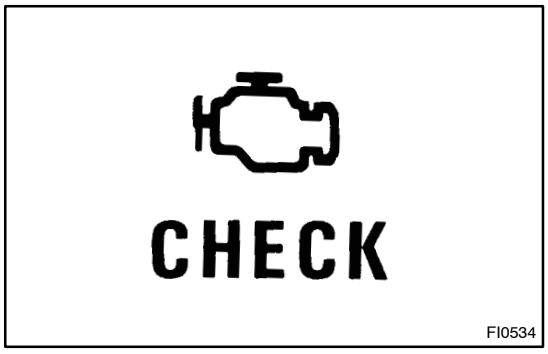
DI00H–22

PRE–CHECK

1. DIAGNOSIS SYSTEM

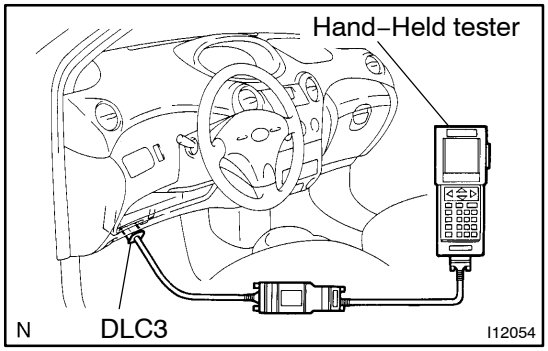
(a) Description

- When troubleshooting OBD II vehicles, the only difference from the usual troubleshooting procedure is that you connect to the vehicle the OBD II scan tool complying with SAE J1978 or hand–held tester, and read off various data output from the vehicle's ECM.



- OBD II regulations require that the vehicle's on–board computer lights up the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in the emission control system/components or in the powertrain control components which affect vehicle emissions, or a malfunction in the computer. In addition to the MIL lighting up when a malfunction is detected, the applicable Diagnostic Trouble Code (DTC) prescribed by SAE J2012 are recorded in the ECM memory (See page DI–3).

If the malfunction does not reoccur in 3 consecutive trips, the MIL goes off automatically but the DTCs remain recorded in the ECM memory.



- To check the DTCs, connect the hand–held tester or OBD II scan tool to Data Link Connector 3 (DLC3) on the vehicle. The hand–held tester or OBD II scan tool also enables you to erase the DTCs and check freeze frame data and various forms of engine data (For operating instructions, see the OBD II scan tool's instruction book.).
- DTCs include SAE controlled codes and manufacturer controlled codes. SAE controlled codes must be set as prescribed by the SAE, while manufacturer controlled codes can be set freely by the manufacturer within the prescribed limits (See DTC chart on page DI–16).

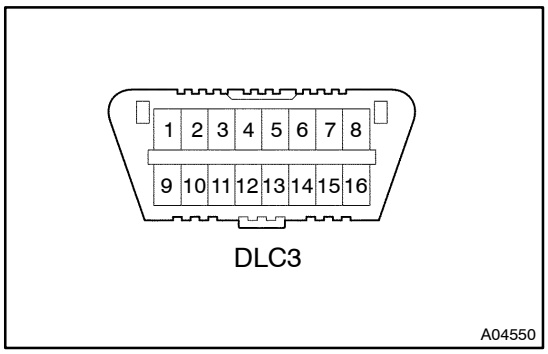
- The diagnosis system operates in normal mode during normal vehicle use. It also has a check mode for technicians to simulate malfunction symptoms and troubleshoot. Most DTCs use *2 trip detection logic to prevent erroneous detection, and ensure thorough malfunction detection. By switching the ECM to check mode when troubleshooting, the technician can cause the MIL to light up for a malfunction that is only detected once or momentarily (Hand–held tester only). (See step 2)
- *2 trip detection logic:
  When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip).

If the same malfunction is first detected again during the second drive test, this second detection causes the MIL to light up (2nd trip) (However, the IG switch must be turned OFF between the 1st trip and the 2nd trip.).

- Freeze frame data:
  Read freeze frame data using the hand–held tester or OBD II scan tool, as freeze frame data records the engine conditions 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. When troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

Priorities for troubleshooting:
If troubleshooting priorities for multiple DTCs are given in the applicable DTC chart, these should be followed.
If no instructions are given troubleshoot DTCs according to the following priorities.

(1) DTCs other than fuel trim malfunction (DTC P0171 and P0172), and misfire (DTC P0300 – P0304).
(2) Fuel trim malfunction (DTC P0171 and P0172).
(3) Misfire (DTC P0300 – P0304).

