SFI SYSTEM (April, 2003)

05288–10

HOW TO PROCEED WITH TROUBLESHOOTING

The hand–held tester can be used at step 3, 4, 5, 7, 10.

1	**VEHICLE BROUGHT TO WORKSHOP**

2	**CUSTOMER PROBLEM ANALYSIS (See page 05–4)**

3	**CONNECT HAND–HELD TESTER TO DLC3**

HINT:
If the display indicates a communication fault in the tool, inspect DLC3.

4	**CHECK DTC AND FREEZE FRAME DATA (See page 05–9)**

HINT:
Record or print DTC and freeze frame data, if needed.

5	**CLEAR DTC AND FREEZE FRAME DATA (See page 05–9)**

6	**VISUAL INSPECTION**

7	**SETTING CHECK (TEST) MODE DIAGNOSIS (See page 05–11)**

8	**PROBLEM SYMPTOM CONFIRMATION**

HINT:
If the engine does not start, perform steps 10 and 12 first.

A	Malfunction does not occur
B	Malfunction occurs

B → **GO TO STEP 10**

A

9	SYMPTOM SIMULATION

10	DTC CHECK (See page 05–9)

A	Malfunction code
B	No code

B → GO TO STEP 12

A

11	DTC CHART (See page 05–9)

GO TO STEP 14

12	BASIC INSPECTION (See page 05–13)

A	Wrong parts not confirmed
B	Wrong parts confirmed

B → GO TO STEP 17

A

13	PROBLEM SYMPTOMS TABLE (See page 05–42)

A	Wrong circuit confirmed
B	Wrong parts confirmed

B → GO TO STEP 17

A

14	CHECK ECM POWER SOURCE CIRCUIT (See page 05–273)

15	CIRCUIT INSPECTION

A	Malfunction not confirmed
B	Malfunction confirmed

B → GO TO STEP 18

A

16	CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

GO TO STEP 18

17	PARTS INSPECTION

18	IDENTIFICATION OF PROBLEM

19	ADJUSTMENT, REPAIR

20	CONFIRMATION TEST

END

05289–10

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

Inspector's Name

Customer's Name		VIN	
Driver's Name		Production Date	
Date Vehicle Brought in		Licence No.	
Odometer Reading	km miles		

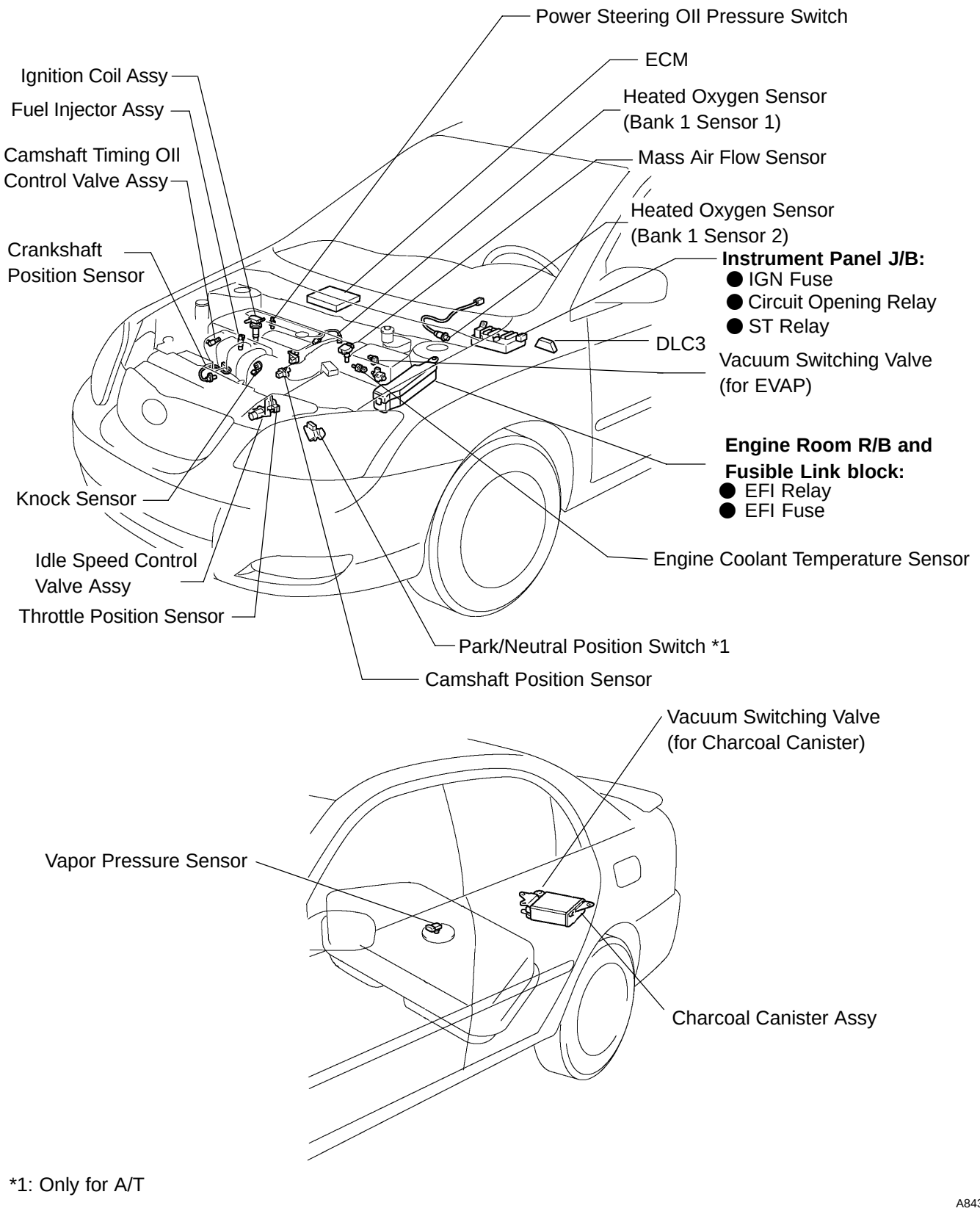
Problem Symptoms	☐ Engine does not Start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion
	☐ Difficult to Start	☐ Engine cranks slowly ☐ Other _____
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal ☐ High (rpm) ☐ Low (rpm) ☐ Rough idling ☐ Other _____
	☐ Poor Driveability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after–fire) ☐ Surging ☐ Knocking ☐ Other _____
	☐ Engine Stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C operation ☐ Shifting from N to D ☐ Other _____
	☐ Others	

Data Problem Occurred		
Problem Frequency		☐ Constant ☐ Sometimes (times per day/month) ☐ Once only ☐ Other _____
Condition When Problem Occurs	Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Other _____
	Outdoor Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (approx. ____ °C/____ °F)
	Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other _____
	Engine Temp.	☐ Cold ☐ Warming up ☐ After Warming up ☐ Any temp. ☐ Other _____
	Engine Operation	☐ Starting ☐ Just after starting (min.) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other _____

Condition of malfunction indicator light (MIL)		☐ Remains on ☐ Sometimes lights up ☐ Does not light up
DTC Inspection	Normal mode (Pre–check)	☐ Normal ☐ Malfunction code(s) (code) ☐ Freeze frame data ( )
	Check Mode	☐ Normal ☐ Malfunction code(s) (code) ☐ Freeze frame data ( )

05285–11

LOCATION

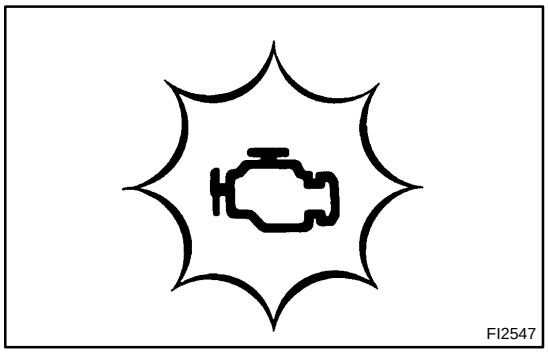


*1: Only for A/T

A84398

05CRG–02

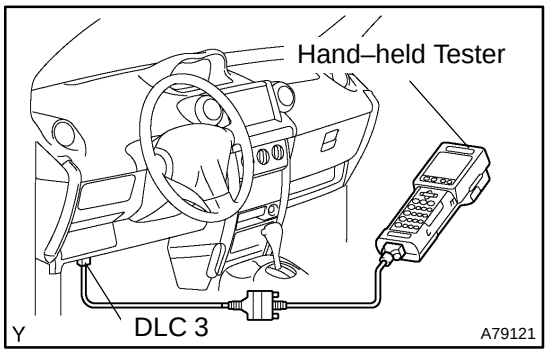
DIAGNOSIS SYSTEM


FI2547

1. DESCRIPTION

- When troubleshooting OBD II vehicles, the only difference from the usual troubleshooting procedure is that you need to connect the vehicle to the OBD II scan tool complying with SAE J1978 or the hand–held tester, and read various data output from the vehicle's ECM.
- OBD II regulations require that the vehicle's on–board computer illuminates the Malfunction Indicator Light (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 illuminating when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTCs) prescribed by SAE J2012 are recorded in the ECM memory (See page 05–35).

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 DTC, connect the hand–held tester or OBD II scan tool to the Data Link Connector 3 (DLC3) of the vehicle. The hand–held tester or OBD II scan tool also enables you to erase the DTC and check the freeze frame data and various forms of engine data (for operating instructions, see the OBD II scan tool's instruction book). The DTC includes 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 a manufacturer within the prescribed limits (see the DTC chart on page 05–35).
- The diagnosis system operates in the normal mode during normal vehicle use. It also has a check mode for technicians to simulate malfunction symptoms and troubleshoot it. Most DTCs use the 2 trip detection logic* to prevent erroneous detection, and to ensure a thorough malfunction detection. By switching the ECM to the check mode when troubleshooting, a technician can cause the MIL to illuminate for a malfunction that is only detected once or momentarily (hand–held tester only) (See page 05–11).
- *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 detected again during the second

drive test, this second detection causes the MIL to illuminate (2nd trip) (However, the ignition switch must be turned OFF between the 1st trip and 2nd trip).

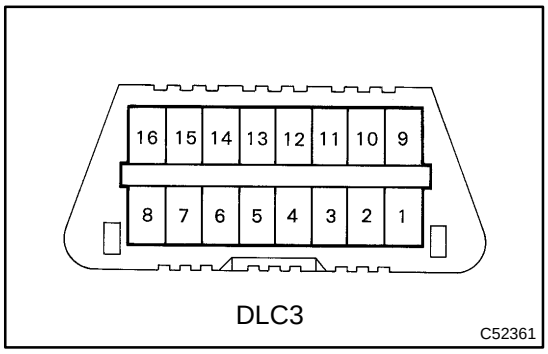
- Freeze frame data:
  The freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

Priorities for troubleshooting:

If troubleshooting priorities for multiple DTCs are given in the applicable DTC chart, these priorities should be followed.

If no instructions are given, perform troubleshooting for those DTCs according to the following priorities.

(a) DTCs other than fuel trim malfunction (DTCs P0171 and P0172) and misfire (DTCs P0300 to P0304).
(b) Fuel trim malfunction (DTCs P0171 and P0172).
(c) Misfire (DTCs P0300 to P0304).



2. CHECK DLC3

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

Symbol	Terminal No.	Name	Reference terminal	Result	Condition
SIL	7	Bus "+" line	5 – Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	9 to 14 V	Always

HINT:

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

- If the communication is normal when the tool is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If the communication is still impossible 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.

3. INSPECT BATTERY VOLTAGE

Battery Voltage: 11 to 14 V

If voltage is below 11 V, recharge the battery before proceeding.

4. CHECK MIL

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

HINT:

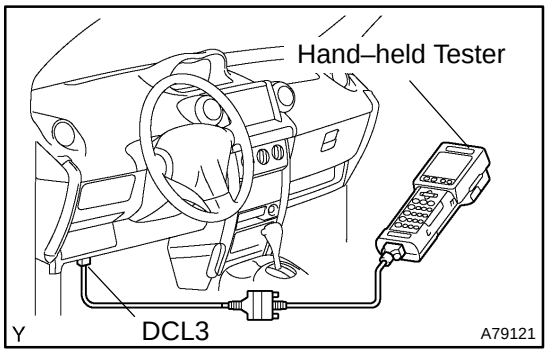
If the MIL is not illuminated, troubleshoot the MIL circuit (See page 05–292).

(b) When the engine is started, the MIL should go off. If the MiL remains on, it means that the diagnosis system has detected a malfunction or abnormality in the system.

DTC CHECK/CLEAR

NOTICE:

- **If there is no DTC in the normal mode, check the pending fault code using the Continuous Test Results function (Mode 7 for SAE J1979) on the OBD II scan tool or the hand–held tester.**
- **Hand–held tester only:**
  When the diagnosis system is switched from the normal mode to the check mode, all the DTCs and freeze frame data recorded in the normal mode will be erased. So before switching modes, always check the DTCs and freeze frame data, and then write them down.



1. CHECK DTC (Using the OBD II scan tool or hand–held tester)

(a) Connect the OBD II scan tool or hand–held tester to the DLC3.

(b) Turn the ignition switch ON.

(c) Use the OBD II scan tool or the hand–held tester to check the DTCs and freeze frame data and then write them down. If you need help with the OBD II scan tool, refer to the scan tool's instruction book.
If there is no DTC in the normal mode, check the pending fault code using the Continuous Test Results function on the OBD II scan tool or the hand–held tester.

(d) See page 05–35 to confirm the details of the DTCs.

NOTICE:

- **When simulating a symptom with the OBD II scan tool (excluding hand–held tester) to check the DTCs, use the normal mode. For code on the DTC chart subject to the "2 trip detection logic", perform either of the following actions.**
- **Turn the ignition switch OFF after the symptom is simulated once. 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 pending fault code using the Continuous Test Results function on the OBD II scan tool.**

2. CLEAR DTC (Using the OBD II scan tool or hand–held tester)

(a) Connect the OBD II scan tool or the hand–held tester to the DLC3.

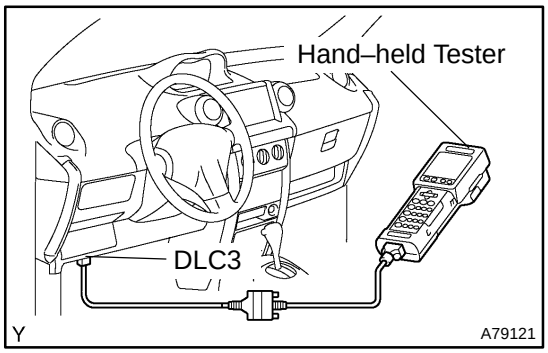
(b) Turn the ignition switch ON.

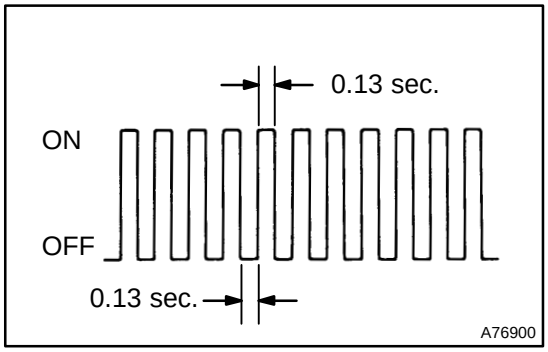
(c) Operate the OBD II scan tool or the hand–held tester to erase the codes. All the DTCs and freeze frame data will be erased. (See the OBD II scan tool's instruction book for operating instructions.)

3. CLEAR DTC (Not using the OBD II scan tool or hand–held tester)

(a) Disconnect the battery terminal or remove the EFI fuse from the engine room R/B for more than 60 seconds.

CHECK MODE PROCEDURE





HINT:

Hand–held tester only:

Compared to the normal mode, the check mode has more sensing ability to detect malfunctions. Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check mode.

1. CHECK MODE PROCEDURE(Using the hand–held tester)

(a) Check the initial conditions.
  (1) Battery positive voltage 11 V or more
  (2) Throttle valve fully closed
  (3) Transmission in the P or N position
  (4) A/C switched OFF

(b) Turn the ignition switch OFF.

(c) Connect the hand–held tester to the DLC3.

(d) Turn the ignition switch ON.

(e) Switch the hand–held tester from the normal mode to the 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 OFF during the check mode, the DTC and freeze frame data will be erased.

(f) Start the engine (MIL goes off after the engine starts).

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

NOTICE:

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

(h) After simulating the malfunction conditions, check the DTC and freeze frame data, etc using the hand–held tester diagnosis selector.

HINT:

Do not turn the ignition switch OFF, as turning it OFF switches the diagnosis system from the check mode to the normal mode, which erases all the DTCs, etc.

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

2. CLEAR DTC (Using the OBD II scan tool or hand–held tester)

(a) Connect the OBD II scan tool or hand–held tester to the DLC3.

(b) Turn the ignition switch ON.

(c) Operate the OBD II scan tool or hand–held tester to erase the codes. All the DTCs and freeze frame data will be erased. (See the OBD II scan tool's instruction book for operating instructions.)

3. CLEAR DTC (Not using the OBD II scan tool or hand–held tester)

(a) Disconnect the battery terminal or remove the EFI fuse from the engine room R/B for more than 60 seconds.

