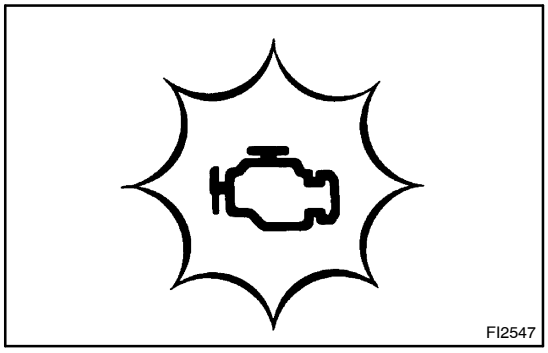
DIDY2–01


FI2547

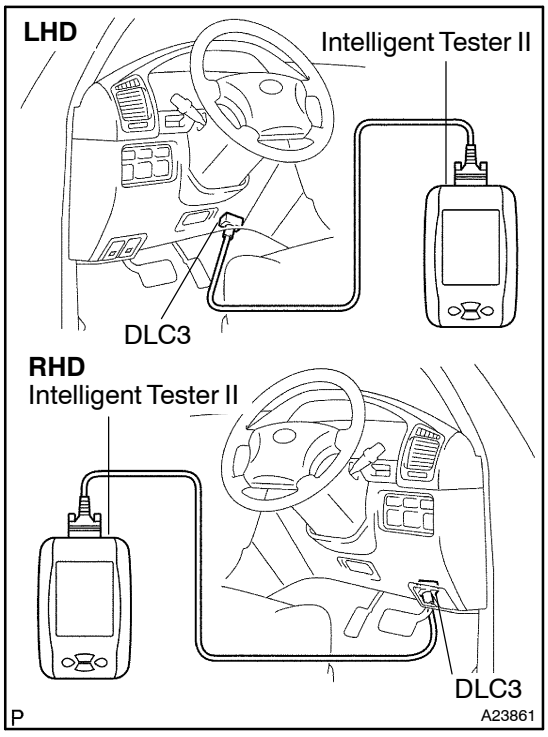
PRE–CHECK

1. DIAGNOSIS SYSTEM

(a) Description

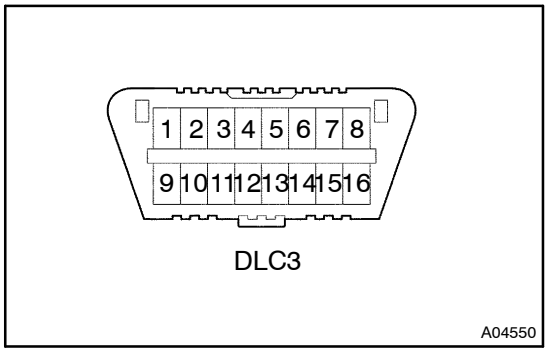
- When troubleshooting Multiplex OBD (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the intelligent tester II to the vehicle, and read off various data output from the vehicle's engine ECU.
- The vehicle's on–board computer lights up the check engine 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 the CHK ENG lighting up when a malfunction is detected, the applicable diagnostic trouble codes are recorded in the engine ECU memory (see page DI–21).

If the malfunction has been repaired, the CHK ENG goes off automatically but the diagnostic trouble codes remain recorded in the engine ECU memory.



- To check the diagnostic trouble codes, connect the intelligent tester II to the Data Link Connector 3 (DLC3) on the vehicle or read the number of blinks of the CHK ENG when TC and CG terminals on the DLC3 are connected. The intelligent tester II also enables you to erase the diagnostic trouble codes, activate several actuators, check freeze frame data and various forms of engine data (for operating instructions, see the intelligent tester II instruction book).
- The diagnosis system operates in normal mode during normal vehicle use. It also has a check mode for technicians to simulate malfunction symptoms and perform troubleshooting. Some diagnostic trouble codes use 2 trip detection logic* to prevent erroneous detection and ensure thorough malfunction detection. By switching the engine ECU to check mode using the intelligent tester II when troubleshooting, the technician can cause the CHK ENG to light up for a malfunction that is only detected once or momentarily (see page DI–21).