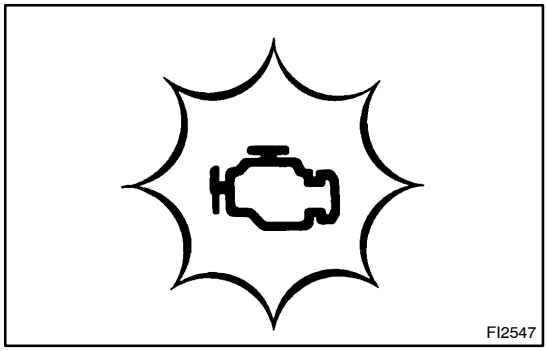


(b) Check the DLC3.
The vehicle's ECM uses ISO 9141–2 for communication. The terminal arrangement of DLC3 complies with SAE J1962 and matches the ISO 9141–2 format.

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

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

- If communication is normal when the tool is connected to another vehicle, inspect DLC3 on the original vehicle.
- If communication is still not possible 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 MIL

(1) The MIL comes on when the ignition switch is turned ON and the engine is not running.

HINT:
If the MIL does not light up, troubleshoot the combination meter (See page BE–2).

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

(b) Check the DTC.

NOTICE:

- **If there is no DTC in the normal mode, check the 1st trip DTC using Continuous Test Result function (Mode 7 for SAE J1979) or the hand–held tester or OBD II scan tool.**

- **Hand–held tester only:**
  When the diagnosis system is switched from normal mode to check mode, it erases all DTCs and freeze frame data recorded in normal mode. So before switching modes, always check the DTCs and freeze frame data, and note them down.
  (1) Prepare the hand–held tester or OBD II scan tool (complying with SAE J1978).
  (2) Connect the hand–held tester or OBD II scan tool to DLC3 under the instrument panel lower pad.
  (3) Turn the ignition switch ON and turn the hand–held tester or OBD II scan tool switch ON.
  (4) Use the hand–held tester or OBD II scan tool to check the DTCs and freeze frame data, note them down. (For operating instructions, see the OBD II scan tool's instruction book.)
  (5) See step 4 to confirm the details of the DTCs.

NOTICE:

- **When simulating symptoms with an OBD II scan tool (excluding hand–held tester) to check the DTCs, use normal mode. For code on the DTC chart subject to "2 trip detection logic", perform the following either action.**
- **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 MIL lights up and the DTCs are recorded in the ECM.**
- **Check the 1st trip DTC using Mode 7 (Continuous Test Results) for SAE J1979.**

(c) Clear the DTC.
The DTCs and freeze frame data will be erased by either action.
  (1) Operating the hand–held tester or OBD II scan tool (complying with SAE J1978) to erase the codes. (See the OBD II scan tool's instruction book for operating instructions.)
  (2) Disconnecting the battery terminals or EFI fuse about for 1 minute.

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 check mode, the DTCs and freeze frame data will be erased.

3. INSPECT DIAGNOSIS (Check 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 mode.

Check the DTC.

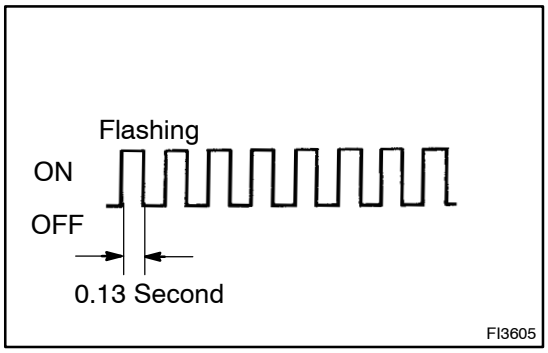
(1) Initial conditions:
- Battery positive voltage 11 V or more.
- Throttle valve fully closed.
- Transmission in ”P” or ”N” position.
- A/C switched OFF.

(2) Turn the ignition switch OFF.

(3) Prepare the hand–held tester.

(4) Connect the hand–held tester to DLC3 under the instrument panel lower pad.

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



(6) Switch the hand–held tester normal mode to check mode (Check that the MIL 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 LOCK during check mode, the DTCs and freeze frame data will be erased.

(7) Switch the engine. (The MIL 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:

Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check mode to normal mode. So all DTCs, etc. are erased.