05CRJ–02

BASIC INSPECTION

When the malfunction is not confirmed in the DTC check, troubleshooting should be carried out in all the possible circuits considered as causes of the problem. In many cases, by carrying out the basic engine check shown in the following flowchart, the location causing the problem can be found quickly and efficiently. Therefore, using this check is essential in the engine troubleshooting.

1	CHECK BATTERY VOLTAGE

NOTICE:
Carry out this check with the engine stopped and ignition switch OFF.

	OK	NG
Voltage	11 V or more	Less than 11 V

NG → **CHARGE OR REPLACE BATTERY**

OK

2	CHECK IF ENGINE WILL CRANK

NG → **PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–42**

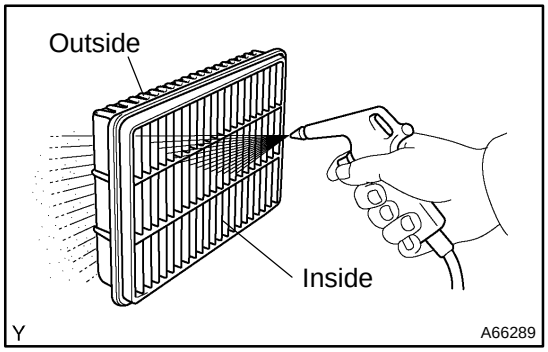
OK

3	CHECK IF ENGINE STARTS

NG → **GO TO STEP 7**

OK

4	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 the inside thoroughly, then blow from the outside of the filter.

NG → **CLEAN OR REPLACE**

OK

5	CHECK IDLE SPEED (See page 14–1)

NG → **PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–42**

OK

6	CHECK IGNITION TIMING (See page 14–1)

NG → PROCEED TO PAGE 14–1 AND CONTINUE TO TROUBLESHOOT

OK

PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–42

7	CHECK FUEL PRESSURE (See page 11–5)

NG → PROCEED TO PAGE 11–1 AND CONTINUE TO TROUBLESHOOT

OK

8	CHECK FOR SPARK (See page 18–1)

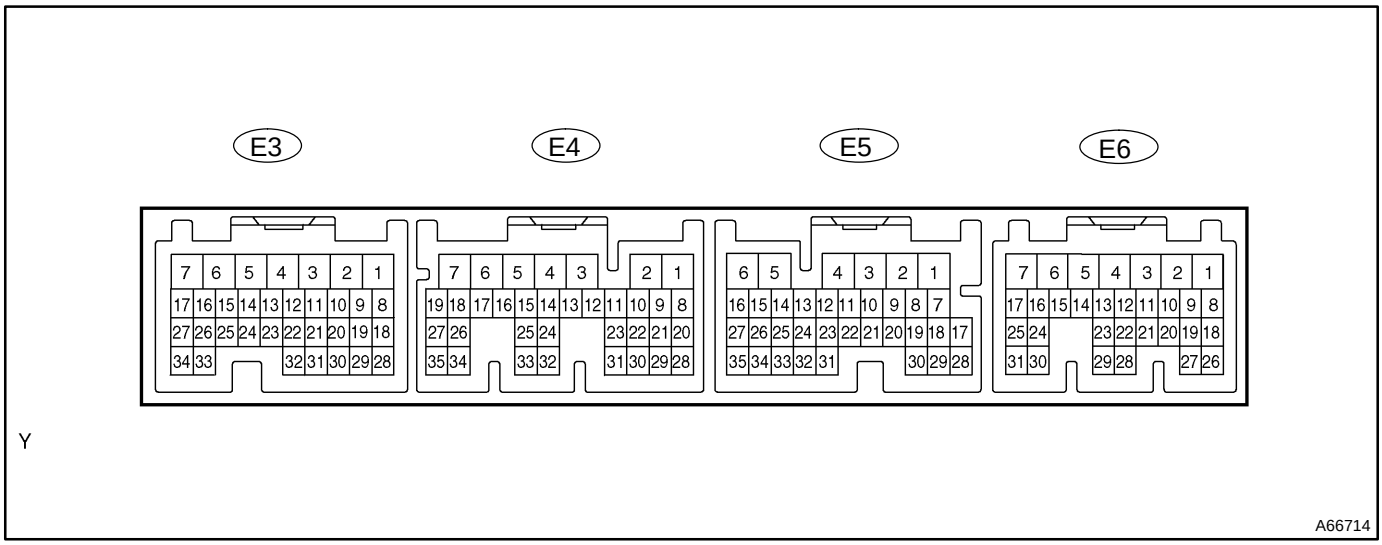
NG → PROCEED TO PAGE 18–1 AND CONTINUE TO TROUBLESHOOT

OK

PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–42

05286–12

TERMINALS OF ECM



Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage (V)
BATT (E6 – 3) – E1 (E4 – 7)	R–W – BR	Battery (for measuring the battery voltage and for the ECM memory)	Always	8 to 14
FC (E6 – 10) – E1 (E4 – 7)	G–R – BR	Fuel pump control	IG switch ON	8 to 14
			Idling	Below 1.5
W (E6 – 11) – E1 (E4 – 7)	R–Y – BR	MIL	Idling	8 to 14
			IG switch ON	Below 3.5
+B (E6 – 1) – E1 (E4 – 7)	B – BR	Power source of ECM	IG switch ON	8 to 14
STP (E5 – 19) *1 – E1 (E4 – 7)	G–W – BR	Stop light switch	IG switch ON, Brake pedal de-pressed	8 to 14
			IG switch ON, Brake pedal released	Below 1.5
F/PS (E6 – 14) – E1 (E4 – 7)	Y – BR	Airbag sensor	IG switch ON	Pulse generation
STA (E4 – 9) – E1 (E4 – 7)	B – BR	Starter signal	Cranking	5.5 or more
PSW (E4 – 29) – E1 (E4 – 7)	L–R – BR	Power steering oil pressure sensor	IG switch ON	8 to 14
SPD (E5 – 17) – E1 (E4 – 7)	V–W – BR	Speed signal from combination meter	IG switch ON, rotate driving wheel slowly	Pulse generation
TACH (E6 – 5) – E1 (E4 – 7)	B – BR	Engine speed	Idling	Pulse generation
VC (E3 – 18) – E2 (E3 – 28)	Y – BR	Power source of sensor (a specific voltage)	IG switch ON	4.5 to 5.5
EVP (E3 – 12) – E01 (E3 – 7)	L–B – W–B	VSV for EVAP	IG switch ON	8 to 14
CCV (E5 – 1) – E01 (E3 – 7)	L – W–B	VSV for CCV	IG switch ON	9 to 14
TBP (E6 – 4) – E01 (E3 – 7)	R – W–B	VSV for Vapor pressure sensor	IG switch ON	9 to 14
PTNK (E6 – 21) – E2 (E3 – 28)	L – BR	Vapor pressure sensor	Ignition switch ON	2.9 to 3.7
			Apply vacuum 4.0 kPa (30 mmHG, 1.18 in.Hg)	Below 0.5
VG (E4 – 24) – EVG (E4 – 32)	G – L–W	Mass air flow sensor	Idling, A/C switch OFF	1.1 to 1.5
OX1A (E4 – 23) – E1 (E4 – 7)	B – BR	Heated oxygen sensor (Sensor 1)	Maintain engine speed at 2,500 rpm for 2 min. after warning up	Pulse generation (See Page 05–96)
HT1A (E4 – 4) – E03 (E4 – 5)	P – W–B	Heated oxygen sensor heater (Sensor 1)	Idling	Below 3.0
			IG switch ON	9 to 14
OX1B (E4 – 21) – E1 (E4 – 7)	W – BR	Heated oxygen sensor (Sensor 2)	Maintain engine speed at 2,500 rpm for 2 min. after warning up	Pulse generation (See Page 05–96)
HT1B (E5 – 4) – E03 (E4 – 5)	P–B – W–B	Heated oxygen sensor heater (Sensor 2)	Idling	Below 3.0
			IG switch ON	9 to 14

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage (V)
THW (E3 – 19) – E2 (E3 – 28)	W – BR	Engine coolant temperature sensor	Idling, Engine coolant temp. at 80˚C (176˚F)	0.2 to 1.0
G22+ (E3 – 26) – NE– (E3 – 34)	B – W	Camshaft position sensor	Idling	Pulse generation (See Page 05–168)
NE+ (E3 – 27) – NE– (E3 – 34)	B – W	Crankshaft position sensor	Idling	Pulse generation See Page 05–168)
THA (E3 – 20) – E2 (E3 – 28)	Y–B – BR	Intake air temperature sensor	Idling, intake air temp. at 20˚C (68˚F)	0.5 to 3.4
VTA (E3 – 21) – E2 (E3 – 28)	LG – BR	Throttle position sensor	IG switch ON, throttle valve fully closed	0.3 to 1.0
			IG switch ON, throttle valve fully open	3.2 to 4.9
#10 (E3 – 1) – E01 (E3 – 7)	Y – W–B	Injector	IG switch ON	8 to 14
#20 (E3 – 2) – E01 (E3 – 7)	B – W–B			
#30 (E3 – 3) – E01 (E3 – 7)	W – W–B			
#40 (E3 – 4) – E01 (E3 – 7)	L – W–B			
IGT1 (E3 – 8) – E1 (E4 – 7)	R–L – BR	Ignition coil and igniter (ignition signal)	Idling	Pulse generation (See Page 05–177)
IGT2 (E3 – 9) – E1 (E4 – 7)	Y–G – BR			
IGT3 (E3 – 10) – E1 (E4 – 7)	GR – BR			
IGT4 (E3 – 11) – E1 (E4 – 7)	W – BR			
IGF (E3 – 23) – E1 (E4 – 7)	L–Y – BR	Ignition coil and igniter (ignition confirmation signal)	IG switch ON	4.5 to 5.5
			Idling	Pulse generation (See Page 05–177)
RSO (E3 – 5) – E01 (E3 – 7)	B–L – W–B	Idle air control valve	IG switch ON	9 to 14
OCV+ (E3 – 15) – OCV– (E3 – 14)	Y – B–Y	Camshaft timing oil control valve	IG switch ON	Pulse generation (See Page 05–44)
KNK1 (E4 – 1) – EKNK (E4 – 2)	B – W	Knock sensor	Idling	Pulse generation (See Page 05–163)
TC (E6 – 20) – E1 (E4 – 7)	P–B – BR	Terminal TC of DLC 3	IG switch ON	9 to 14
SIL (E6 – 18) – E1 (E4 – 7)	L–R – BR	Terminal SIL of DLC3	Connect hand–held tester to DLC3	Pulse generation

*1: A/T only

05CRK–02

DATA LIST/ACTIVE TEST

1. DATA LIST

HINT:

Using the DATA LIST displayed by the hand–held tester or the OBD II scan tool, you can read the value of the switches, sensors, actuators and so on without parts removal. Reading the DATA LIST as a first step of troubleshooting is one method to shorten diagnostic time.

NOTICE:

The values given below for "Normal Condition" are representative values. A vehicle may still be normal even if its value differs from those listed here. Do not solely depend on the "Normal Condition" here when deciding whether a part is faulty or not.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(d) Turn the ignition switch ON.
(e) Push the "ON" button of the hand–held tester or the OBD II scan tool.
(f) Select the item "DIAGNOSIS / ENHANCED OBD II / DATA LIST".
(g) According to the display on the tester, read the "DATA LIST".

Hand–held tester display	Measurement Item/Range (Display)	Normal Condition*1	Diagnostic Note
INJECTOR	Injection period of the No. 1 cylinder/ Min.: 0 ms, Max: 32.64 ms	Idling: 1.1 to 2.5 ms	—
IGN ADVANCE	Ignition timing advance for No. 1 cylinder/ Min.: –64 deg., Max.: 63.5 deg.	Idling: BTDC 8 to 20˚	—
IAC DUTY RATIO	Intake Air Control Valve duty ratio Opening ratio rotary solenoid type ISC valve/ Min.: 0 %, Max.: 99 %	Idling: 25 to 45 % Running without load (2,500 rpm): 12.3 to 17.9 %	—
CALC LOAD	Calculated load by ECM/ Min.: 0 %, Max.: 100 %	Idling: 11.3 to 20.0 % Running without load (2,500 rpm): 11.5 to 17.9 %	—
MAF	Air flow rate from MAF sensor/ Min.: 0 gm/s, Max.: 655 gm/s	Idling: M/T 1.4 to 2.3 gm/s. A/T 1.4 to 2.3 gm/s. Racing without load (2,500 rpm): 5.4 to 7.9 gm/s.	If the value is approximately 0.0 gm/s: • Mass air flow meter power source circuit open • VG circuit open or short If the value is 160.0 gm/s or more: • E2G circuit open
ENGINE SPD	Engine Speed/ Min.: 0 rpm, Max.: 16,383 rpm	Idling: M/T 650 to 750 rpm A/T 650 to 750 rpm	—
COOLANT TEMP	Coolant temperature/ Min.: –40 °C, Max.: 140 °C	After warming up: 80 to 95˚C (176 to 203˚F)	• If the value is –40°C (–40°F): sensor circuit is open. • If the value is greater than 140°C (284°F): sensor circuit is 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: 8 to 18 % Throttle Fully Open: 64 to 98 %	Read the value with the ignition switch ON (Do not start engine)
CTP SW	Closed throttle position switch/ ON or OFF	Throttle Fully Closed: ON Throttle Open: OFF	—
VEHICLE SPD	Vehicle Speed/ Min.: 0 km/h, Max.: 255 km/h	Vehicle stopped: 0 km/h (0 mph)	—

Hand–held tester display	Measurement Item/Range (Display)	Normal Condition*1	Diagnostic Note
O2S B1 S1	Heated oxygen sensor output voltage for bank 1 sensor 1/ Min.: 0 V, Max.: 1.275 V	Idling: 0.1 to 0.9 V	Performing the INJ VOL or A/F CONTROL function of the ACTIVE TEST enables the technician to check the voltage output of each sensor.
O2S B1 S2	Heated oxygen sensor output voltage for bank 1 sensor 2/ Min.: 0 V, Max.: 1.275 V	Idling: 0.1 to 0.9 V	
VAPOR PRESS	Vapor Pressure/ Min.: –4.125 kPa, Max.: 2.125 kPa	Fuel tank cap removed: 0 kPa	Pressure inside the fuel tank can be read by the vapor pressure sensor
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%	This item is the overall fuel compensation carried out in long–term to compensate for a continual deviation of the short–term fuel trim from the central value.
TOTAL FT #1	Total fuel trim of bank 1: Average value for fuel trim system of bank 1/ Min.: 0.5, Max.: 1.496	Idling: 0.5 to 1.4	—
O2FT B1 S1	Short term fuel trim associated with the bank 1 sensor 2/ Min.: –100 %, Max.: 100 %	0 ± 20 %	Same as SHORT FT #1
O2FT B1 S2	Short term fuel trim associated with the bank 1 sensor 2/ Min.: –100 %, Max.: 100 %	0 ± 20 %	Same as SHORT FT #2
FUEL SYS #1	Fuel system status (Bank 1)/ OL or CL or OL DRIVE or OL FAULT or CL FAULT	Idling after warming up: CLOSED	• OL: Open loop has not yet satisfied conditions to go closed loop. • CL: Closed loop using heated oxygen sensor(s) as feed back for fuel control. • OL DRIVE: Open loop due to driving conditions. (fuel enrichment) • OL FAULT: Open loop due to detected system fault. • CL FAULT: Closed loop but one of heated oxygen sensors, which is used for fuel control, is functioning improperly.
FC IDL	Fuel cut idle/ON or OFF	Fuel cut operating: ON	FC IDL = ”ON” when throttle valve is fully closed and engine speed is over 1,500 rpm.
O2 LR B1 S1	Responsetime of the heated oxygen sensor, lean to rich (bank 1 sensor 1)/ Min.: 0 ms, Max.: 16,711 ms	Idling after warming up: 0 to 1,000 m/s.	—
O2 RL B1 S1	Responsetime of the heated oxygen sensor, from rich to lean (bank 1 sensor 1)/ Min.: 0 ms, Max.: 16,711 ms	Idling after warming up: 0 to 1,000 m/s.	—
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	—
PNP SW [NSW] *2	Park/neutral position switch signal/ ON or OFF	P or N position: ON	—
ELECT LOAD SIG	Electrical load signal / ON or OFF	Defogger switch ON: ON	—

Hand–held tester display	Measurement Item/Range (Display)	Normal Condition*1	Diagnostic Note
STOP LIGHT SW *2	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	When the steering wheel is turned	This signal is usually ON status until the IG switch is turned OFF.
FUEL PUMP / SPD	Fuel pump / speed status / ON/H or OFF/M,L	Idling: ON	—
A/C MAG CLUTCH	A/C magnet clutch status / ON or OFF	A/C magnet clutch ON: ON	—
EVAP VSV	VSV status for EVAP control/ ON or OFF	VSV operating: ON	VSV for EVAP is controlled by the ECM (ground side duty control)
VVT CTRL B1	VVT control status (bank 1)/ ON or OFF	VVT system operation: ON	—
IGNITION	Ignition counter/ Min.: 0, Max.: 400	0 to 400	—
CYL #1, #2, #3, #4	Misfire ratio of the cylinder 1 to 4/ Min.: 0 %, Max.: 50 %	0 %	This item is displayed in only idling
MISFIRE LOAD	Engine load for first misfire range/ Min.: 0 g/rev, Max.: 3.98 g/rev	Misfire 0: 0 g/rev	—
MISFIRE RPM	Engine RPM for first misfire range/ Min.: 0 rpm, Max.: 6,375 rpm	Misfire 0: 0 rpm	—
O2 LR B1 S2	Responsetime of the heated oxygen sensor, lean to rich (bank 1 sensor 2)/ Min.: 0 ms, Max.: 16,711 ms	Idling after warming up: 0 to 1,000 m/s.	—
FC TAU	Fuel Cut TAU: Fuel cut during very light load	Fuel cut operating: ON	The fuel cut is being performed under very light load to prevent the engine combustion from becoming incomplete.
O2 RL B1 S2	Responsetime of the heated oxygen sensor, rich to lean (bank 1 sensor 2)/ Min.: 0 ms, Max.: 16,711 ms	Idling after warming up: 0 to 1,000 m/s.	—
CHECK MODE	Check mode/ON or OFF	Check mode ON:OFF	—

*1: If no conditions are specifically stated for ”Idling”, it means the shift lever is in the N or P position, the A/C switch is OFF and all accessory switches are OFF.
*2: A/T only

2. ACTIVE TEST

HINT:

Performing the ACTIVE TEST using the hand–held tester or the OBD II scan tool 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 method to shorten diagnostic 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 hand–held tester or the OBD II scan tool to the DLC3.
(d) Turn the ignition switch ON.
(e) Push the ”ON” button of the hand–held tester or the OBD II scan tool.
(f) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST”.
(g) According to the display on the tester, perform the ”ACTIVE TEST”.