- *2 trip detection logic:
  When a malfunction is first detected, the malfunction is temporarily stored in the engine ECU memory (1st trip). If the same malfunction is detected during the next subsequent drive cycle, the CHK ENG is illuminated (2nd trip).
- Freeze frame data:
  Freeze frame data records the engine conditions (fuel system, calculated engine load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air –fuel ratio was lean or rich, and other data from the time the malfunction occurred.

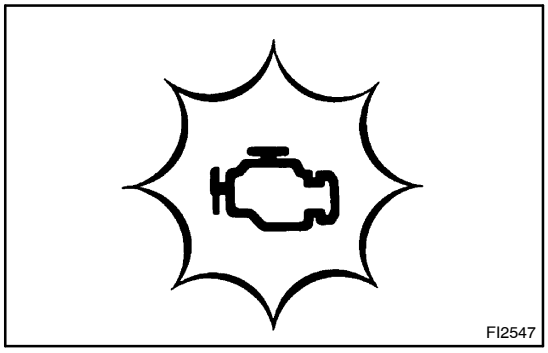


(b) Check the DLC3.
The vehicle's engine ECU uses ISO 14230 for communication. The terminal arrangement of the DLC3 complies with ISO 15031–3 and matches the ISO 14230 format.

Symbols (Terminal No.)	Terminal Description	Condition	Specified Condition
SIL (7) – SG (5)	Bus "+" line	During transmission	Pulse generation
CG (4) – Body ground	Chassis ground	Always	Below 1 Ω
SG (5) – Body ground	Signal ground	Always	Below 1 Ω
BAT (16) – Body ground	Battery positive	Always	9 to 14 V

HINT:
Connect the cable of the intelligent tester II to the DLC3, turn the ignition switch ON and attempt to use the tester. If the display indicates that a communication error has occurred, there is a problem either with the vehicle or with the tester.

- If communication is normal when the tester is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still not possible when the tester is connected to another vehicle, the problem is probably in the tester itself. Consult the Service Department listed in the tester's instruction manual.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2. INSPECT DIAGNOSIS (Normal Mode)

(a) Check the CHK ENG.

(1) The CHK ENG lights up when the ignition switch is turned ON and the engine is not running.

HINT:

If the CHK ENG does not light up, troubleshoot the combination meter.

(2) When the engine is started, the CHK ENG 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 the intelligent tester II.

NOTICE:

When the diagnosis system is changed from normal mode to check mode, or vice versa, all the DTCs and freeze frame data recorded in normal mode will be erased. Before changing modes, always check and make a note of any recorded DTCs and freeze frame data.

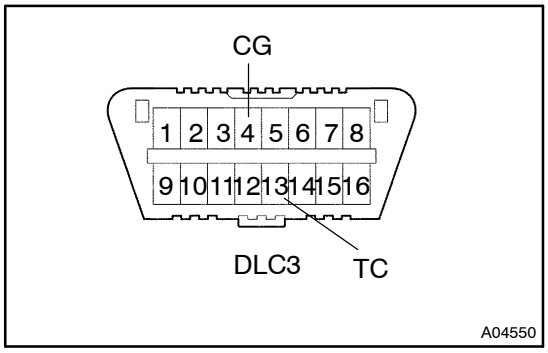
(1) Connect the intelligent tester II to the DLC3.

(2) Turn the ignition switch ON and turn the intelligent tester II ON.

(3) Enter the following menus: Powertrain / Engine and ECT / DTC.

(4) Check and make a note of DTCs and freeze frame data.

(5) Confirm the details of the DTCs.



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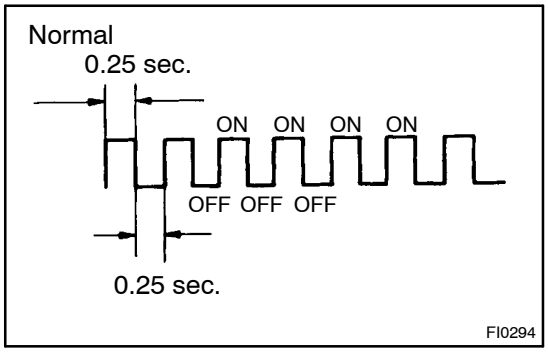
(c) Check the DTC without using the intelligent tester II.