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

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
P0031 P0032	The heater circuit in which an abnormality is detected is turned off	Ignition switch OFF
P0100	Ignition timing fixed at 5° BTDC	Returned to normal condition

P0110 P0112 P0113	Intake air temp. is fixed at 20˚C (68˚F)	Returned to normal condition
P0115	Engine coolant temp. is fixed at 80˚C (176˚F)	Returned to normal condition
P0120	VTA is fixed at 0˚	The following condition must be repeated at least 2 times consecutively 0.1 V ≦ VTA ≦ 0.95 V
P0325	Max. timing retardation	Ignition switch OFF
P0351 P0352 P0353 P0354	Fuel cut	IGF signal is detected for 2 consecutive ignitions

5. CHECK FOR INTERMITTENT PROBLEMS

HINT:

Hand–held tester only:

By putting the vehicle's ECM in check mode, 1 trip detection logic is possible instead of 2 trip detection logic and 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 mode (See step 3).
(c) Perform a simulation test (See page IN–19).
(d) Check the connector and terminal (See page IN–29).
(e) Handle the connector (See page IN–29).

6. BASIC INSPECTION

When the malfunction code is not confirmed in the DTC 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.

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 page ST–1 and continue to trouble-shoot.**

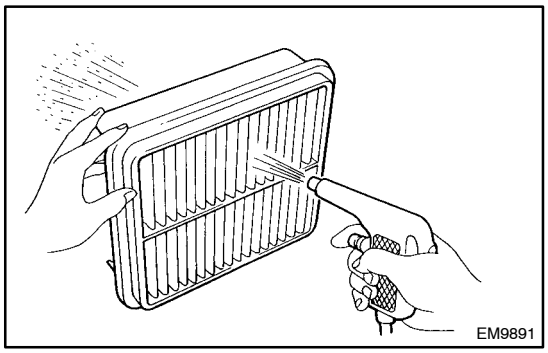
YES

3	**Does engine start?**

NO → **Go to step 7.**

YES

4	**Check air filter.**



PREPARATION:
Remove the air filter.
CHECK:
Visual check that the air filter is not dirty or excessive 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 engine idle speed.**

PREPARATION:
(a) Warm up engine to normal operating temperature.
(b) Switch off all accessories.
(c) Switch off A/C.
(d) Shift transmission into N position.
(e) Connect the hand–held tester or OBD II scan tool to DLC3 on the vehicle.

CHECK:
Use CURRENT DATA to check the idle speed.

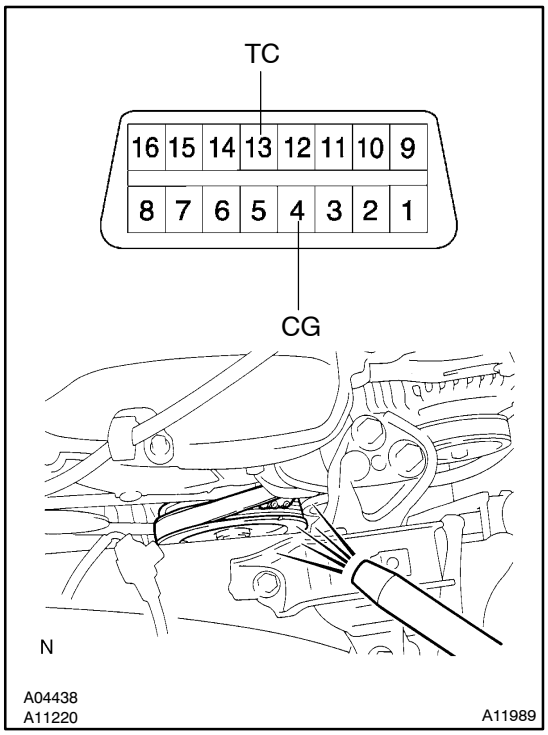
OK:

Idle speed:
M/T 600 – 700 rpm
A/T 650 – 750 rpm

NG → **Proceed to problem symptoms table on page DI–25.**

OK

6	Check ignition timing.



PREPARATION:

(a) Warm up engine to normal operating temperature.
(b) Shift transmission into N position.
(c) Keep the engine speed at idle.
(d) Using SST, connect terminals TC and CG of DLC3.
SST 09843–18040
(e) Using a timing light, connect the tester to the ignition coil connector wire (See page IG–5).

CHECK:

Check ignition timing.