Hand–held Tester Display	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	• All injectors are tested at once. • Injection volume is gradually changed between –12.5 and 25%.
A/F CONTROL	[Test Details] Control the injection volume –12.5 or 25 % (Change the injection volume –12.5 % or 25 %.) [Vehicle Condition] Engine speed: 3,000 rpm or less	The following A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the A/F sensor and heated oxygen sensor. For displaying the graph indication, enter ”ACTIVE TEST/A/F CONTROL/USER DATA”, then select ”O2S B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.
IAC DUTY RATIO	[Test Details] Control the ISC duty ratio 0 to 90 % [Vehicle Condition] • Engine speed: Idling • Vehicle speed: 0 mph (0 km/h) • Battery voltage: 8.5 V or more	—
CAN CTRL VSV	[Test Details] Activate the VSV for canister control ON or OFF	—
TANK BYPASS VSV	[Test Details] Activate the VSV for tank bypass. ON or OFF	—
EVAP VSV (ALONE)	[Test Details] Activate the VSV for EVAP control ON or OFF	—
A/C MAG CLUTCH	[Test Details] Control the A/C magnet clutch. ON or OFF	—
FUEL PUMP / SPD	[Test Details] Control the fuel pump ON or OFF	—

Hand–held Tester Display	Test Details	Diagnostic Note
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	—
FC IDL PROHBT	[Test Details] Control the idle fuel cut prohibit ON or OFF	—

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DEFINITION OF TERMS

Term	Definition
Monitor description	Description of what the ECM monitors and how it detects malfunction (monitoring purpose and its details).
Related DTCs	Diagnostic code
Typical enabling condition	Preconditions that allow the ECM to detect malfunction. With all preconditions satisfied, the ECM sets the DTC when the monitored value(s) exceeds the malfunction threshold(s).
Sequence of operation	The priority order that is applied to monitoring, if multiple sensors and components are used to detect the malfunction. While another sensor is being monitored, the next sensor or component will not be monitored until the previous monitoring has concluded.
Required sensor/components	The sensors and components that are used by the ECM to detect malfunction.
Frequency of operation	The number of times that the ECM checks for malfunction per driving cycle. ”Once per driving cycle” means that the ECM detects malfunction only one time during a single driving cycle. ”Continuous” means that the ECM detects malfunction every time when enabling condition is met.
Duration	The minimum time that the ECM must sense a continuous deviation in the monitored value(s) before setting a DTC. This timing begins after the ”typical enabling conditions” are met.
Malfunction thresholds	Beyond this value, the ECM will conclude that there is malfunction and set a DTC.
MIL operation	MIL illumination timing after a defect is detected. ”Immediately” means that the ECM illuminates the MIL the instant the ECM determines that there is malfunction. ”2 driving cycle” means that the ECM illuminates the MIL if the same malfunction is detected again in the 2nd driving cycle.

05DIE–01

TOYOTA/LEXUS PART AND SYSTEM NAME LIST

This reference list indicates the part names used in this manual along with their definitions.

TOYOTA/LEXUS name	Definition
Toyota HCAC system, Hydro–carbon Adsorptive Catalyst (HCAC) system, HC adsorptive three–way catalyst	HC adsorptive three–way catalytic converter
Variable Valve Timing sensor, VVT sensor	Camshaft position sensor
Variable valve timing system, VVT system	Camshaft timing control system
Camshaft timing oil control valve, Oil control valve, OCV, VVT, VSV	Camshaft timing oil control valve
Variable timing and lift	Camshaft timing and lift control
Crankshaft position sensor ”A”	Crankshaft position sensor
Engine speed sensor	Crankshaft position sensor
THA	Intake air temperature
Knock control module	Engine knock control module
Knock sensor	Engine knock sensor
Mass or volume air flow circuit	Mass air flow sensor circuit
Vacuum sensor	Manifold air pressure sensor
Internal control module, Control module, Engine control ECM, PCM	Power train control module
FC idle	Deceleration fuel cut
Idle air control valve	Idle speed control
VSV for CCV, Canister close valve, VSV for canister control	Evaporative emissions canister vent valve
VSV for EVAP, Vacuum switching valve assembly No. 1, EVAP VSV, Purge VSV	Evaporative emissions canister purge valve
VSV for pressure switching valve, Bypass VSV	Evaporative emission pressure switching valve
Vapor pressure sensor, EVAP pressure sensor, Evaporative emission control system pressure sensor	Fuel tank pressure sensor
Charcoal canister	Evaporative emissions canister
ORVR system	On–boad refueling vapor recovery system
Intake manifold runner control	Intake manifold tuning system
Intake manifold runner valve, IMRV, IACV (runner valve)	Intake manifold tuning valve
Intake control VSV	Intake manifold tuning solenoid valve
AFS	Air fuel ratio sensor
O2 sensor	Heated oxygen sensor
Oxygen sensor pumping current circuit	Oxygen sensor output signal
Oxygen sensor reference ground circuit	Oxygen sensor signal ground
Accel position sensor	Accelerator pedal position sensor
Throttle actuator control motor, Actuator control motor, Electronic throttle motor, Throttle control motor	Electronic throttle actuator
Electronic throttle control system, Throttle actuator control system	Electronic throttle control system
Throttle/pedal position sensor, Throttle/pedal position switch, Throttle position sensor/switch	Throttle position sensor
Turbo press sensor	Turbocharger pressure sensor
Turbo VSV	Turbocharger pressure control solenoid valve
P/S pressure switch	Power–steering pressure switch
VSV for ACM	Active control engine mount
Speed sensor, Vehicle speed sensor ”A”, Speed sensor for skid control ECU	Vehicle speed sensor
ATF temperature sensor, Trans. fluid temp. sensor, ATF temperature sensor ”A”	Transmission fluid temperature sensor
Electronic controlled automatic transmission, ECT	Electronically controlled automatic
Intermediate shaft speed sensor ”A”	Counter gear speed sensor

TOYOTA/LEXUS name	Definition
Output speed sensor	Output shaft speed sensor
Input speed sensor, Input turbine speed sensor ”A”, Speed sensor (NT), Turbine speed sensor	Input turbine speed sensor
PNP switch, NSW	Park/neutral position switch
Pressure control solenoid	Transmission pressure control solenoid
Shift solenoid	Transmission shift solenoid valve
Transmission control switch, Shift lock control unit	Shift lock control module
Engine immobiliser system, Immobiliser system	Vehicle anti–theft system

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LIST OF DISABLE A MONITOR

HINT:

This table indicates ECM monitoring status for the items in the upper columns if the DTCs in each line on the left are being set.

Monitor disablement (○−not disabled, ×−disabled, N−not applicable)

Monitor detected malfunction	Fault code	Component/system	P0010, P0020 VVT VSV 1, 2	P0011 VVT System 1 – Advance	P0012 VVT System 1 – Retard	P0016, P0018 VVT System – Misalinment	P0021 VVT System 2 – Advance	P0022 VVT System 2 – Retard	P0030–P0050 Fr O2S heater	P0100, P0101 MAF sensor	P0105, P0106 MAP sensor	P0110 IAT sensor	P0115, P0116 ECT sensor	P0120, P0121 TP sensor	P0125 insufficient ECT for Closed Loop	P0128 Thermostat	P0130–P0153 Fr O2S	P0134, P0154 Fr O2S, A/F sensor (No Activity)	P0135, P0155 A/F sensor heater	P0136, P0156 Rr O2S	P0141–P0167 Rr O2S heater	P0171, P0172 Fuel system	P0174, P0175 Fuel system	P0300–P0308 Misfire	P0325, P0330 Knock sensor	P0335 CKP sensor	P0340, P0341 CMP sensor	P0340–P0346 VVT sensor 1, 2	P0351–P0358 Ignitor	P0385 CKP sensor 2	P0401 EGR system (closed)	P0402 EGR system (open)	P0405 Lift sensor	P0409 Lift sensor	P0420, P0430 Catelyst
	P0010, P0020	VVT VSV 1, 2		○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○
	P0011	VVT System 1 – Advance	○		○	×	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	×	×	○	○	○	○	○	○	×	×	○	○	×
	P0012	VVT System 1 – Retard	○	○		×	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	×	×	○	○	○	○	○	○	×	×	○	○	×
	P0016, P0018	VVT System – Misalinment	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0021	VVT System 2 – Advance	○	○	×	×		○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	×	×	○	○	○	○	○	○	×	×	○	○	×
	P0022	VVT System 2 – Retard	○	○	×	×	○		○	○	○	○	○	○	○	○	×	○	○	○	○	○	×	×	○	○	○	○	○	○	×	×	○	○	×
	P0030–P0050	Fr O2S heater	○	○	○	○	○	○		○	○	○	○	○	○	○	×	×	×	N	×	○	×	×	○	○	○	○	○	○	×	×	○	○	×
	P0100, P0101	MAF sensor	○	×	×	○	×	×	○		○	○	○	○	×	○	×	×	×	×	×	○	×	×	×	○	○	○	○	○	×	×	○	○	×
	P0105, P0106	MAP sensor	○	×	×	○	×	×	○	○		○	○	○	×	○	×	×	×	×	×	○	×	×	×	○	○	○	○	○	×	×	○	○	×
	P0110	IAT sensor	○	○	○	○	○	○	○	○	○		○	○	○	○	×	×	×	○	×	○	○	○	×	○	○	○	○	○	×	×	○	○	○
	P0115, P0116	ECT sensor	○	×	×	×	×	×	○	○	×	○			○	×	×	×	×	○	×	○	○	×	×	○	○	○	○	○	×	×	○	×	×
	P0120, P0121	TP sensor	○	○	○	○	○	○	○	○	○	×	○	○		○	○	×	×	○	×	○	○	×	×	×	○	○	○	○	×	×	○	○	×
	P0125	insufficient ECT for Closed Loop	○	×	×	○	×	×	○	○	×	○	×	○	○		○	×	×	×	×	○	○	×	×	×	○	○	○	○	×	×	○	×	×
	P0128	Thermostat	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0130–P0153	Fr O2S	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×		×	N	×	○	○	○	○	○	○	○	○	○	×	×	○	○	×
	P0134, P0154	Fr O2S, A/F sensor (No Activity)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×		×	×	○	×	×	×	○	○	○	○	○	×	×	○	○	×
	P0135, P0155	A/F sensor heater	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	N	N		×	○	×	×	○	○	○	○	○	○	×	×	○	○	×
	P0136, P0156	Rr O2S	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0141–P0167	Rr O2S heater	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×		○	○	○	○	○	○	○	○	○	○	○	○	×
	P0171, P0172	Fuel system	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	×	○	×	○			○	○	○	○	○	○	○	○	×	×	○	×
	P0174, P0175	Fuel system	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	×	○	×	○			○	○	○	○	○	○	○	○	×	×	○	×
	P0300–P0308	Misfire	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	×	○	×	○	○	○		○	○	○	○	○	○	○	×	×	○	×
	P0325, P0330	Knock sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	×	×	○	○
	P0335	CKP sensor	○	×	×	○	×	×	○	○	×	○	×	○	○	○	×	×	×	○	×	○	×	×	×	×		○	○	○	○	○	×	×	○	×
	P0340, P0341	CMP sensor	○	×	×	○	×	×	○	○	×	○	×	○	○	○	×	×	×	○	×	○	×	×	×	×	○		○	○	○	○	×	×	○	×
	P0340–P0346	VVT sensor 1, 2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○
	P0351–P0358	Ignitor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	×	×	○	○	○	○	○		○	×	×	○	×
	P0385	CKP sensor 2	○	×	×	○	×	×	○	○	×	○	×	○	○	○	×	×	×	○	×	○	×	×	×	×	○	○	○	○		○	×	×	○	×
	P0401	EGR system (closed)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	×	×	○	○	○	○	○	○	○		○	○	×
	P0402	EGR system (open)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	×	○	×	○	×	×	○	○	○	○	○	○	○	○		○	○	×
	P0405, P0409	Lift sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○	○
	P0420, P0430	Catelyst	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	P0442–P0456	EVAP system	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0450, P0451	EVAP press sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0500	VSS	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	×	○	×	○	×	×	×	○	○	○	○	○	×	×	○	○	×
	P0505, P0511	IAC valve	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0510	Idle switch	○	○	○	○	○	○	○	×	○	×	○	○	○	○	×	×	○	○	×	○	×	×	×	○	○	○	○	○	○	○	×	○	○	×
	P0560	Battery	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0617	Starter signal	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0705	Shift lever position switch	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0710	Trans fluid temp sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0715–P0717	Output speed sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0715–P0717	Input speed sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0724	Stop lamp switch	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0741–P0796	Trans solenoid (function)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0748–P0798	Trans solenoid (range)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0850	PNP switch	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○
	P1010, P1020	VVTL	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	×	×	○	○	○	○	○	○	○	○	○	○	○	○
	P1100	BARO sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1120, P1121	Accel position sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1125, P1128	Throttle motor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1126	Electronic magnet clutch	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1129	Electronic throttle system	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1400, P1401	Sub–TP sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1405, P1406	Turbo press sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1430	HC adsorber ACT press sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1511, P1512	Turbo VSV	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1605	Knock control module	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1652–P1662	Turbo VSV 1 – 4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P2196, P2198	A/F sensor (rationality)	○	○	○	○	○	○	N	○	○	○	○	○	○	○	×	N	N		×	○	○	○	○	○	○	○	○	○	○	×	×	○	○	×
	P2237, P2240	A/F sensor (open)	○	○	○	○	○	○	N	○	○	○	○	○	○	○	×	N	N		×	○	○	○	○	○	○	○	○	○	○	×	×	○	○	×
	P2714–P2759	Trans solenoid (SLU–SLD)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P2A00, P2A03	A/F sensor (slow response)	○	○	○	○	○	○	N	○	○	○	○	○	○	○	×	N	N	○	×	○	○	○	○	○	○	○	○	○	○	×	×	○	○	×

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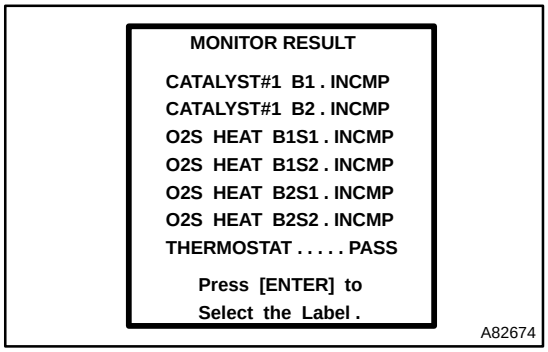
Monitor disablement (○—not disabled, ×—disabled, N—not applicable)

