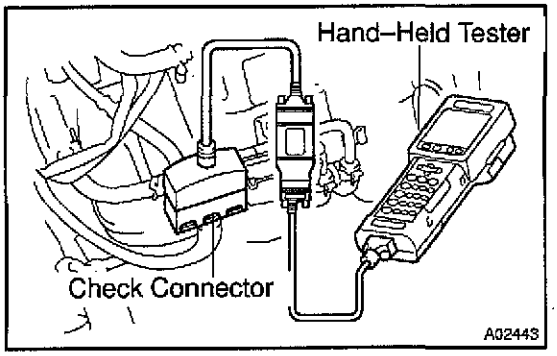
NOTICE:

To prevent excessive fuel being injected from the injectors during this check, don't crank the engine for more than 1–2 seconds at a time.

NG → **Proceed to (See Pub. RM467E) and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–18.



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 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 cold to hot Engine idling at normal operating temp. *1	Gradually decreases Approx. 3 – 4 msecs
IGNITION	Increase engine speed	Gradually increases
ENGINE SPEED	RPM kept stable (Comparison with tachometer)	No great changes
INTAKE MAN.	Engine idling at normal operating temp. *1 Increase engine load	Approx. 160 – 350 Gradually increases
COOLANT TEMP.	Engine at normal operating temp.	75 – 95°C (185 – 203°F) *2
THROTTLE	Closed throttle position Wide open throttle From closed throttle position to wide open throttle	Below 5° Above 70° Gradually increases
VEHICLE SPD	During driving (Comparison with speedometer)	No large differences
TARGET A/F L	Engine idling at normal operating temp.	2.50 ± 0.7 V *3
A/F FB LEFT	RPM stable at 2,500 rpm with normal operating temp.	ON
STA SIGNAL	During cranking	ON
IDL SIGNAL	Closed throttle position	ON
A/C SIGNAL	A/C switch ON	ON

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

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

*3: When feedback control is forbidden, 0 V is displayed.