OK:

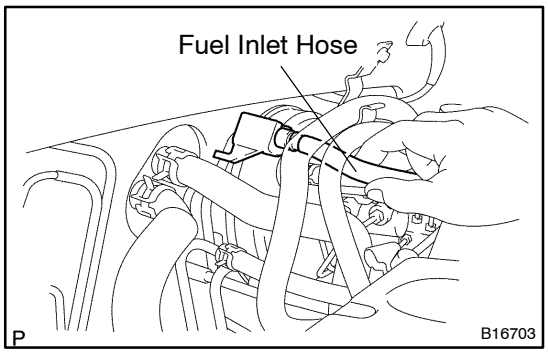
Ignition timing: 8 – 12° BTDC at idle

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

OK

Proceed to problem symptoms table on page DI–25.

7	Check fuel pressure.



PREPARATION:

(a) Be sure that enough fuel is in the tank.
(b) Connect the hand–held tester to the DLC3.
(c) Turn the ignition switch ON and push the hand–held tester main switch ON.
(d) Use the ACTIVE TEST mode to operate the fuel pump.
(e) Please refer to the hand–held tester operator's manual for further details.
(f) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector (See page SF–6).

CHECK:

Check for fuel pressure in the fuel inlet hose when it is pinched off.

HINT:

At this time, you will hear a fuel flowing noise.

NG → **Proceed to page SF–6 and continue to troubleshoot.**

OK

8	**Check for spark.**

PREPARATION:

(a) Remove the ignition coil (See page IG–5).
(b) Remove the spark plug.
(c) Install the spark plug to ignition coil and connect the ignition coil connector to ignition coil.
(d) Disconnect the injector connector.
(e) Be sure to ground the screw of the spark plug securely.

CHECK:

Check if spark occurs while engine is being cranked.

NOTICE:

- **Do not crash the electrode gap.**
- **To prevent excess fuel being injected from the injectors during this test, don't crank the engine for more than 5 – 10 seconds at a time.**

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

OK

Proceed to problem symptoms table on page DI–25.

7. DATA LIST

HINT:

According to the DATA LIST displayed by the OBD II scan tool or hand–held tester, you can read the value of the switch, sensor, actuator and so on without parts removal. Reading the DATA LIST as a first step of troubleshooting is one of the method to shorten the labor time.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the OBD II scan tool or hand–held tester to the DLC3.
(d) Turn the ignition switch ON.
(e) According to the display on tester, read the ”DATA LIST”.

Item	Measurement Item/Range (Display)	Normal Condition	Diagnostic Note
INJECTOR	Injection period/ Min.: 0 ms, Max.: 32.64 ms	Idling: 1.0 – 3.0 ms	
IGN ADVANCE	Ignition timing advance/ Min.: –64 deg., Max.: 63.5 deg.	Idling: BTDC 0 – 14 deg.	
IAC DUTY RATIO	Duty ratio of the IAC valve/ Min.: 0%, Max.: 2.125	Idring: 10 – 40%	
CALC LOAD	Calculated load by engine ECM/ Min.: 0 %, Max.: 100 %	• Idling: 10.0 – 30.0 % • Racing without load(2,500 rpm): 10.0 – 30.0 %	
MAF	Air flow rate from MAF sensor/ Min.: 0 gm/s, Max.: 655 gm/s	• Idling: 1.0 – 3.0 gm/sec. • Racing without load (2,500 rpm): 3.0 – 8.0 gm/sec.	
ENGINE SPD	Engine Speed/ Min.: 0 rpm, Max.: 16,383 rpm	Idling: MT : 600 – 700 rpm AT: 650 – 750 rpm (N)	
COOLANT TEMP	Coolant temperature/ Min.: –40 °C, Max.: 140 °C	After warming up: 80 – 95°C (176 – 203°F)	If the value is ”–40 °C” or ”140 °C”, sensor circuit is open or shorted.
INTAKE AIR	Intake air temperature/ Min.: –40 °C, Max.: 140 °C	Equivalent to Ambient Temp.	
THROTTLE POS	Absolute throttle position sensor/ Min.: 0 %, Max.: 100 %	• Throttle fully closed: 0 – 5 % • Throttle fully open: 90 – 100 %	
VEHICLE SPD	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Vehicle stopped: 0 km/h (0 mph)	
O2S B1 S1	Oxygen sensor output voltage of the bank 1 sensor 2/ Min.: 0 V, Max.: 1.275 V	Driving: 0.1 – 0.9 V	
O2S B1 S2	Oxygen sensor output voltage of the bank 2 sensor 2/ Min.: 0 V, Max.: 1.275 V		
VAPOR PRESS	Vapor pressure Min.: 4.125, Max.: 2.125		
SHORT FT #1	Short term fuel trim of bank 1/ Min.: –100 %, Max.: 100%	0 ± 20 %	
LONG FT #1	Long term fuel trim of bank 1/ Min.: –100 %, Max.: 100 %	0 ± 20 %	
TOTAL FT #1	Total fuel trim of bank 1/ Min.: 0.5, Max.: 1.496	Idling: 0.5 – 1.4	
02FT B1 S1	Short term fuel trim associated with the bank 1, sensor 2 / Min.: –100%, Max.: 100%	0 ± 20 %	