(1) Turn the ignition switch ON.

(2) Using SST, connect between terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843–18040



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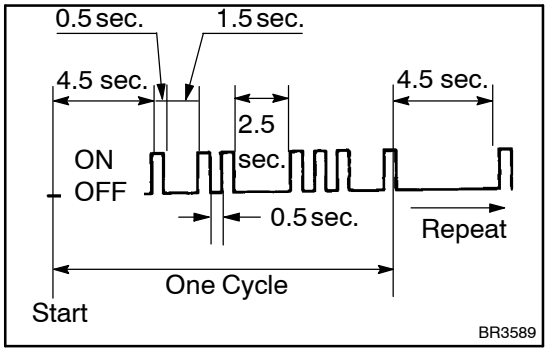
(3) Read DTCs by observing the CHK ENG. If any DTC is not detected, the CHK ENG blinks as shown in the illustration.

HINT:

- If a diagnostic trouble code is not output, check the diagnostic connector (DLC3) circuit (See page DI–146).



(d) Example

As an example, the blinking patterns for codes 12 and 3 1 are as shown on the illustration.

DTCs 12 and 3 1 are detected and the CHK ENG starts displaying the DTCs, as shown on the left. The CHK ENG blinking pattern of DTC 12 will be displayed first.

(1) A 2.5 second pause will occur between the CHK ENG blinking patterns of each DTC.

(2) The CHK ENG blinking pattern of DTC 3 1 will be displayed.

(3) A 4.5 second pause will occur when the CHK ENG blinking pattern is the last of a string of multiple DTCs.

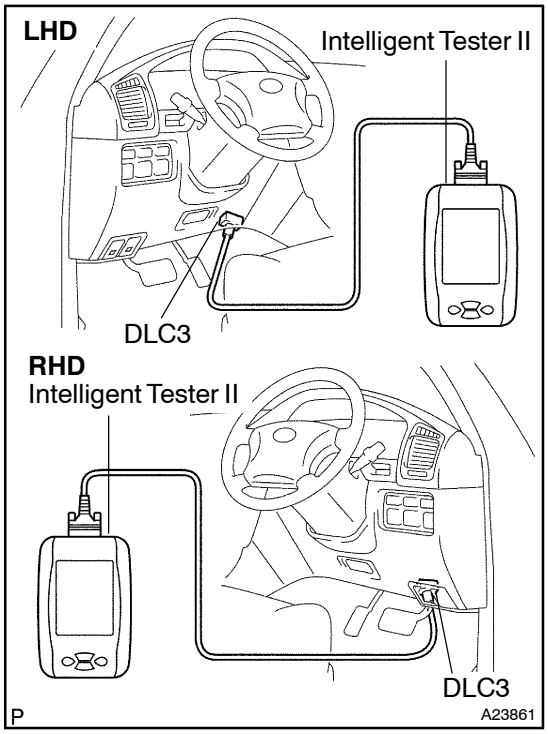
(4) The MIL will repeat the display of the string of DTCs again.

- Check the details of the malfunction using the diagnostic trouble code chart on page DI–21.
- After completing the check, disconnect terminals 13 (TC) and 4 (CG) and turn off the display.

HINT:

If 2 or more DTCs are detected, the CHK ENG will display the smaller number DTC first.

- Confirm the details of the DTCs.



3. INSPECT DIAGNOSIS (Check Mode)

HINT:

Check mode has a higher sensitivity to malfunctions and can detect malfunctions that normal mode cannot detect. Check mode can also detect all malfunctions that normal mode can. In check mode, the engine ECU sets DTCs using 1 trip detection logic.

NOTICE:

All the stored DTCs and freeze frame data are erased if: 1) the engine ECU is changed from normal mode to check mode or vice versa; or 2) the ignition switch is turned from ON to ACC or OFF during check mode.

Before changing modes, always check and make a note of any stored DTCs and freeze frame data.

(a) Check mode procedure.