Fault code	Component/system	P0440–P0446 EVAP system	P0450, P0451 EVAP press sensor	P0500 VSS (ECT2 sensor)	P0500 VSS (ECT1 sensor, non-ECT)	P0500 VSS (M/T)	P0505, P0511 IAC valve	P0510 Idle switch	P0560 Battery	P0617 Starter signal	P0705 Shift lever position switch	P0710 Trans fluid temp sensor	P0715–P0717 Output speed sensor	P0715–P0717 Input speed sensor	P0724 Stop lamp switch	P0741–P0796 Trans solenoid (function) *1	P0741–P0796 Trans solenoid (function) *2	P0748–P0798 Trans solenoid (range)	P0850 PNP switch	P1010, P1020 VVTL	P1100 BARO sensor	P1120, P1121 Accel position sensor	P1125, P1128 Throttle motor	P1126 Electronic magnet clutch	P1129 Electronic throttle system	P1400, P1401 Sub–TP sensor	P1405, P1406 Turbo press sensor	P1430 HC adsorber ACT press sensor	P1511, P1512 Turbo VSV	P1605 Knock control module	P1652–P1662 Turbo VSV 1 – 4	P2196, P2198 A/F sensor (rationality)	P2237, P2240 A/F sensor (open)	P2714–P2759 Trans solenoid (SLU–SLD)	P2A00, P2A03 A/F sensor (slow response)
Monitor detected malfunction	P0010, P0020 VVT VSV 1, 2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0011 VVT System 1 – Advance	×	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0012 VVT System 1 – Retard	×	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0016, P0018 VVT System – Misalinment	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0021 VVT System 2 – Advance	×	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0022 VVT System 2 – Retard	×	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0030–P0050 Fr O2S heater	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	N	○	○	N
	P0100, P0101 MAF sensor	×	○	○	○	×	×	○	○	○	○	○	○	○	○	×	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0105, P0106 MAP sensor	×	○	○	○	×	×	○	○	○	○	○	○	○	○	×	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0110 IAT sensor	×	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0115, P0116 ECT sensor	×	○	○	○	×	×	○	○	○	○	○	○	○	○	×	×	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0120, P0121 TP sensor	×	○	○	×	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0125 insufficient ECT for Closed Loop	×	○	○	○	×	×	○	○	○	○	○	○	○	○	×	×	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0128 Thermostat	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0130–P0153 Fr O2S	○	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	N	N	○	N
	P0134, P0154 Fr O2S, A/F sensor (No Activity)	×	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0135, P0155 A/F sensor heater	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0136, P0156 Rr O2S	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○
	P0141–P0167 Rr O2S heater	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○
	P0171, P0172 Fuel system	×	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0174, P0175 Fuel system	×	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0300–P0308 Misfire	×	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0325, P0330 Knock sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0335 CKP sensor	×	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0340, P0341 CMP sensor	×	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0340–P0346 VVT sensor 1, 2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0351–P0358 Ignitor	×	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0385 CKP sensor 2	×	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0401 EGR system (closed)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0402 EGR system (open)	×	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0405, P0409 Lift sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0420, P0430 Catelyst	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0442–P0456 EVAP system	▨	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0450, P0451 EVAP press sensor	×	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0500 VSS	×	○	▨	▨	▨	×	○	○	○	○	○	×	×	○	×	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0505, P0511 IAC valve	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0510 Idle switch	×	○	○	○	○	×	▨	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P0560 Battery	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0617 Starter signal	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0705 Shift lever position switch	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0710 Trans fluid temp sensor	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0715–P0717 Output speed sensor	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0715–P0717 Input speed sensor	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0724 Stop lamp switch	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0741–P0796 Trans solenoid (function)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0748–P0798 Trans solenoid (range)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	▨	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P0850 PNP switch	○	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1010, P1020 VVTL	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1100 BARO sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	×	×	○	×
	P1120, P1121 Accel position sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1125, P1128 Throttle motor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○	○
	P1126 Electronic magnet clutch	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○	○
	P1129 Electronic throttle system	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○	○	○
	P1400, P1401 Sub–TP sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	×	×	○	×
	P1405, P1406 Turbo press sensor	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○	○
	P1430 HC adsorber ACT press sensor	×	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○	○
	P1511, P1512 Turbo VSV	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○	○
	P1605 Knock control module	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○	○
	P1652–P1662 Turbo VSV 1 – 4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	○	○
	P2196, P2198 A/F sensor (rationality)	○	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	○	×
	P2237, P2240 A/F sensor (open)	○	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○	×
	P2714–P2759 Trans solenoid (SLU–SLD)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○	○
	P2A00, P2A03 A/F sensor (slow response)	○	○	○	○	○	×	○	○	○	○	○	○	○	○	×	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▨	○

G26589

CHECKING MONITOR STATUS

HINT:
”MONITOR RESULT” indicates normal or malfunction of each component and system when judgment has done.



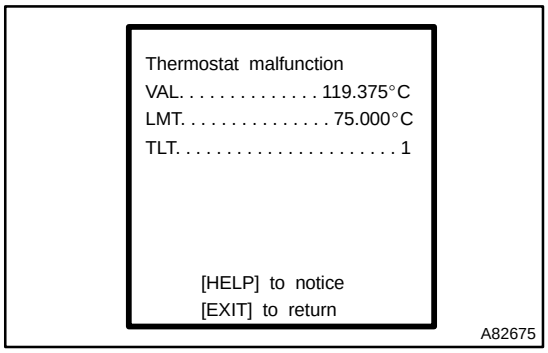
1. HOW TO READ DATA

(a) Connect the hand–held tester to the DLC 3.

(b) Enter ”MONITOR RESULT” from ”DIAGNOSIS / ENHANCED OBD II / MONITOR INFO / MONITOR RESULT” on the hand–held tester. You will see ”Test ID” and ”INCMP”, ”Pass” or ”Fail” on the MONITOR RESULT screen.

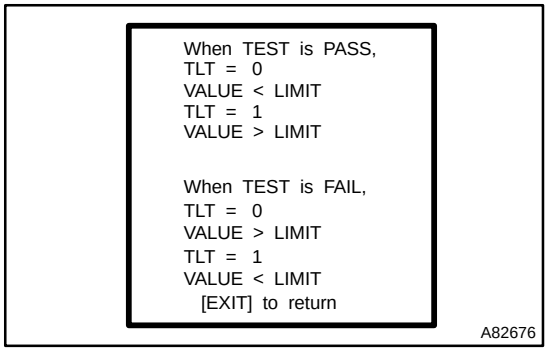
HINT:

- INCMP: The judgement has not been done yet.
- PASS: Normal is detected.
- FAIL: Malfunction is detected.



(c) Select a Test ID that you want from the list and press the ”ENTER” button. You will see the following screen:

(1) VAL (TEST VALUE) [Test Data] [Unit]
(2) LMT (TEST LIMIT) [Test Limit] [Unit]
(3) TLT [Test Limit Type]



(d) By pressing the ”HELP” button, you can see more information.

HINT:

- Monitor test results can be viewed in the MONITOR RESULT screen.
- Monitor test results indicate the latest malfunction judgement result of this diagnostic.
- TEST VALUE indicates the detection parameter value (Example: P0128 Thermostat Malfunction = Engine coolant temperature) at the time of malfunction (or normal) judgement is done.
- TEST LIMIT indicates a threshold of malfunction judgement (Example: P0128 Thermostat Malfunction = 75°C).
- When the monitor runs, the monitored Parameter’s VALUE is recorded. The value is then compared to the TEST LIMIT to determine if the result is PASS or FAIL.
- By comparing the Parameter VALUE to the TEST LIMIT, it is possible to determine the degree of failure.

- In rare cases, the monitor may have passed even with a DTC set and MIL illuminated. The monitor may have failed on a previous trip, and then passed on the most recent trip. This would indicated an intermittent problem may be the cause of the DTC.

05DIH–01

READINESS MONITOR DRIVE PATTERN

1. PURPOSE OF THE READINESS TESTS

- The On–Board Diagnostic (OBD II) system is designed to monitor the performance of emission–related components and report any detected abnormalities in the form of Diagnostic Trouble Codes (DTCs). Since the various components need to be monitored during different driving conditions, the OBD II system is designed to ran separate monitoring programs called Readiness Monitors. Many state Inspection and Maintenance (I/M) programs require that vehicles complete their Readiness Monitors prior to beginning an emissions test.
- The current status of the Readiness Monitors can be seen by using the hand–held tester with version 9.0 software (or newer), or a generic OBD II scan tool.
- To view the Readiness Monitor status using the hand–held tester, select ”Monitor Status” from the Enhanced OBD II Menu.
- A status of ”complete” indicates that the necessary conditions have been met to run the performance tests for the related Readiness Monitor.
- The Readiness Monitor will be reset to ”incomplete” if:
  - ECM has lost power (battery or fuse).
  - DTCs have been cleared.
  - The conditions for running the Readiness Monitor have not been met.
- In the event that any Readiness Monitor shows ”incomplete,” follow the appropriate Readiness Monitor Drive Pattern to change the readiness status to ”complete.”

CAUTION:

Strict observance of posted speed limits, traffic laws, and road conditions are required when performing these drive patterns.

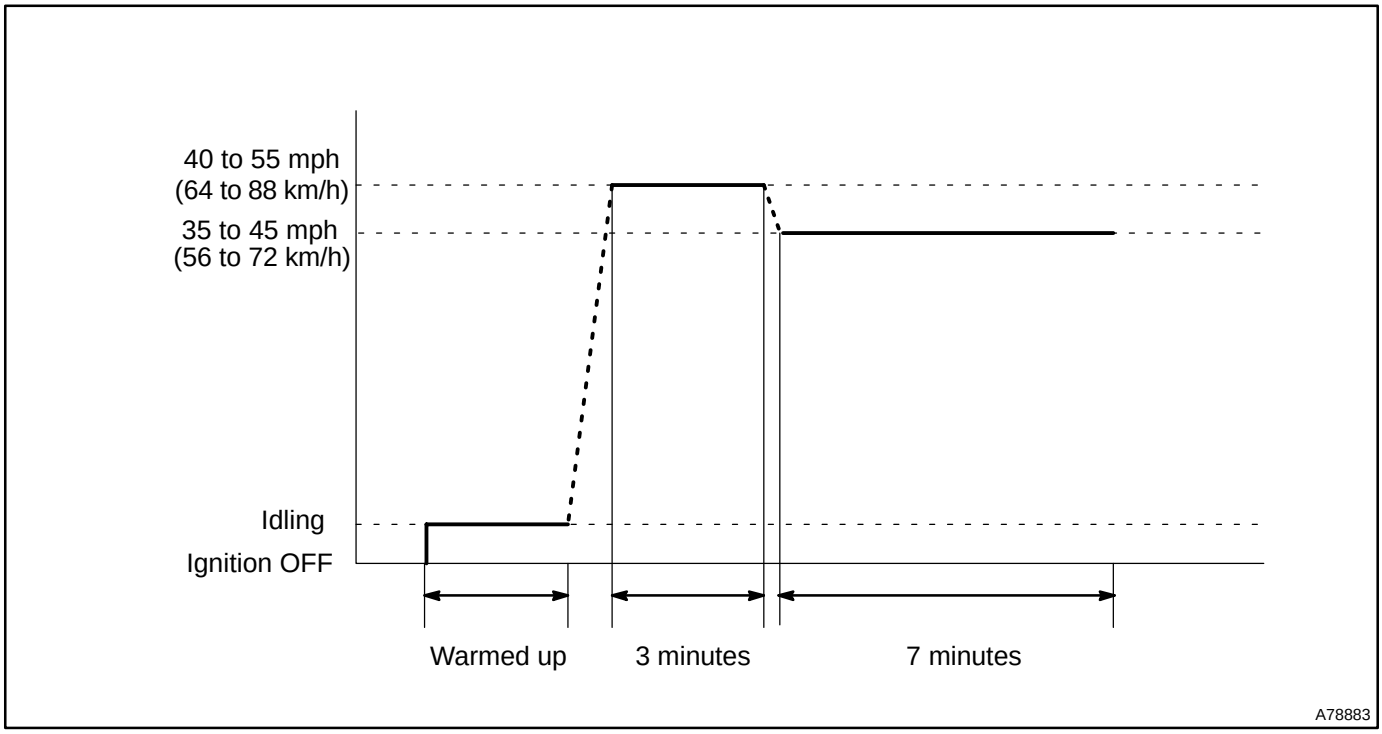
NOTICE:

These drive patterns represent the fastest method to satisfy all necessary conditions which allow the specific readiness monitor to complete.

In the event that the drive pattern must be interrupted (possibly due to traffic conditions or other factors) the drive pattern can be resumed, and in most cases, the readiness monitor will still set to complete.

To ensure rapid completion of readiness monitors, avoid sudden changes in vehicle load and speed (driving up and down hills and/or sudden acceleration).

2. CATALYST MONITOR (O2S TYPE)



(a) Preconditions

The monitor will not run unless:

- MIL is OFF.
- Engine Coolant Temperature (ECT) is 176˚F (80˚C) or greater.
- Intake Air Temperature (IAT) is 14˚F (–10˚C) or greater.*

NOTICE:

*** 2002 and later MY vehicles:**

The readiness test can be completed in cold ambient conditions (less than 14˚F / –10˚C), if the drive pattern is repeated a second time after cycling the ignition off.

(b) Drive Pattern

(1) Connect the OBD II scan tool to the DLC3 to check monitor status and preconditions.

(2) Drive the vehicle at 40 to 55 mph (64 to 88 km/h) for approximately 3 minutes.

NOTICE:

Drive with smooth throttle operation and avoid sudden acceleration.

If IAT is less than 50˚F (10˚C) when starting engine, continue to drive vehicle at 40 to 55 mph (64 to 88km/h) for approximately 4 minutes.

(3) Drive the vehicle at 35 to 45 mph (56 to 72 km/h) for approximately 7 minutes.

NOTICE:

Drive with smooth throttle operation and avoid sudden deceleration as much as possible with the throttle fully closed.

(4) If readiness status dose not switch to complete, make sure that the preconditions are met and the ignition switch is turned OFF and then repeat steps (2) and (3).

(5) Release pressure in the fuel tank by removing and then reinstalling the fuel tank cap.

(6) Start the engine and immediately begin driving as directed.

3. EVAP MONITOR (VACUUM PRESSURE MONITOR)

NOTICE:

A cold soak must be performed prior to conducting the drive pattern to complete the Internal Pressure Readiness Monitor.

(a) Cold Soak Preconditions

The monitor will not run unless:

- MIL is OFF.
- Fuel level is approximately 1/2 to 3/4.
- Altitude is 7800 feet (2400 m) or less.

(b) Cold Soak Procedure

Let the vehicle cold soak for 8 hours or until the difference between IAT and ECT becomes less than 13˚F (7˚C).

HINT:

Examples:

- Scenario 1

  ECT = 75˚F (24˚C)

  IAT = 60˚F (16˚C)

  Difference between ECT and IAT is 15˚F (8˚C).

  → The monitor will not run because difference between ECT and IAT is greater than 13˚F (7˚C).

- Scenario 2

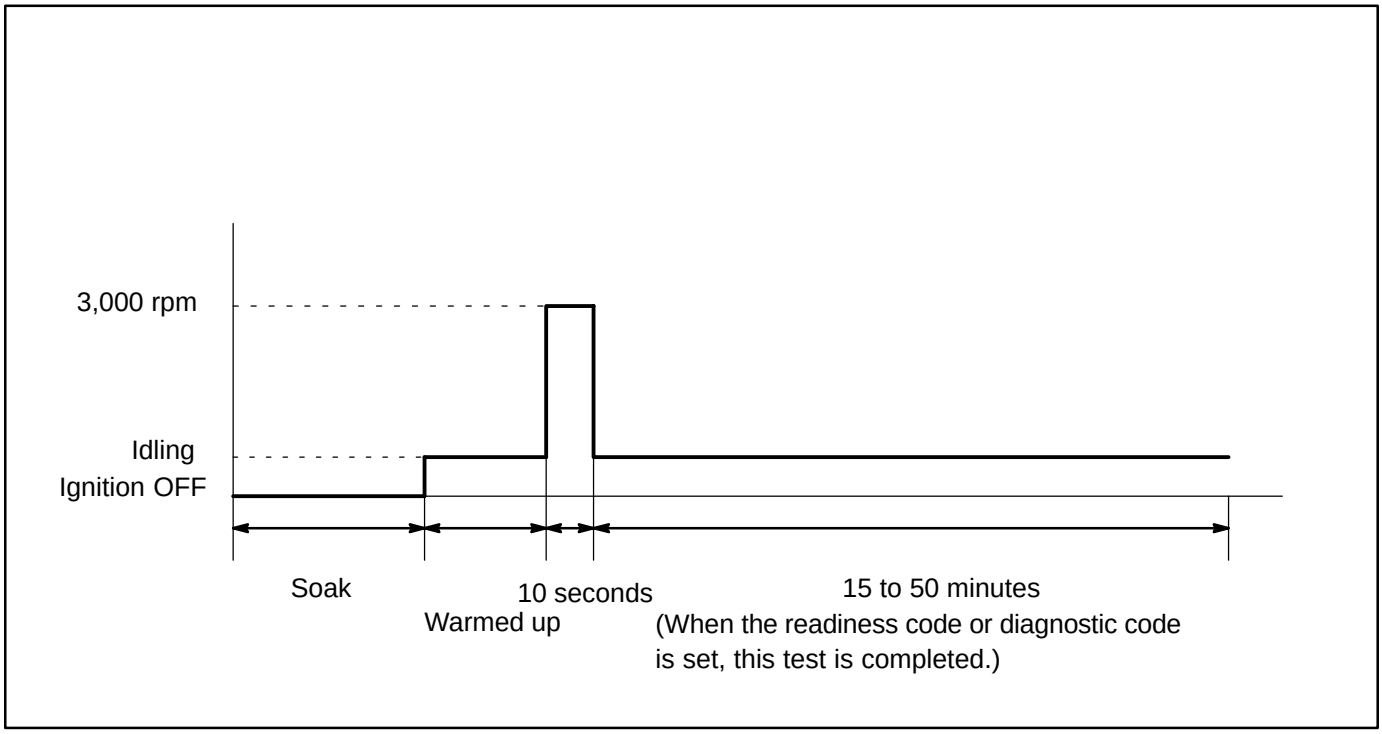
  ECT = 70˚F (21˚C)

  IAT = 68˚F (20˚C)

  Difference between ECT and IAT is 2˚F (1˚C).