02FT B1 S2	Short term fuel trim associated with the bank 1, sensor 2/ Min.: –100%, Max.: 100%	0 ± 20 %	
02 LR B1 S1	Response time of the O2 sensor lean to rich (bank 1, sensor 1) / Min.: 0 , Max.: 16.711 ms	Idling after warming up: 0 – 1,000 ms	
02 RL B1 S1	Short term fuel trim associated with the bank 1, sensor 2/ Min.: –100%, Max.: 100%	Idling after warming up: 0 – 1,000 ms	
CTP SW	Closed throttle position switch/ ON or OFF	• Throttle fully closed: ON • Throttle open: OFF	
FUEL SYS #1	Fuel system status (Bank1) / OL or CL or OLDRIVE or OLFAULT or CLFAULT	Idling after warming up: CL	• OL: Open Loop–has not yet satisfied conditions to go closed loop. • CL: Closed Loop–using oxygen sensor(s) as feed back for fuel control. • OL DRIVE: Open loop due to driving conditions. (power enrichment, deceleration eneanment) • OL FAULT: Open loop due to detected system fault. • CL FAULT: Closed loop, but fault with at least one oxygen sensor may be using single oxygen sensor for fuel control.
FC IDL	Idle fuel cut / ON or OFF	Fuel cut operation: ON	
MIL	MIL status / ON or OFF	MIL ON: ON	
STARTER SIG	Starter signal / ON or OFF	Cranking: ON	
A/C SIG	A/C signal / ON or OFF	A/C ON: ON	
STOP LIGHT SW	Stop light switch / ON or OFF	• Brake pedal depressed: ON • Brake pedal released: OFF	
PS OIL PRESS SW	Power steering signal / ON or OFF	Steering position is; center: OFF Except center:ON	
PS SIGNAL	Power steering signal / ON or OFF	• After engine start: OFF • After steer the steering: ON	
A/C CUT SIG	A/C cut signal ON or OFF	A/C S/W OFF : ON	
IGNITION	Ignition counter / Min.: 0, Max.: 600	0 – 600	
CYL #1, #2, #3, #4	Misfire ratio of the cylinder 1 / Min.: 0 %, Max.: 50 %	0 %	
FUEL PUMP / SPD	Fuel pump / speed status / ON/H or OFF/M,L	Idling: ON	
EVAP VSV	VSV status for EVAP control / ON or OFF	VSV operating: ON	

8. ACTIVE TEST

HINT:

Performing the ACTIVE TEST using the OBD II scan tool or hand–held tester allows the relay, VSV, actuator and so on to operate without parts removal. Performing the ACTIVE TEST as a first step of troubleshooting is one of the method to shorten the labor time.

It is possible to display the DATA LIST during the ACTIVE TEST.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the OBD II scan tool or hand–held tester to the DLC3.
(d) Turn the ignition switch ON.
(e) According to the display on tester, perform the ”ACTIVE TEST”.

Item	Test Details	Diagnostic Note
INJ VOL	[Test Details] Control the injection volume Min.: –12.5 %, Max.: 24.8 % [Vehicle Condition] Engine speed: 3,000 rpm or less	
IAC DUTY RATIO	[Test Details] Control the IAC duty ratio Min.: 0 %, Max.: 90 % [Vehicle Condition] Vehicle speed: 0 km/h Engine speed: Idling Battery voltage: 8.5 V or more	When Engine speed does not change, IAC system has some failure
A/C CUT SIG	[Test Details] Control the A/C cut signal ON or OFF	
CAN CTRL VSV	[Test Details] Activate the VSV for canister control ON or OFF	
EVAP VSV (ALONE)	[Test Details] Activate the VSV for EVAP control ON or OFF	
FUEL PUMP	[Test Details] Control the fuel pump ON or OFF	
INT AIR CTL VSV	[Test Details] Activate the VSV for intake air contrpl ON or OFF	
VVT CTRL B1	[Test Details] Activate the VVT system (Bank 1) ON or OFF	• ON: Rough idle or engine stall • OFF: Normal engine speed
TC/TE1	[Test Details] Connect the TC and TE1 ON or OFF	