(1) Make sure that the vehicle is in the following condition:

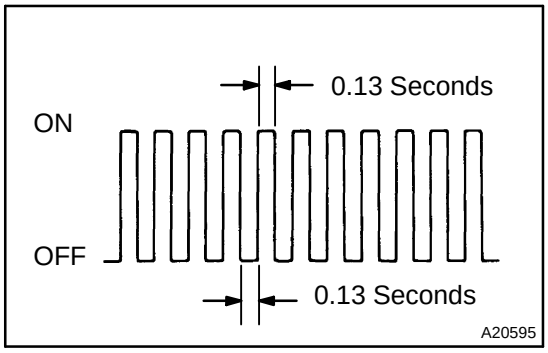
- Battery positive voltage 11 V or more
- Throttle valve fully closed
- Transmission in neutral position
- Air conditioning switch OFF

(2) Turn the ignition switch OFF.

(3) Connect the intelligent tester II to the DLC3.

(4) Turn the ignition switch ON and turn the intelligent tester II ON.

(5) Enter the following menus: Powertrain / Engine and ECT / Check Mode.



(6) Make sure that the CHK ENG flashes as shown in the illustration.
(7) Start the engine (the CHK ENG should turn off).
(8) Simulate the conditions of the malfunction described by the customer.
(9) Check the DTC(s) and freeze frame data using the intelligent tester II.
(10) After checking the DTC, inspect the appropriate circuits.

(b) Clear the DTC and freeze frame data.
(using intelligent tester II)
(1) Connect the intelligent tester II to the DLC3.
(2) Turn the ignition switch ON (do not start the engine) and turn the intelligent tester II ON.
(3) Enter the following menus: Powertrain / Engine and ECT / DTC / Clear.
(4) Erase DTCs and freeze frame data by pressing YES on the tester.

(c) Clear the DTC and freeze frame data.
(not using intelligent tester II)
(1) Disconnect the cable from the negative (−) battery terminal and wait for more than 1 minute.
(2) Remove the EFI OR ECD NO. 1 fuse from the engine room J/B located inside the engine compartment and wait for more than 1 minute.

4. FAIL−SAFE CHART

If any of the following DTCs are set, the engine ECU enters fail−safe mode to allow the vehicle to be driven temporarily.

DTC No.	Fail−Safe Operation	Fail−Safe Deactivation Conditions
P0105/35	Intake air pressure is fixed at 101.3 kPa (760 mmHg, 30 in.Hg)	Return to normal condition
P0110/24*	Atmospheric temp. is fixed at 60°C (140°F)	Return to normal condition
P0115/22	Engine coolant temp. is fixed at 100°C (212°F)	Return to normal condition
P0180/39	Fuel temp. is fixed at 60°C (140°F)	Return to normal condition
P0335/13	$Fuel cut $TCV duty is fixed at 1.0% $Close diesel throttle valve	2 of more NE signals are detected for 0.5 sec.
P0340/12	$TCV duty is fixed at 35.0% $Fuel injection volume is limited	2 of more TDC signals are detected for 4 engine revolutions
P0500/42	Reading of speedmeter is fixed at 0 km/h (0 mph)	Vehicle speed > 9 km/h (5.6 mph)
P1115/23	Intake air temp. is fixed at 20°C (68°F)	Return to normal condition
P1120/19	Accelerator pedal closed position SW ON: Accelerator pedal position is fixed at 0% Accelerator pedal closed position SW OFF: Accelerator pedal position is fixed at 10%	Ignition switch OFF
P1121/19	Accelerator pedal position below 10%	Ignition switch OFF
P1121/19	Accelerator pedal closed position SW ON: Accelerator pedal position is fixed at 0% Accelerator pedal closed position SW OFF: Accelerator pedal position is fixed at 8%	Ignition switch OFF
P1122/19 P1123/19	When idle SW is faulty. Accelerator pedal closed position SW ON: Accelerator pedal position is fixed at 0% Accelerator pedal closed position SW OFF: Accelerator pedal position is fixed at 10%	Ignition switch OFF
	When idle SW is normal. Idle SW ON: Accelerator pedal position is fixed at 0% Idle SW OFF: Accelerator pedal position below 10%	Ignition switch OFF
	Accelerator pedal position below 10%	Ignition switch OFF
P1220/14	Fuel injection volume is limited	Return to normal condition
P1222/15	Accelerator pedal opening angle is limited	Ignition switch OFF
P1250/34*	Variable nozzle is full opened	Ignition switch OFF
P1255/34*	Variable nozzle is full opened Accelerator pedal opening angle is limited	Ignition switch OFF
P1256/34*	Variable nozzle is full opened	Ignition switch OFF
P1416/58*	$Accelerator pedal opening angle is limited $EGR cut	Ignition switch OFF