  → The monitor will run because difference between ECT and IAT is less than 13˚F (7˚C).

4. EVAP MONITOR (VACUUM PRESSURE MONITOR) (CONTINUED)



(a) Preconditions

The monitor will not run unless:

- MIL is OFF.
- Fuel level is approximately 1/2 to 3/4.
- Altitude is 7800 feet (2400 m) or less.*
- Engine Coolant Temperature (ECT) is between 40˚F and 95˚F (4.4˚C and 35˚C).
- Intake Air Temperature (IAT) is between 40˚F and 95 ˚F (4.4˚C and 35˚C).*
- Cold Soak Procedure has been completed.
- Before starting the engine, the difference between ECT and IAT must be less than 13˚F (7˚C).

HINT:

Examples:

- Scenario 1
  ECT = 75˚F (24˚C)
  IAT = 60˚F (16˚C)
  Difference between ECT and IAT is 15˚F (8˚C).
  → The monitor will not run because difference between ECT and IAT is greater than 13˚F (7˚C).
- Scenario 2
  ECT = 70˚F (21˚C)
  IAT = 68˚F (20˚C)
  Difference between ECT and IAT is 2˚F (1˚C).
  → The monitor will run because difference between ECT and IAT is less than 13˚F (7˚C).

NOTICE:

*** NOTE for 2002 and later MY vehicles:**

The readiness test can be completed in cold ambient conditions (less than 40˚F / 4.4˚C) and/or at high altitudes (more than 7800 feet / 2400 m) if the drive pattern is repeated a second time after cycling the ignition off.

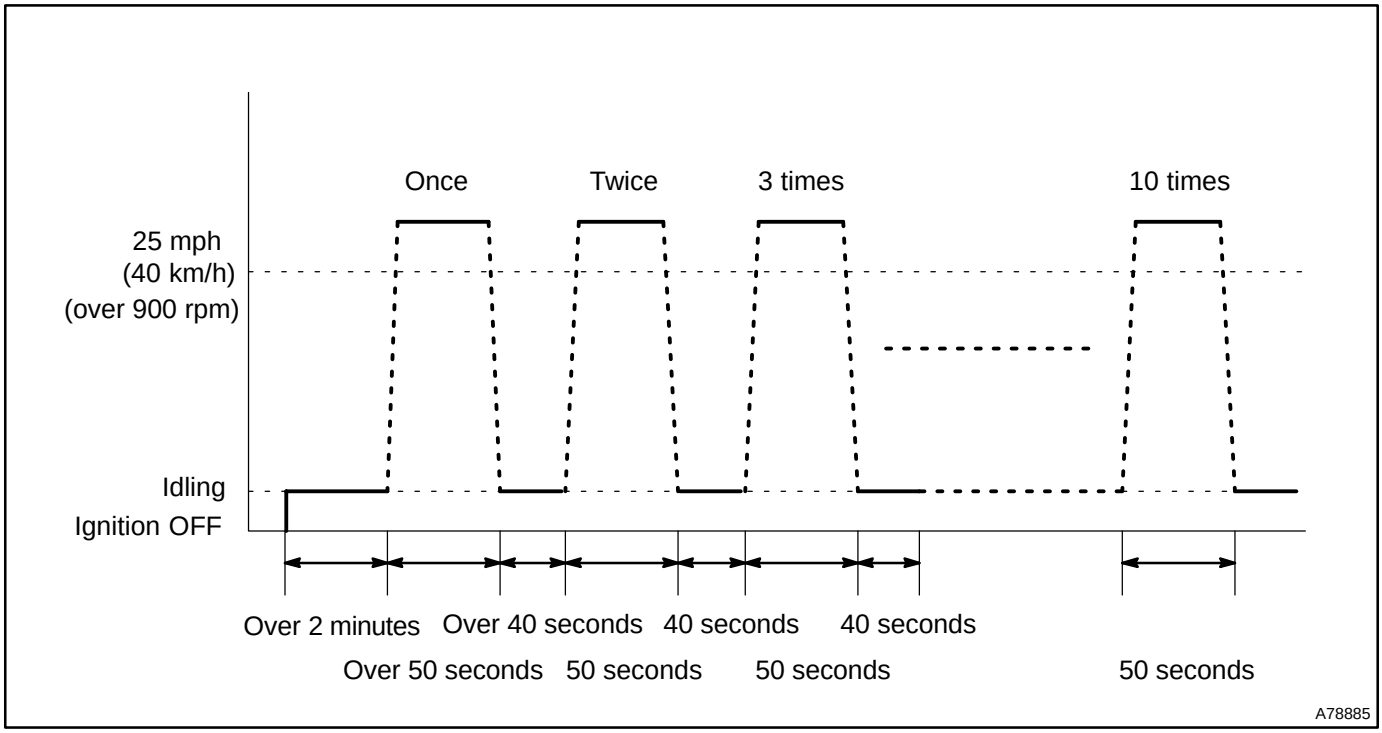
(b) Drive Pattern
(1) Connect the OBD II scan tool to DLC3 to check monitor status and preconditions.
(2) Release pressure in the fuel tank by removing and then reinstalling the fuel tank cap.
(3) Start the engine and allow it to idle until ECT becomes 167˚F (75˚C) or greater.
(4) Run the engine at 3,000 rpm for about 10 seconds.
(5) Allow the engine to idle with the A/C ON (to create slight load) for 15 to 50 minutes.

NOTICE:

If the vehicle is not equipped with A/C put a slight load on the engine by doing the following :

- **Securely set the parking brake.**
- **Block the drive wheels with wheel chocks.**
- **Allow the vehicle to idle in drive for 15 to 50 minutes.**

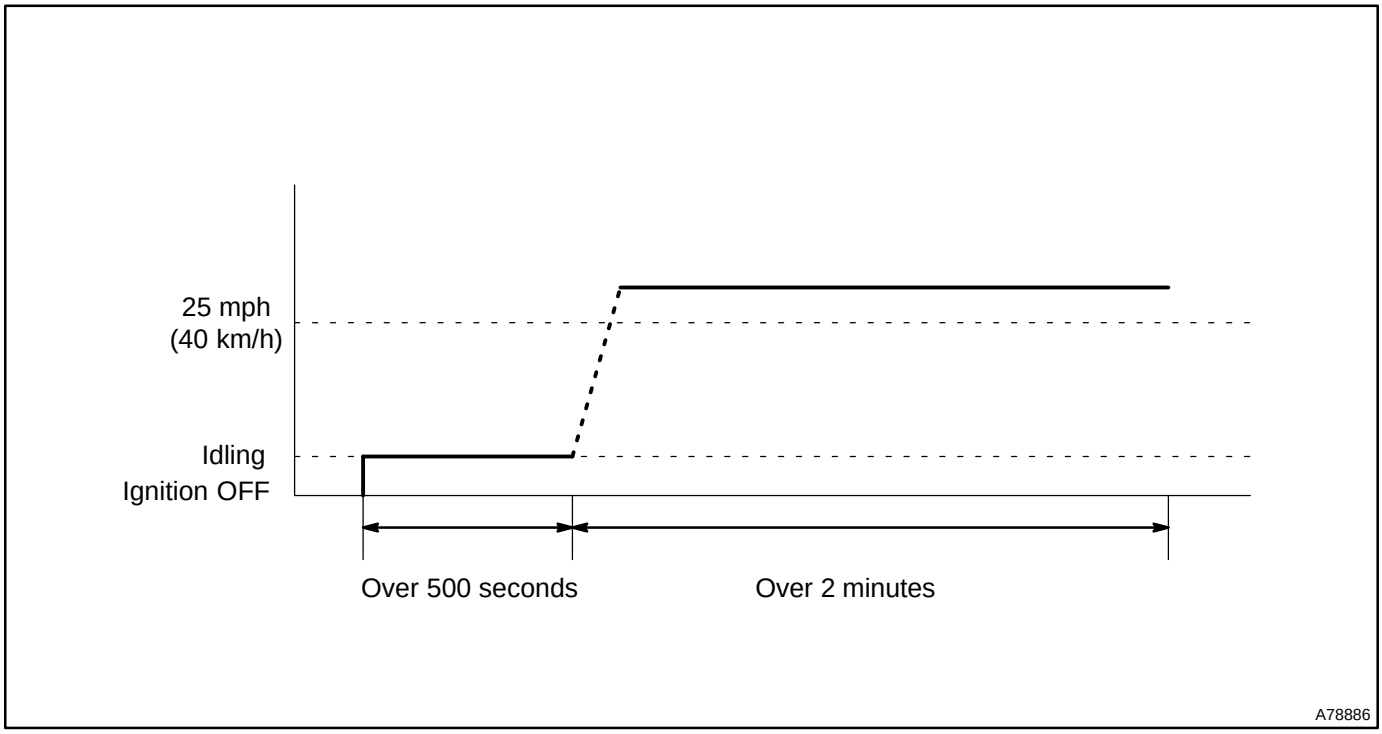
5. OXYGEN SENSOR MONITOR (FRONT AND REAR O2S SYSTEM)



(a) Preconditions
The monitor will not run unless:
- MIL is OFF

(b) Drive Pattern
(1) Connect the OBD II scan tool to the DLC3 to check monitor status and preconditions.
(2) Start the engine and allow it to idle for 2 minutes or more.
(3) Drive the vehicle at 25 mph (40 km/h) or more for at least 50 seconds.
(4) Stop the vehicle and allow the engine to idle for 40 seconds or more.
(5) Perform steps (3) and (4) ten times.
(6) If the readiness status dose not switch to complete, make sure that the preconditions are met and the ignition switch is turned OFF and then repeat steps (1) through (5).

6. OXYGEN / AF SENSOR HEATER MONITOR



(a) Preconditions

The monitor will not run unless:

- MIL is OFF

(b) Drive Pattern

(1) Connect the OBD II scan tool to the DLC3 to check monitor status and preconditions.

(2) Start the engine and allow it to idle for 9 minutes.

(3) Drive the vehicle at 25 mph (40 km/h) or more for at least 2 minutes.

(4) If the readiness status dose not switch to complete, make sure that the preconditions are met and the ignition switch turned OFF and then repeat steps (2) and (3).

05284–12

DIAGNOSTIC TROUBLE CODE CHART

HINT:

- As for the vehicle for MEXICO, refer to Repair Manual 2003 COROLLA (Pub. No. RM938U).
- Parameters listed in the chart may not be exactly the same as your readings due to the type of instrument or other factors.

If a malfunction code is displayed during the DTC check in the check mode, check the circuit for the codes listed in the table below. For details of each code, refer to the ''See page'' under the respective ''DTC No.'' in the DTC chart.

DTC No. (See Page)	Detection Item	Trouble Area	MIL*1	Memory
P0010 (05–44)	Camshaft Position ”A” Actuator Circuit (Bank 1)	• Open or short in oil control valve circuit • Oil control valve • ECM	○	○
P0011 (05–50)	Camshaft Position ”A” –Timing Over–Advanced or System Performance (Bank 1)	• Valve timing • Oil control valve • Camshaft timing gear assy • ECM	○	○
P0012 (05–50)	Camshaft Position ”A” –Timing Over– Retarded (Bank 1)		○	○
P0016 (05–58)	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor A)	• Mechanical system (Timing chain has jumped a tooth, chain stretched) • ECM	○	○
P0031 (05–60)	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 1)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • EFI relay • ECM	○	○
P0032 (05–60)	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 1)		○	○
P0037 (05–60)	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)		○	○
P0038 (05–60)	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)		○	○
P0100 (05–65)	Mass or Volume Air Flow Circuit	• Open or short in mass air flow sensor circuit • Mass air flow sensor • ECM	○	○
P0101 (05–72)	Mass or Volume Air Flow Circuit Range/Performance Problem	• Mass air flow sensor	○	○
P0102 (05–65)	Mass or Volume Air Flow Circuit Low Input	• Open or short in mass air flow sensor circuit • Mass air flow sensor • ECM	○	○
P0103 (05–65)	Mass or Volume Air Flow Circuit High Input		○	○
P0110 (05–74)	Intake Air Temperature Circuit	• Open or short in intake air temperature sensor circuit • Intake air temperature sensor (built in mass air flow sensor) • ECM	○	○
P0112 (05–74)	Intake Air Temperature Circuit Low Input		○	○
P0113 (05–74)	Intake Air Temperature Circuit High Input		○	○
P0115 (05–80)	Engine Coolant Temperature Circuit	• Open or short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM	○	○
P0116 (05–85)	Engine Coolant Temperature Circuit Range/Performance Problem	• Cooling system • Engine coolant temperature sensor • Thermostat (water inlet)	○	○
P0117 (05–80)	Engine Coolant Temperature Circuit Low Input	• Open or short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM	○	○
P0118 (05–80)	Engine Coolant Temperature Circuit High Input		○	○
P0120 (05–87)	Throttle/Pedal Position Sensor/ Switch ”A” Circuit	• Throttle position sensor (built in throttle body) • ECM	○	○

DTC No. (See Page)	Detection Item	Trouble Area	MIL*1	Memory
P0121 (05–94)	Throttle/Pedal Position Sensor/ Switch "A" Circuit Range/Performance Problem	• Throttle position sensor (built in throttle body)	○	○
P0122 (05–87)	Throttle/Pedal Position Sensor/ Switch "A" Circuit Low Input	• Throttle position sensor (built in throttle body) • Short in VTA circuit • Open in VC circuit • ECM	○	○
P0123 (05–87)	Throttle/Pedal Position Sensor/ Switch "A" Circuit High Input	• Throttle position sensor (built in throttle body) • Open in VTA circuit • Open in E2 circuit • VC and VTA circuit are short–circuited • ECM	○	○
P0125 (05–96)	Insufficient Coolant Temperature for Closed Loop Fuel Control	• Cooling system • Engine coolant temperature sensor • Thermostat	○	○
P0128 (05–98)	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	• Thermostat • Cooling system • Engine coolant temperature sensor • ECM	○	○
P0130 (05–101)	Oxygen Sensor Circuit (Bank 1 Sensor 1)	• Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Heated oxygen sensor (bank 1 sensor 1) • Heated oxygen sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM	○	○
P0133 (05–111)	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)	• Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Heated oxygen sensor (bank 1 sensor 1) • Heated oxygen sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM	○	○
P0134 (05–120)	Oxygen Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	• Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Heated oxygen sensor (bank 1 sensor 1) • Heated oxygen sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • PCV hose connection • PCV valve and hose • Injector • Gas leakage in exhaust system • PCV piping • ECM	○	○
P0136 (05–128)	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	• Open or short in heated oxygen sensor (bank 1 sensor 2) circuit • Heated oxygen sensor (bank 1 sensor 2) • Heated oxygen sensor heater (bank 1 sensor 2) • EFI relay	○	○

DTC No. (See Page)	Detection Item	Trouble Area	MIL*1	Memory
P0171 (05–136)	System too Lean (Bank 1)	• Air induction system • Injector blockage • Mass air flow sensor • Engine coolant temperature sensor • Fuel pressure • Gas leakage in exhaust system • Open or short in heated oxygen sensor (bank 1, sensor 1) circuit • Heated oxygen sensor (bank 1, sensor 1) • Heated oxygen sensor heater (bank 1, sensor 1) • EFI relay • PCV valve and hose • PCV hose connection • ECM	○	○
P0172 (05–136)	System too Rich (Bank 1)	• Injector leak, blockage • Mass air flow sensor • Engine coolant temperature sensor • Ignition system • Fuel pressure • Gas leakage in exhaust system • Open or short in heated oxygen sensor (bank 1, sensor 1) circuit • Heated oxygen sensor (bank 1, sensor 1) • Heated oxygen sensor heater (bank 1, sensor 1) • EFI relay • ECM	○	○
P0300 (05–149)	Random/Multiple Cylinder Misfire Detected	• Open or short in engine wire • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Mass air flow sensor • Engine coolant temperature sensor • Compression pressure • Valve clearance • Valve timing • PCV hose connection • PCV hose • ECM	○*2	○
P0301 (05–149)	Cylinder 1 Misfire Detected		○*2	○
P0302 (05–149)	Cylinder 2 Misfire Detected		○*2	○
P0303 (05–149)	Cylinder 3 Misfire Detected		○*2	○
P0304 (05–149)	Cylinder 4 Misfire Detected		○*2	○
P0325 (05–163)	Knock Sensor 1 Circuit (Bank 1 or Single Sensor)	• Open or short in knock sensor circuit • Knock sensor (under–torqued or loose) • ECM	○	○
P0327 (05–163)	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	• Open or short in knock sensor circuit • Knock sensor (under–torqued or loose) • ECM	○	○
P0328 (05–163)	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	• Open or short in knock sensor circuit • Knock sensor (under–torqued or loose) • ECM	○	○
P0335 (05–168)	Crankshaft Position Sensor ”A” Circuit	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Signal plate (crankshaft) • ECM	○	○
P0339 (05–168)	Crankshaft Position Sensor ”A” Circuit Intermittent	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Signal plate (crankshaft) • ECM	—	○

DTC No. (See Page)	Detection Item	Trouble Area	MIL*1	Memory
P0340 (05–173)	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft timing pulley • Timing chain has jumped a tooth • ECM	○	○
P0341 (05–173)	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft timing pulley • Timing chain has jumped a tooth • ECM	○	○
P0351*3 (05–177)	Ignition Coil "A" Primary/Secondary Circuit	• Ignition system • Open or short in IGF or IGT circuit from ignition coil with igniter to ECM (ignition coil circuit 1 through 4) • Ignition coil with igniter (ignition coil circuit 1 through 4) • ECM	○	○
P0352*3 (05–177)	Ignition Coil "B" Primary/Secondary Circuit		○	○
P0353*3 (05–177)	Ignition Coil "C" Primary/Secondary Circuit		○	○
P0354*3 (05–177)	Ignition Coil "D" Primary/Secondary Circuit		○	○
P0420 (05–186)	Catalyst System Efficiency Below Threshold (Bank 1)	• Gas leakage in exhaust system • Heated oxygen sensor (bank 1 sensor 1, 2) • Three–way catalytic converter	○	○
P0441 (05–193)	Evaporative Emission Control System Incorrect Purge Flow	• Fuel tank cap incorrectly installed • Fuel tank cap cracked or damaged • Vacuum hose cracks, blocked, damaged or disconnected ((1), (2), (3), (4), (5), (6), (7), (8), (9), (10) and (11) in Fig. 1) • Open or short in vapor pressure sensor circuit • Vapor pressure sensor • Open or short in VSV circuit for EVAP • VSV for EVAP • Open or short in VSV circuit for CCV • VSV for CCV • Open or short in VSV circuit for pressure switching valve • VSV for pressure switching valve • Fuel tank cracked, or damaged • Charcoal canister cracked, or damaged • Fuel tank over fill check valve cracked damaged • ECM	○	○
P0442 (05–218)	Evaporative Emission Control System Leak detected (small leak)		○	○
P0446 (05–193)	Evaporative Emission Control System Vent Control Circuit	• Same as DTC No. P0441	○	○
P0451 (05–242)	Evaporative Emission Control System Pressure Sensor Range/Performance	• Open or short in vapor pressure sensor circuit • Vapor pressure sensor • ECM	○	○
P0452 (05–242)	Evaporative Emission Control System Pressure Sensor/Switch Low Input		○	○
P0453 (05–242)	Evaporative Emission Control System Pressure Sensor/Switch High Input		○	○
P0456 (05–218)	Evaporative Emission Control System Leak Detected (very small leak)	• Same as DTC No. P0442	○	○
P0500 (05–247)	Vehicle Speed Sensor "A"	• Open or short in speed sensor circuit • Speed sensor • Combination meter • ECM • Stability control ECU	○	○

DTC No. (See Page)	Detection Item	Trouble Area	MIL*1	Memory
P0505 (05–251)	Idle Air Control System	• Open or short in idle speed control (ISC) valve circuit • Idle speed control (ISC) valve is stuck or closed • A/C switch circuit • Air induction system • PCV valve and hose • ECM	○	○
P0511 (05–251)	Idle Air Control Circuit		○	○
P0560 (05–260)	System Voltage	• Open in back up power source circuit • ECM	○	○
P0606 (05–264)	ECM/PCM Processor	• ECM	○	○
P0617 (05–265)	Starter Relay Circuit High	• Short in Park/Neutral position switch circuit (A/T) • Park/Neutral position switch (A/T) • Clutch start switch (M/T) • ECM	○	○
P0705 (05–379)	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	• Electronic controlled automatic transmission (ECT)	○	○
P0724 (05–384)	Brake Switch "B" Circuit High		○	○
P0741 (05–386)	Torque Converter Clutch Solenoid Performance (Shift Solenoid Valve SL)		○	○
P0751 (05–389)	Shift Solenoid "A" Performance (Shift Solenoid Valve S1)		○	○
P0756 (05–394)	Shift Solenoid "B" Performance (Shift Solenoid Valve S2)		○	○
P0850 (05–379)	Park/Neutral Switch Input Circuit		○	○
P0973 (05–402)	Shift Solenoid "A" Control Circuit Low (Shift Solenoid Valve S1)		○	○
P0974 (05–402)	Shift Solenoid "A" Control Circuit High (Shift Solenoid Valve S1)		○	○
P0976 (05–406)	Shift Solenoid "B" Control Circuit Low (Shift Solenoid Valve S1)		○	○
P0977 (05–406)	Shift Solenoid "B" Control Circuit High (Shift Solenoid Valve S1)		○	○
P2195 (05–101)	Oxygen Sensor Signal Stuck Lean (Bank 1 Sensor 1)	• Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Heated oxygen sensor (bank 1 sensor 1) • Heated oxygen sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM	○	○
P2196 (05–101)	Oxygen Sensor Signal Stuck Rich (Bank 1 Sensor 1)		○	○
P2716 (05–409)	Pressure Control Solenoid "D" Electrical	• Electronic controlled automatic transmission (ECT)	○	○
P2769 (05–413)	DSL Solenoid Circuit Low (Shift Solenoid Valve DSL)		○	○
P2770 (05–413)	DSL Solenoid Circuit High (Shift Solenoid Valve DSL)		○	○

*1: "○" ... MIL is illuminated, "—" ... MIL is not illuminated.
*2: MIL is illuminated or blinks
*3: This DTC is indicate a malfunction related to primary circuit.

05CRL–02

FAIL–SAFE CHART

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

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
P0031 P0032 P0037 P0038	The heater circuit in which the abnormality is detected is turned off	Ignition switch OFF
P0100 P0102 P0103	Ignition timing is calculated from engine speed and a throttle angle	”Pass” condition detected.
P0110 P0112 P0113	Intake air temperature is fixed at 20˚C (68˚F)	”Pass” condition detected.
P0115 P0117 P0118	Engine coolant temperature is fixed at 80˚C (176˚F)	”Pass” condition detected.
P0120 P0122 P0123	Fuel cut intermittently	”Pass” condition detected and ignition switch OFF
P0121	Fuel cut intermittently	”Pass” condition detected and ignition switch OFF
P0325 P0327 P0328	Max. ignition timing retardation	Ignition switch OFF
P0351 P0352 P0353 P0354	Fuel cut	”Pass” condition detected.

05CRM–02

CHECK FOR INTERMITTENT PROBLEMS

Hand–held tester only:

By putting the vehicle's ECM in the check mode, the 1 trip detection logic is possible instead of the 2 trip detection logic, and the sensitivity to detect faults is increased. This makes it easier to detect intermittent problems.

(a) Clear the DTCs (See page 05–11).
(b) Set the check mode (See page 05–11).
(c) Perform a simulation test (See page 01–20).
(d) Check the connector and terminal (See page 01–30).
(e) Wiggle the harness and connector (See page 01–30).

05287–11

PROBLEM SYMPTOMS TABLE

When the malfunction code is not confirmed in the diagnostic trouble code check and the problem still can not be confirmed in the basic inspection, proceed to this problem symptoms tables and troubleshoot according to the numbered order given below.

Symptom	Suspect Area	See page
Engine does not crank (Does not start)	1. Starter and starter relay 2. Neutral start switch circuit *	19–1 40–6
No initial combustion (Does not start)	1. ECM power source circuit 2. Ignition coil (w/ Igniter) circuit 3. Fuel pump control circuit 4. Injector	05–273 05–177 05–278 05–149
No complete combustion (Does not start)	1. Fuel pump control circuit 2. Ignition coil (w/ Igniter) circuit 3. Injector	05–278 05–177 05–149
Engine cranks normally but difficult to start	1. Starter signal circuit 2. ISC valve circuit 3. Fuel pump control circuit 4. Ignition coil (w/ Igniter) 5. Spark plug 6. Compression 7. Injector	05–265 05–251 05–278 05–177 18–2 14–1 05–149
Difficult to start with cold engine	1. Starter signal circuit 2. ISC valve circuit 3. Fuel pump control circuit 4. Injector 5. Ignition coil (w/ Igniter) 6. Spark plug	05–265 05–251 05–278 05–149 05–177 18–2
Difficult to start with hot engine	1. Starter signal circuit 2. ISC valve circuit 3. Fuel pump control circuit 4. Injector 5. Ignition coil (w/ Igniter) 6. Spark plug	05–265 05–251 05–278 05–149 05–177 18–2
Incorrect first idle (Poor idling)	1. ISC valve circuit	05–251
High engine idle speed (Poor idling)	1. ISC valve circuit 2. ECM power source circuit 3. Neutral start switch circuit *	05–251 05–273 40–6
Low engine idle speed (Poor idling)	1. ISC valve circuit 2. Neutral start switch circuit * 3. Fuel pump control circuit 4. Injector	05–251 40–6 05–278 05–149
Rough idling (Poor idling)	1. ISC valve circuit 2. Injector 3. Ignition coil (w/ Igniter) circuit 4. Compression 5. Fuel pump control circuit	05–251 05–149 05–177 14–1 05–278
Hunting (Poor idling)	1. ISC valve circuit 2. ECM power source circuit 3. Fuel pump control circuit	05–251 05–273 05–278
Hesitation/Poor acceleration (Poor drivability)	1. Injector 2. Fuel pump control circuit 3. Ignition coil (w/ Igniter) circuit 4. A/T faulty *	05–149 05–278 05–177 05–374
Muffler explosion, after fire (Poor drivability)	1. Ignition coil (w/ Igniter) 2. Spark plug 3. Injector	05–177 18–2 05–149

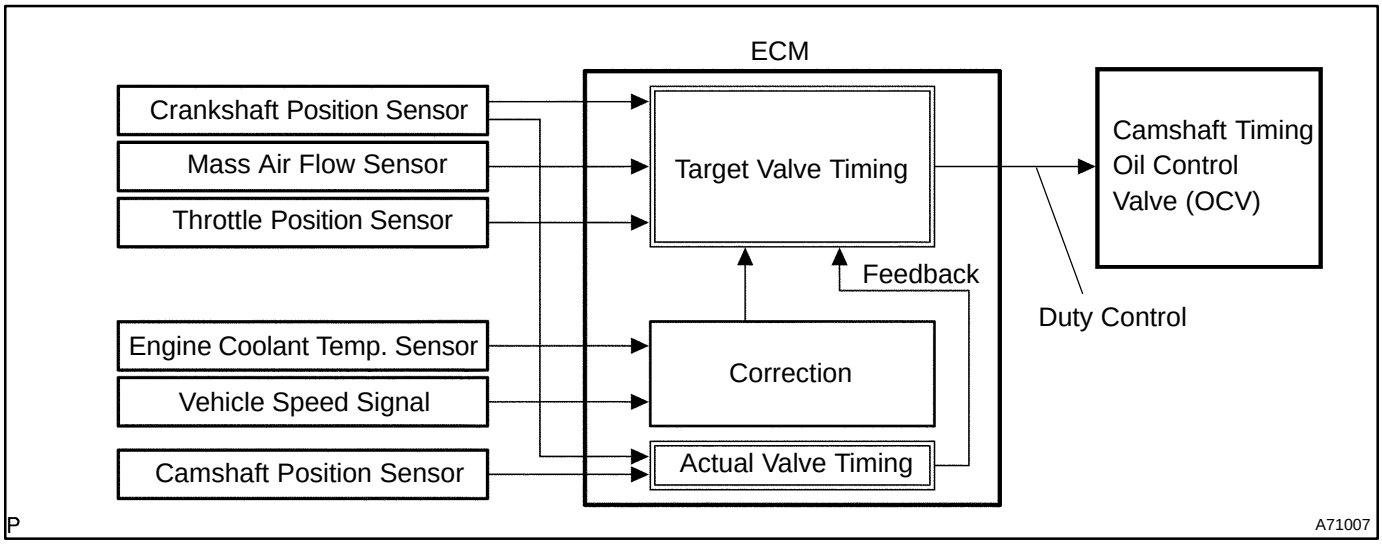
Surging (Poor drivability)	1. Fuel pump control circuit 2. Spark plug 3. Injector	05–278 18–2 05–149
Engine stall (Soon after starting)	1. Fuel pump control circuit 2. ISC valve circuit	05–278 05–251
Engine stall (After accelerator pedal released)	1. Injector 2. ISC valve circuit 3. ECM	05–149 05–251 01–30
Engine stall (When shifting N to D)	1. Neutral start switch circuit* 2. ISC valve circuit	40–6 05–251

*: A/T only

DTC	P0010	CAMSHAFT POSITION ”A” ACTUATOR CIRCUIT (BANK 1)

CIRCUIT DESCRIPTION

The Variable Valve Timing (VVT) system includes the ECM, the Oil Control Valve (OCV) and the VVT controller. The ECM sends a target ”duty–cycle” control signal to the OCV. This control signal, applied to the OCV, regulates the oil pressure supplied to the VVT controller. Camshaft timing control is performed based on engine operation conditions such as the intake air volume, throttle position and engine coolant temperature. The ECM controls the OCV, based on the signals output from the sensors. The VVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft is optimized, and the engine torque improves, fuel economy improves, and exhaust emissions decrease under overall driving conditions. Also, the ECM detects the actual valve timing using signals from the camshaft position sensor and the crankshaft position sensor, and performs the feedback control. This is how target valve timing is verified by the ECM.



DTC No.	DTC Detection Condition	Trouble Area
P0010	Open or short in oil control valve circuit	• Open or short in oil control valve circuit • Oil control valve • ECM

MONITOR DESCRIPTION

After the ECM sends the ”target” duty–cycle signal to the OCV, the ECM monitors the OCV current to establish an ”actual” duty–cycle. The ECM detects a malfunction and sets a DTC when the actual duty–cycle ratio varies from the target duty–cycle ratio.

MONITOR STRATEGY

Related DTCs	P0010	VVT oil control valve bank 1 range check
Required sensors/components	OCV	
Frequency of operation	Continuous	
Duration	1 seconds	
MIL operation	Immediately	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Battery voltage	11 V	13 V
Target duty ratio	–	70 %
Starter	OFF	
Current cut status	Not cut	

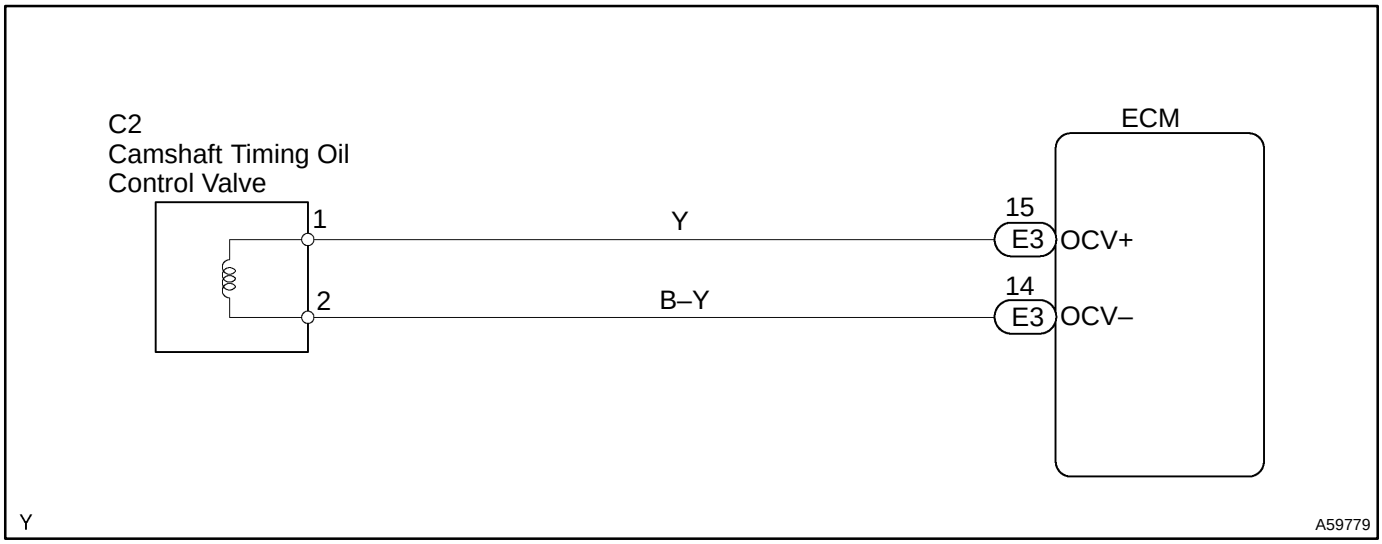
TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
One of the following condition is met:	(a) or (b)
(a) Output signal duty for OCV	Output duty ratio is 100 % (always ON) despite the target duty ratio is less than 70 %
(b) Output signal duty for OCV	Output duty is 3 % or less despite the ECM supplying the current to the OCV

COMPONENT OPERATING RANGE

Parameter	Standard Value
Output signal duty for OCV	Between 3 % and 100 %

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

Hand–held tester:

1	**PERFORM ACTIVE TEST BY HAND–HELD TESTER(OPERATE OCV)**

(a) Connect the hand–held tester to the DLC3.
(b) Start the engine and warm it up.
(c) Turn the ignition switch ON and push the hand–held tester main switch ON.
(d) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1”.
(e) Check the engine speed when operating the Oil control valve (OCV) by the hand–held tester.
Standard:

Tester Operation	Specified Condition
OCV is OFF	Normal engine speed
OCV is ON	Rough idle or engine stall

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

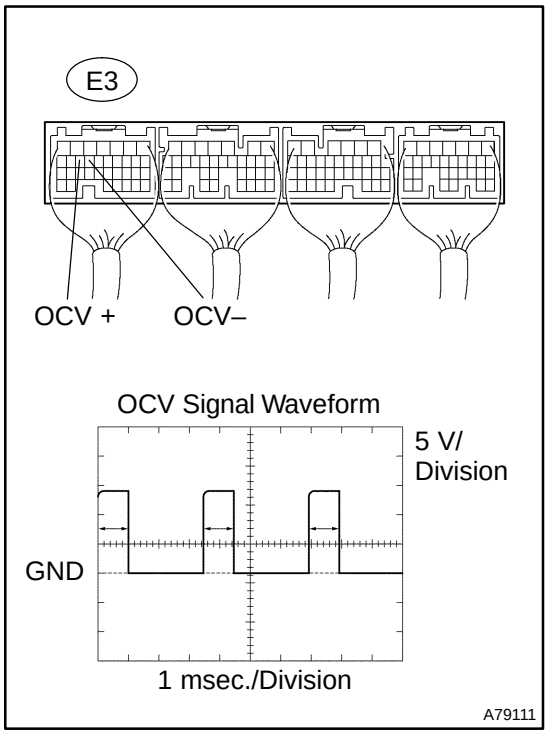
NG

2	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV) (See page 10–2)**

NG → **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY**

OK

3 INSPECT ECM(OCV SIGNAL)



(a) Inspection using the oscilloscope.
(b) During idling, check the waveform between the terminals of the E3 ECM connector.