HINT:

*: Only for Europe

5. CHECK FOR INTERMITTENT PROBLEMS

HINT:

Intelligent tester II:

Inspect the vehicle's engine ECU using check mode. Intermittent problems are easier to detect when the engine ECU is in check mode with the intelligent tester II. In check mode, the engine ECU uses 1 trip detection logic, which has a higher sensitivity to malfunctions than normal mode (default), which uses 2 trip detection logic.

(a) Clear the DTC (see step 3).
(b) Change the engine ECU from normal mode to check mode using the intelligent tester II (see step 3).
(c) Perform a simulation test (see page IN−9).
(d) Check the connector and terminal (see page IN−19).
(e) Wiggle the harness and the connector (see page IN−19).

6. BASIC INSPECTION

When a malfunction cannot be confirmed by the DTC check, troubleshooting should be performed on all circuits that are possible causes of the problem. However, in most cases, performing the basic engine check shown below can help you find the problem quickly and efficiently. Always perform this check first when troubleshooting the engine.

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−16.**

YES

3	**Check air filter (See Pub. No. RM617E on page EM−1).**

CHECK:

Visually check that the air filter is not excessively contaminated with dirt or oil.

NG → **Repair or replace.**

OK

4	**Check fuel quality.**

CHECK:

- Check that only diesel fuel is used.
- Check that the fuel does not contain any impurity.

NG → **Replace fuel.**

OK

5	**Check fuel for air.**

NG → **Bleed air from fuel.**

OK

6	**Check fuel pipes and hoses.**

CHECK:

Check that the fuel pipes and fuel hoses are not blocked, damaged, disconnected or bent.

NG → **Repair or replace.**

OK

7	**Check fuel filter for blockage.**

NG → **Clean or replace.**

OK

8	**Check engine oil (See Pub. No. RM617E on page LU−1).**

NG → **Add or replace.**

OK

9	**Check coolant (See Pub. No. RM617E on page CO−1).**

NG → **Replace coolant.**

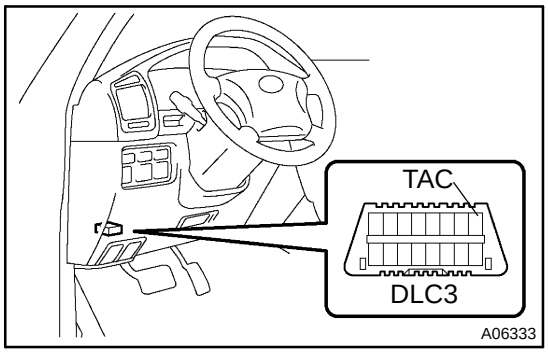
OK

10	**Check injection timing (See Pub. No. RM617E on page EM−14).**

NG → **Adjust injection timing.**

OK

11	Check idle speed and maximum speed.



PREPARATION:
Connect the tester probe of a tachometer to terminal TAC of the DLC3.
Start the engine.
Warm up the engine.
CHECK:
Check the idle speed.
RESULT:
Idle speed: 550 to 650 rpm
PREPARATION:
(a) Start the engine.
(b) Warm up the engine.
(c) Depress the accelerator pedal all the way.
CHECK:
(a) Check the maximum speed.
RESULT:
Maximum speed: 4300 to 4500 rpm

NG	Repair or replace injection pump.

OK

12	Check diagnostic connector (DLC3) circuit (See page DI−146).

NG	Repair or replace.

OK

13	Check vacuum pump.

NG	Repair or replace.

OK

Proceed to problem symptoms table on page DI−16.

7. DATA LIST

HINT:

Using the intelligent tester II's Data List allows switch, sensor, actuator, and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to save time.

NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch ON.
(e) Turn the intelligent tester II ON.
(f) Enter the following menus: Powertrain / Engine and ECT / Data List.
(g) Read the Data List.