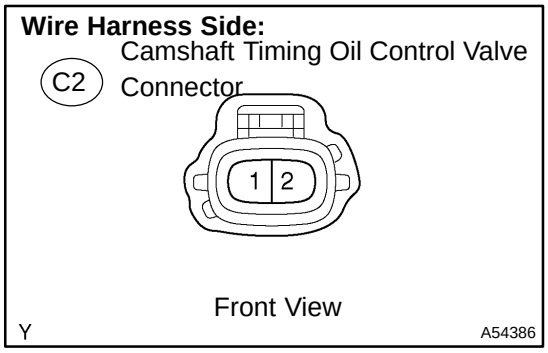
Standard:

Tester Connection	Specified Condition
OCV+ (E3–15) – OCV– (E3–14)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10–11)**

OK

4 CHECK HARNESS AND CONNECTOR(CAMSHAFT TIMING OIL CONTROL VALVE (OCV) – ECM)



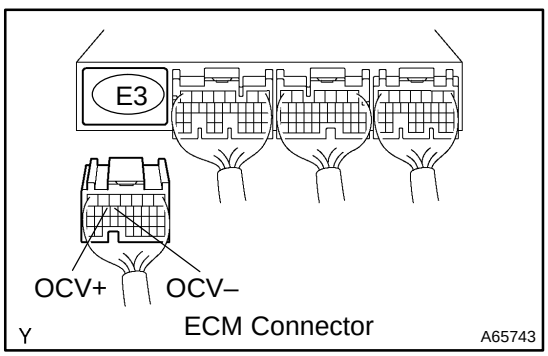
(a) Disconnect the C2 camshaft timing oil control valve connector.
(b) Disconnect the E3 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
Oil control valve (C2–1) – OCV+ (E3–15)	Below 1 Ω
Oil control valve (C2–2) – OCV– (E3–14)	

Standard (Check for short):

Tester Connection	Specified Condition
Oil control valve (C2–1) or OCV+ (E3–15) – Body ground	10 kΩ or higher
Oil control valve (C2–2) or OCV– (E3–14) – Body ground	



(d) Reconnect the camshaft timing oil control valve connector.
(e) Reconnect the ECM connector.

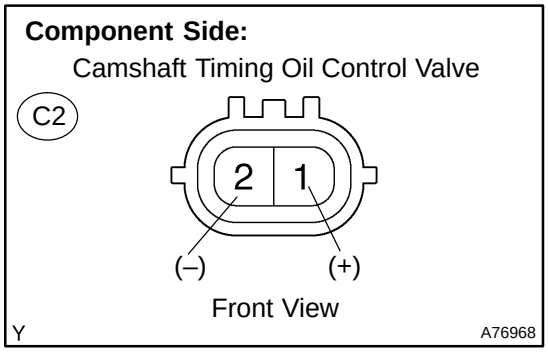
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

OBDII scan tool (excluding hand–held tester):

1	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OPERATE OCV)

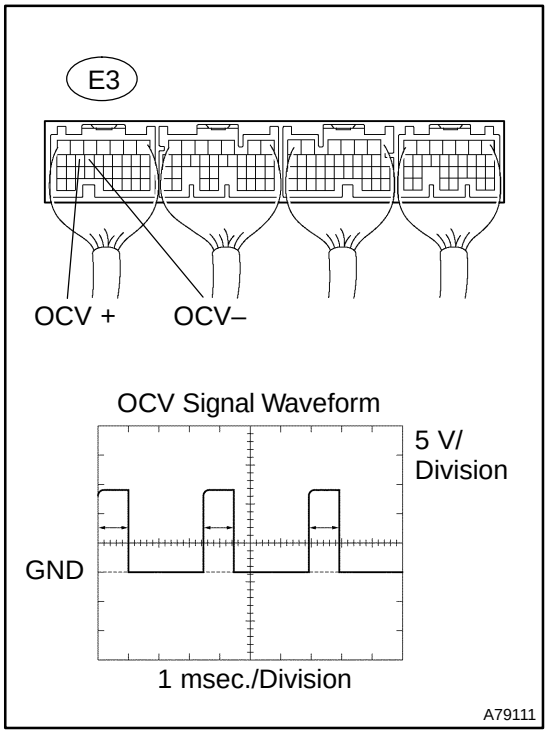


(a) Disconnect the C2 camshaft timing oil control valve connector.
(b) Apply positive battery voltage between the terminals of the camshaft timing oil control valve.
(c) Check the engine speed.
Standard:
Engine speed is rough idle or engine is stalled.
(d) Reconnect the camshaft timing oil control valve connector.

NG → **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY**

OK

2	INSPECT ECM(OCV SIGNAL)



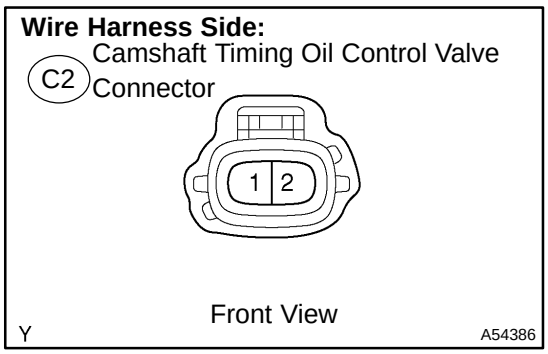
(a) Inspection using the oscilloscope.
(b) During idling, check the waveform between the terminals of the E3 ECM connector.
Standard:

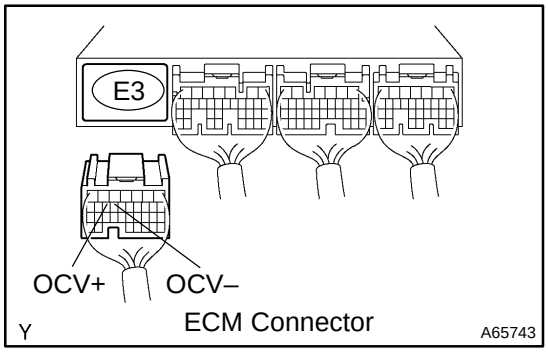
Tester Connection	Specified Condition
OCV+ (E3–15) – OCV– (E3–14)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10–11)**

OK

3	CHECK HARNESS AND CONNECTOR(CAMSHAFT TIMING OIL CONTROL VALVE (OCV) – ECM)





(a) Disconnect the C2 camshaft timing oil control valve connector.

(b) Disconnect the E3 ECM connector.

(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
Oil control valve (C2–1) – OCV+ (E3–15)	Below 1 Ω
Oil control valve (C2–2) – OCV– (E3–14)	

Standard (Check for short):

Tester Connection	Specified Condition
Oil control valve (C2–1) or OCV+ (E3–15) – Body ground	10 kΩ or higher
Oil control valve (C2–2) or OCV– (E3–14) – Body ground	

(d) Reconnect the camshaft timing oil control valve connector.

(e) Reconnect the ECM connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

DTC	P0011	CAMSHAFT POSITION ”A” –TIMING OVER–ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

DTC	P0012	CAMSHAFT POSITION ”A” –TIMING OVER–RETARDED (BANK 1)

CIRCUIT DESCRIPTION

Refer to DTC P0010 on page 05–44.

DTC No.	DTC Detection Condition	Trouble Area
P0011	Condition (a) or (b) continues after engine is warmed up and engine speed at 550 to 4,000 rpm (Problem of the advanced OCV): (a) Valve timing does not change from current valve timing (b) Current valve timing is fixed	• Valve timing • Oil control valve • Camshaft timing gear assy • ECM
P0012	Condition (a) or (b) continues after engine is warmed up and engine speed at 550 to 4,000 rpm (Problem of the retarded OCV): (a) Valve timing does not change from current valve timing (b) Current valve timing is fixed	

MONITOR DESCRIPTION

The ECM optimizes the valve timing using the Variable Valve Timing (VVT) system to control the intake valve camshaft. The VVT system includes the ECM, the Oil Control Valve (OCV) and the VVT controller. The ECM sends a target ”duty–cycle” control signal to the OCV. This control signal, applied to the OCV, regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake valve camshaft.

Example:

When a difference between the targeted and actual valve timing is more than 5° camshaft angle ”CA” and this condition continues for more than 4.5 sec, and if the OCV is forcibly activated 63 times or more.

Advanced cam DTCs are subject to ”1 trip” detection logic.

Retarded cam DTCs are subject to ”2 trip” detection logic.

MONITOR STRATEGY

Related DTCs	P0011	VVT system advance (bank 1)
	P0012	VVT system retard (bank 1)
Required sensors/components	Main sensors	Camshaft position sensor
	Related sensors	Engine coolant temperature sensor, crankshaft position sensor
Frequency of operation	Once per drive cycles	
Duration	10 sec	
MIL operation	P0011: Immediately P0012: 2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
Battery voltage	11 V	–
Engine speed	550 rpm	4,000 rpm
Engine coolant temperature	75°C (167°F)	100°C (212°F)

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Duration time of the following conditions (a) and (b) are met:	4.5 seconds or more
(a) Following conditions are met:	1 and 2
1. VVT control status	Feedback
2. Deviation of valve timing (Difference between targeted and actual valve timing)	More than 5°CA
(b) Following conditions is met:	
Response of valve timing	1 sec/°CA or more

WIRING DIAGRAM

Refer to DTC P0010 on page 05–44.

INSPECTION PROCEDURE

HINT:

Advanced timing over (Valve timing is out of specified range)	P0011
Retarded timing over (Valve timing is out of specified range)	P0012

- If DTC P0011 or P0012 is displayed, check the VVT system circuit.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

Hand–held tester:

1	**CHECK VALVE TIMING(CHECK FOR LOOSE AND JUMPED TOOTH OF TIMING CHAIN) (See page 14–82)**

NG → **ADJUST VALVE TIMING (See page 14–82)**

OK

2	PERFORM ACTIVE TEST BY HAND–HELD TESTER(OPERATE OCV)

(a) Connect the hand–held tester to the DLC3.
(b) Start the engine and warm it up.
(c) Turn the ignition switch ON and push the hand–held tester main switch ON.
(d) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1”.
(e) Check the engine speed when operating the OCV by the hand–held tester.
Standard:

Tester Operation	Specified Condition
OCV is OFF	Normal engine speed
OCV is ON	Rough idle or engine stall

NG → **Go to step 4**

OK

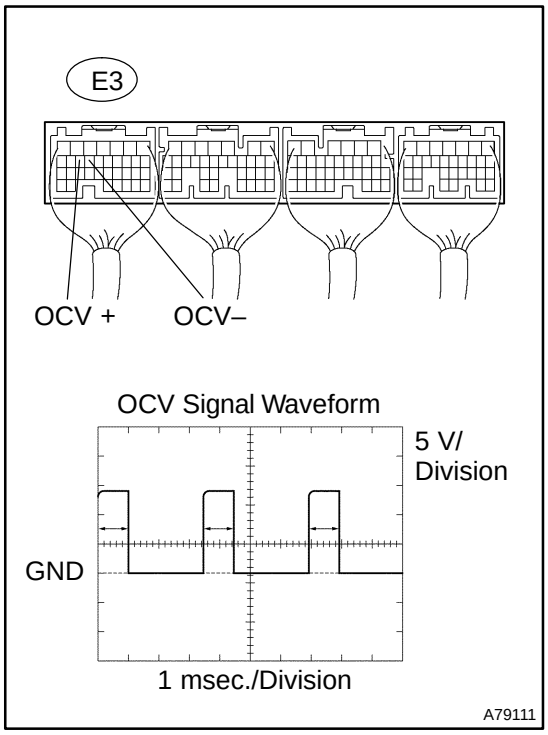
3	CHECK IF DTC OUTPUTS REOCCUR

(a) Clear the DTCs.
(1) Operate the hand–held tester to erase the codes, or disconnect the battery terminal or remove the EFI fuse for more than 60 seconds.
(b) Start and warm up the engine.
(c) Drive the vehicle around for 10 minutes or more.
(d) Read output DTCs using the hand–held tester.
Standard: No DTC output.
HINT:
*: DTC P0011 or P0012 is output when a foreign object in engine oil is caught in some part of the system. These codes will stay registered even if the system returns to normal after a short time. These foreign objects are then captured by the oil filter, thus eliminating the source of the problem.
(e) Reconnect the battery terminal or install the EFI fuse.

OK → **VVT SYSTEM OK ***

NG

4	INSPECT ECM(OCV SIGNAL)



(a) Inspect using the oscilloscope.
(b) During idling, check the waveform between the terminals of the E3 ECM connector.

Standard:

Tester Connection	Specified Condition
OCV+ (E3–15) – OCV– (E3–14)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10–11)**

OK

5	INSPECT OIL CONTROL VALVE FILTER

NG → **REPLACE OIL CONTROL VALVE FILTER**

OK

6	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV) (See page 10–2)

OK → **Go to step 8**

NG

7	REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV)

GO

8	INSPECT CAMSHAFT TIMING GEAR ASSY (See page 14–96)

OK → **Go to step 10**

NG

9	REPLACE CAMSHAFT TIMING GEAR ASSY

GO

10	CHECK FOR BLOCKAGE(OCV, OIL CHECK VALVE AND OIL HOLE)

NG → REPAIR OR REPLACE

OK

11	CHECK IF DTC OUTPUTS REOCCUR

(a) Clear the DTCs.
  (1) Operate the hand–held tester to erase the codes, or disconnect the battery terminal or remove the EFI fuse for more than 60 seconds.
(b) Start and warm up the engine.
(c) Drive the vehicle around for 10 minutes or more.
(d) Read output DTC using the hand–held tester.

Standard: No DTC output.

HINT:

*: DTC P0011 or P0012 is output when a foreign object in engine oil is caught in some part of the system. These codes will stay registered even if the system returns to normal after a short time. These foreign objects are then captured by the oil filter, thus eliminating the source of the problem.

(e) Reconnect the battery terminal or install the EFI fuse.

OBDII scan tool (excluding hand–held tester):

OK → VVT SYSTEM OK *

NG

REPLACE ECM (See page 10–11)

1	CHECK VALVE TIMING(CHECK FOR LOOSE AND JUMPED TOOTH OF TIMING CHAIN) (See page 14–82)

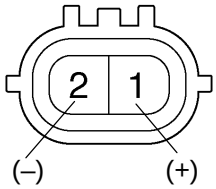
NG → ADJUST VALVE TIMING (See page 14–82)

OK

2	CHECK OPERATION OF OCV

Component Side:

C2



Camshaft Timing Oil Control Valve

Y A76968

(a) Start the engine.
(b) Check the engine speed at (1) and (2).
  (1) Disconnect the C2 camshaft timing oil control valve connector.
  (2) Apply battery positive voltage between the terminals of the camshaft timing oil control valve.

Result:

Proceed to	Check (1)	Check (2)
A	Normal engine speed	Rough idle or engine stall
B	Conditions other than A	

  (3) Reconnect the camshaft timing oil control valve connector.

B → **Go to step 4**

A

3	CHECK IF DTC OUTPUTS REOCCUR(CHECK IF DTC OUTPUT RECURS)

(a) Clear the DTCs.
  (1) Operating the OBD II scan tool to erase the codes, or disconnect the battery terminal or remove the EFI fuse for more than 60 seconds.
(b) Start and warm up the engine.
(c) Drive the vehicle around for 10 minutes or more.
(d) Read output DTCs using the OBD II scan tool.

Standard: No DTC output.