Intelligent Tester II Display	Measurement Item/Range (Display)	Normal Conditions*	Diagnostic Notes
MAF	Air flow rate from MAF meter status/ Min.: 0 gm/s, Max.: 655.35 gm/s	S 8 to 12 gm/s: Idling S 52 to 62 gm/s: Running without load (2,000 rpm)	If value approximately 0.0 gm/s: S Mass air flow meter power source circuit open S VG circuit open or shorted If value 135 gm/s or more: S E2G circuit open
MAP	Absolute pressure inside intake manifold/ Min.: 0 kPa, Max.: 225 kPa	S 90 to 110 kPa: Idling S 100 to 130 kPa: Engine running at 2,000 rpm S 110 to 130 kPa: Engine running at 3,000 rpm	—
Engine Speed	Engine speed/ Min.: 0 rpm, Max.: 16383.75 rpm	550 to 650 rpm: Idling (After warming up engine and A/C off)	—
Coolant Temp	Engine coolant temperature/ Min.: −40_C, Max.: 140_C	80 to 95˚C (167 to 194˚F): After warming up engine	If value is −40_C (−40_F) or 140_C (284_F), sensor circuit open or shorted
Intake Air	Intake air temperature/ Min.: −40_C, Max.: 140_C	Equivalent to temperature at intake manifold	If value is −40_C (−40_F) or 140_C (284_F), sensor circuit open or shorted
Vehicle Speed	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Actual vehicle speed	Speed indicated on speedometer
Injection Volume	Injection volume/ Min.: 0 mm^3, Max.: 1279.98 mm^3	4 to 11 mm^3: Idling	—
Starter Signal	Starter signal/ ON or OFF	ON: Cranking	—
Closed Throttle Position SW	Closed throttle position switch/ ON or OFF	OFF: Accelerator pedal released	—
Power Steering Signal	Power steering signal/ ON or OFF	When steering wheel is turned: ON	—
A/C Signal	A/C signal/ ON or OFF	ON: A/C ON	—
Stop Light Switch	Stop lamp switch/ ON or OFF	S ON: Brake pedal depressed S OFF: Brake pedal released	—
Newtral Position SW Signal	PNP switch signal/ ON or OFF	ON: P or N position	—

Intelligent Tester II Display	Measurement Item/Range (Display)	Normal Conditions*	Diagnostic Notes
Power Steering Oil Pressure Switch	Power steering oil pressure switch signal/ ON or OFF	$While turning steering wheel: ON $While not turning steering wheel: OFF	This signal is usually ON unitil ignition switch is turned OFF
EGR System	EGR status for Active Test/ ON or OFF	—	Active Test support date
Injection Timing	Injection timing/ Min.: 0˚CA, Max.: 51˚CA	$16 to 21˚CA: Idling $13 to 24˚CA: Engine running at 2,000 rpm $18 to 31˚CA: Engine running at 3,000 rpm	—
Fuel Temperature	Fuel temperature/ Min.: −40_C, Max.: 140_C	Actual fuel temperature	If value is −40_C (−40_F) or 140_C (284_F), sensor circuit open or shorted
Accel Position	Accelerator position status/ Min.: 0%, Max.: 100%	$0 to 10%: Accelerator pedal released $59 to 100%: Accelerator pedal depressedased	—
Throttle Step Position	Throttle step position/ Min.: 1 step, Max.: 255 step	160 to 180 step: Idling	—
ACT VSV	A/C cut status ON or OFF	ON: A/C OFF	—

HINT:

*: If no idling conditions are specified, the shift lever is in the neutral position, and the A/C switch and all accessory switches are OFF.

8. ACTIVE TEST

HINT:

Performing the intelligent tester II's Active Test allows relay, VSV, actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to save time. The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch ON.
(e) Turn the intelligent tester II ON.
(f) Enter the following menus: Powertrain / Engine and ECT / Active Test.
(g) Perform the Active Test.

Intelligent Tester II Display (Abbreviation)	Test Details	Control Range	Diagnostic Notes
Control the EGR System	Activate E−VRV for EGR	ON/OFF	—
Control the A/C Cut Signal	Control A/C signal	ON/OFF	—
Connect the TC and TE1	Turn on TC and TE1 connection	ON/OFF	—