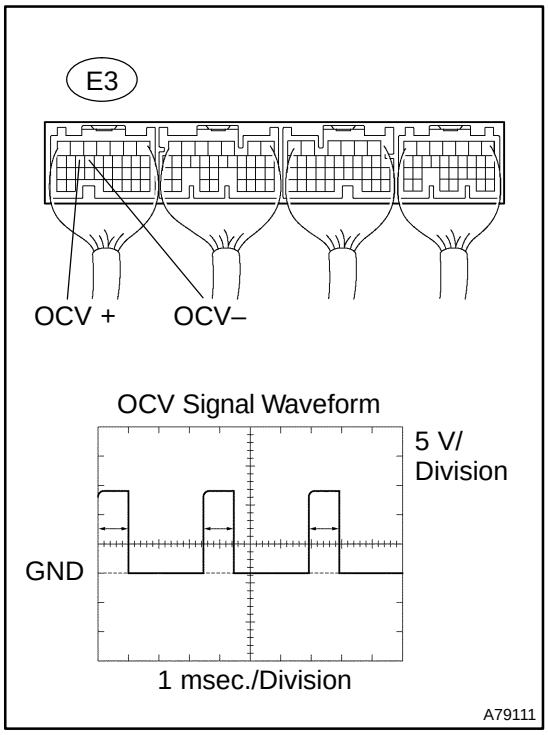
HINT:

*: DTC P0011 or P0012 is output when a foreign object in engine oil is caught in some part of the system. These codes will stay registered even if the system returns to normal after a short time. These foreign objects are then captured by the oil filter, thus eliminating the source of the problem.

OK → **VVT SYSTEM OK ***

NG

4	INSPECT ECM(OCV SIGNAL)



(a) Inspect using the oscilloscope.
(b) During idling, check the waveform between the terminals of the E3 ECM connector.

Standard:

Tester Connection	Specified Condition
OCV+ (E3–15) – OCV– (E3–14)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10–11)**

OK

5	INSPECT OIL CONTROL VALVE FILTER

NG → **REPLACE OIL CONTROL VALVE FILTER**

OK

6	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV) (See page 10–2)

OK → **Go to step 8**

NG

7	REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV)

GO

8	INSPECT CAMSHAFT TIMING GEAR ASSY (See page 14–96)

OK → **Go to step 10**

NG

9	REPLACE CAMSHAFT TIMING GEAR ASSY

GO

10	CHECK FOR BLOCKAGE(OCV, OIL CHECK VALVE AND OIL HOLE)

NG → REPAIR OR REPLACE

OK

11	CHECK IF DTC OUTPUTS REOCCUR

(a) Clear the DTCs.
  (1) Operate the OBD II scan tool to erase the codes, or disconnect the battery terminal or remove the EFI fuse for more than 60 seconds.
(b) Start and warm up the engine.
(c) Drive the vehicle around for 10 minutes or more.
(d) Read output DTCs using the OBD II scan tool.

Standard: No DTC output.

HINT:

*: DTC P0011 or P0012 is output when a foreign object in engine oil is caught in some part of the system. These codes will stay registered even if the system returns to normal after a short time. These foreign objects are then captured by the oil filter, thus eliminating the source of the problem.

(e) Reconnect the battery terminal or install the EFI fuse.

OK → VVT SYSTEM OK

NG

REPLACE ECM (See page 10–11)

DTC	P0016	CRANKSHAFT POSITION – CAMSHAFT POSITION CORRELATION (BANK 1 SENSOR A)

CIRCUIT DESCRIPTION

Refer to DTC P0335 on page 05–168.

DTC No.	DTC Detection Condition	Trouble Area
P0016	Deviation in crankshaft position sensor signal and camshaft position sensor signal (2 trip detection logic)	• Mechanical system (Timing chain has jumped a tooth, chain stretched) • ECM

MONITOR DESCRIPTION

The ECM optimizes the valve timing using the Variable Valve Timing (VVT) system to control the intake valve camshaft. The VVT system includes the ECM, the Oil Control Valve (OCV) and the VVT controller. The ECM sends a target ”duty–cycle” control signal to the OCV. This control signal, applied to the OCV, regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake valve camshaft. The ECM calibrates the valve timing of the VVT system by setting the camshaft to the maximum retard angle when the engine speed is idling. The ECM closes the OCV to retard the cam. The ECM stores this valve as ”VVT learned value” (When the difference between the target valve timing and the actual valve timing is 5 ° or less, the ECM learns it).

If the learned value meets both of the following conditions (”a” and ”b”), the ECM interprets this as a defect in the VVT system and set a DTC.

(a) ”VVT learning” value is less than 24°CA, or more than 46°CA.

(b) Above condition continues for more than 18 seconds.

MONITOR STRATEGY

Related DTCs	P0016	Deviation in crankshaft position sensor signal and camshaft position sensor signal (bank 1)
Required sensors/components	Crankshaft position sensor, camshaft position sensor	
Frequency of operation	Once per drive cycles	
Duration	60 seconds	
MIL operation	2 drive cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
VVT feedback mode	ON	
Engine speed	600 rpm	1,400 rpm

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Either the following condition is met:	(a) or (b)
(a) ”VVT learned” value	Less than 24°CA
(b) ”VVT learned” value	More than 46°CA

WIRING DIAGRAM

Refer to DTC P0335 on page 05–168.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1	**CHECK VALVE TIMING(CHECK FOR LOOSE AND JUMPED TOOTH OF TIMING CHAIN) (See page 14–82)**

NG → **ADJUST VALVE TIMING (See page 14–82) (REPAIR OR REPLACE TIMING CHAIN)**

OK

REPLACE ECM (See page 10–11)

DTC	P0031	OXYGEN SENSOR HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

DTC	P0032	OXYGEN SENSOR HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

DTC	P0037	OXYGEN SENSOR HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

DTC	P0038	OXYGEN SENSOR HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

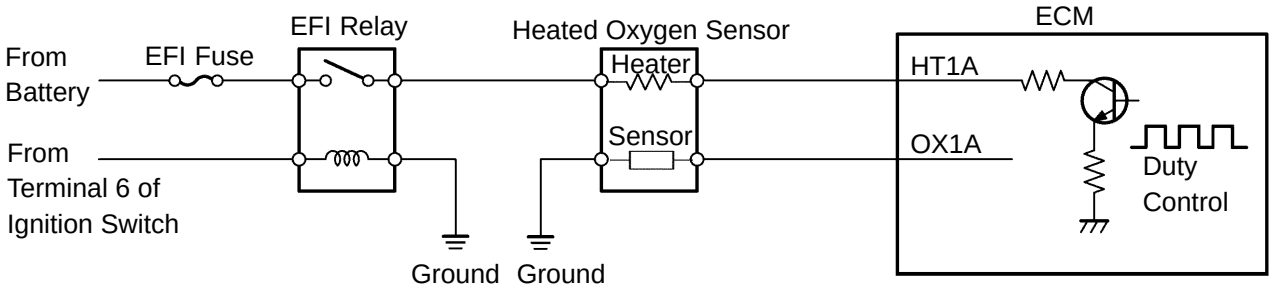
CIRCUIT DESCRIPTION

Refer to DTC P0130 on page 05–101.

HINT:

The ECM provides a pulse width modulated control circuit to adjust current through the heater. The heated oxygen sensor heater circuit uses a relay on the B+ side of the circuit.

Reference (Bank 1 Sensor 1 System Drawing):



DTC No.	DTC Detection Condition	Trouble Area
P0031 P0037	Heated current is 0.25 A or less when heater operates with B+ greater than 11.5 V (1 trip detection logic)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • EFI relay • ECM
P0032 P0038	Heated current exceeds 3.5 A when heater operates (1 trip detection logic)	

MONITOR DESCRIPTION

The ECM uses the heated oxygen sensor information to regulate the air–fuel ratio close to a stoichiometric ratio. This maximizes the catalytic converter's ability to purify the exhaust gas. The sensor detects oxygen levels in the exhaust gas and sends this signal to the ECM.

The inner surface of the sensor element is exposed to the outside air. The outer surface of the sensor element is exposed to the exhaust gas. The sensor element is made of the platinum coated zirconia and includes an integrated heating element. The heated oxygen sensor has the characteristic whereby its output voltage change suddenly in the vicinity of the stoichiometric air–fuel ratio. When heated, the sensor becomes very efficient. If the temperature of the exhaust is low, the sensor will not generate useful voltage signals without supplemental heating. The ECM regulates the supplemental heating using a duty–cycle approach to regulate the average current in the heater element. If the heater current is out of the normal range, the sensor's output signals will be inaccurate and the ECM cannot regulate the air–fuel ratio properly. When the heater current is out of the normal operating range, the ECM interprets this as a malfunction and sets a DTC.

Example:

The ECM will set a high current DTC if the current in the sensor is more than 2 A when the heater is OFF. Similarly, the ECM will set a low current DTC if the current is less than 0.25 A when the heater is ON.

MONITOR STRATEGY

Related DTCs	P0031, P0037	Heated oxygen sensor heater current bank 1 sensor 1, sensor 2 (low current)
	P0032, P0038	Heated oxygen sensor heater current bank 1 sensor 1, sensor 2 (high current)
Required sensors/components	Main sensors	Heated oxygen sensor
	Related sensors	Vehicle speed sensor
Frequency of operation	Continuous	
Duration	0.3 seconds	
MIL operation	1 driving cycle	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
P0032, P0038 (High current):		
Intrusive heating is OFF		
P0031, P0037 (Low current):		
Either following condition is met:	A or B	
A. Following conditions are met:	1, 2, 3, 4 and 5	
1. Time after engine start	250 seconds	500 seconds
2. Battery voltage	10.5 V	16 V
3. Vehicle speed	–	56 mph (90 km/h)
4. Misfire	No detect	
5. Pass/Fail detection in this driving cycle	No detect	
B. Following conditions are met:	1, 2, 3, 4 and 5	
1. Time after engine start	500 seconds	–
2. Battery voltage	10.5 V	16 V
3. Vehicle speed	25 mph (40 km/h)	–
4. Misfire	None detected	
5. Pass/Fail detection in this driving cycle	Pass and fail detection has not occurred yet	

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0032, P0038 (High current):	
Heated oxygen sensor heater current	More than 2 A (while intrusive heating is off)
P0031, P0037 (Low current):	
Heated oxygen sensor heater current	Less than 0.25 A (at 0.3 seconds after heater "ON")

COMPONENT OPERATING RANGE

Parameter	Standard Value
Heated oxygen sensor heater current under the following conditions: • Idling • Heated oxygen sensor is warmed up • Battery voltage is 11 to 14 V	0.4 to 1.0 A

MONITOR RESULT (MODE 06 DATA)

Test ID	Comp ID	Description of Test Data	Description of Test Limit	Unit	Conversion Factor
$04	$81 to $82	Maximum heated oxygen sensor heater current	Maximum threshold heater current to detect heated oxygen sensor heater circuit malfunction	A	Multiply by 0.000076

Refer to page 05–27 for detailed information on Checking Monitor Status.

WIRING DIAGRAM

Refer to DTC P0130 on page 05–101.

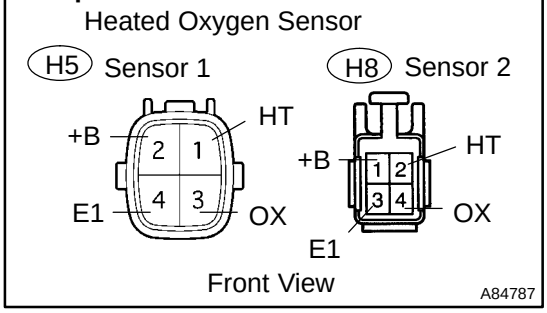
INSPECTION PROCEDURE

HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1 INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)

Component Side:



(a) Disconnect the H5 or H8 heated oxygen sensor connector.

(b) Measure the resistance between the terminals of the heated oxygen sensor connector.

Standard:

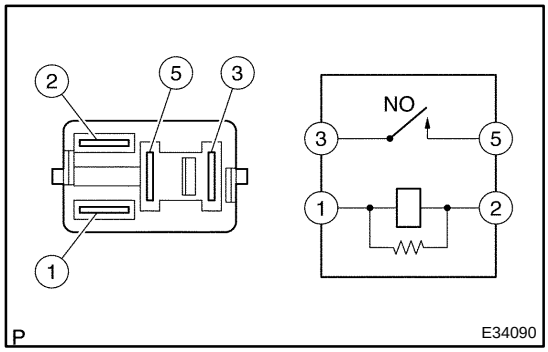
Tester Connection	Specified Condition
HT (H5–1) – +B (H5–2)	5 to 10 Ω at 20 °C (68 °F)
HT (H5–1) – E1 (H5–4)	10 kΩ or higher
HT (H8–2) – +B (H8–1)	5 to 10 Ω at 20 °C (68 °F)
HT (H8–2) – E1 (H8–3)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

2 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B.
(b) Check for continuity in the EFI relay.
Standard:

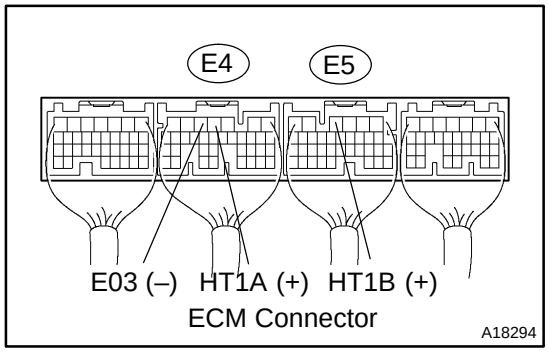
Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No continuity
	Continuity (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

3 INSPECT ECM(HT1A OR HT1B VOLTAGE)



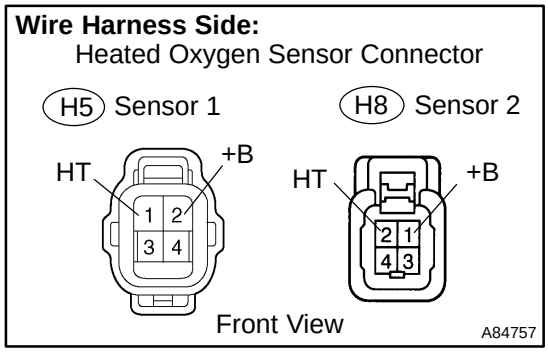
(a) Turn the ignition switch ON.
(b) Measure the voltage between the applicable terminals of the E4 and E5 ECM connectors.
Standard:

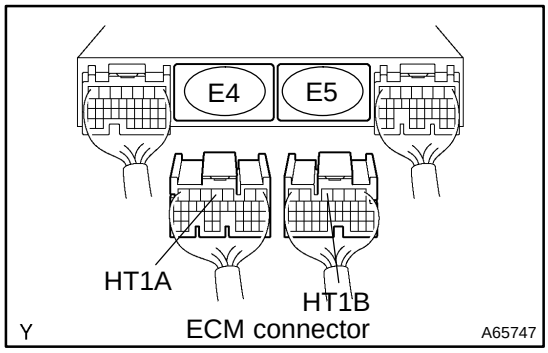
Tester Connection	Specified Condition
HT1A (E5–4) – E03 (E4–5)	9 to 14 V
HT1B (E5–4) – E03 (E4–5)	9 to 14 V

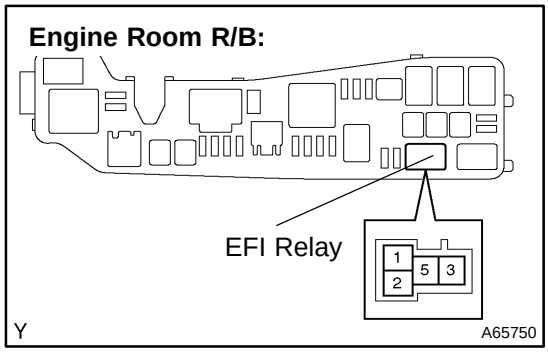
OK → **REPLACE ECM (See page 10–11)**

NG

4	CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM, HEATED OXYGEN SENSOR – EFI RELAY)







(a) Check the harness and connector between the ECM and heated oxygen sensor connectors.

(1) Disconnect the H5 or H8 heated oxygen sensor connector.

(2) Disconnect the E4 or E5 ECM connector.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
HT (H5–1) – HT1A (E4–4)	Below 1 Ω
HT (H8–2) – HT1B (E5–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
HT (H5–1) or HT1A (E4–4) – Body ground	10 kΩ or higher
HT (H8–2) or HT1B (E5–4) – Body ground	10 kΩ or higher

(4) Reconnect the heated oxygen sensor connector.

(5) Reconnect the ECM connector.

(b) Check the harness and connector between the heated oxygen sensor connector and EFI relay.

(1) Disconnect the H5 or H8 heated oxygen sensor connector.

(2) Remove the EFI relay from the engine room R/B.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
+B (H5–2) – EFI relay (3)	Below 1 Ω
+B (H8–1) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
+B (H5–2) or EFI relay (3) – Body ground	10 kΩ or higher
+B (H8–1) or EFI relay (3) – Body ground	10 kΩ or higher

(4) Reconnect the heated oxygen sensor connector.

(5) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

DTC	P0100	MASS OR VOLUME AIR FLOW CIRCUIT

DTC	P0102	MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

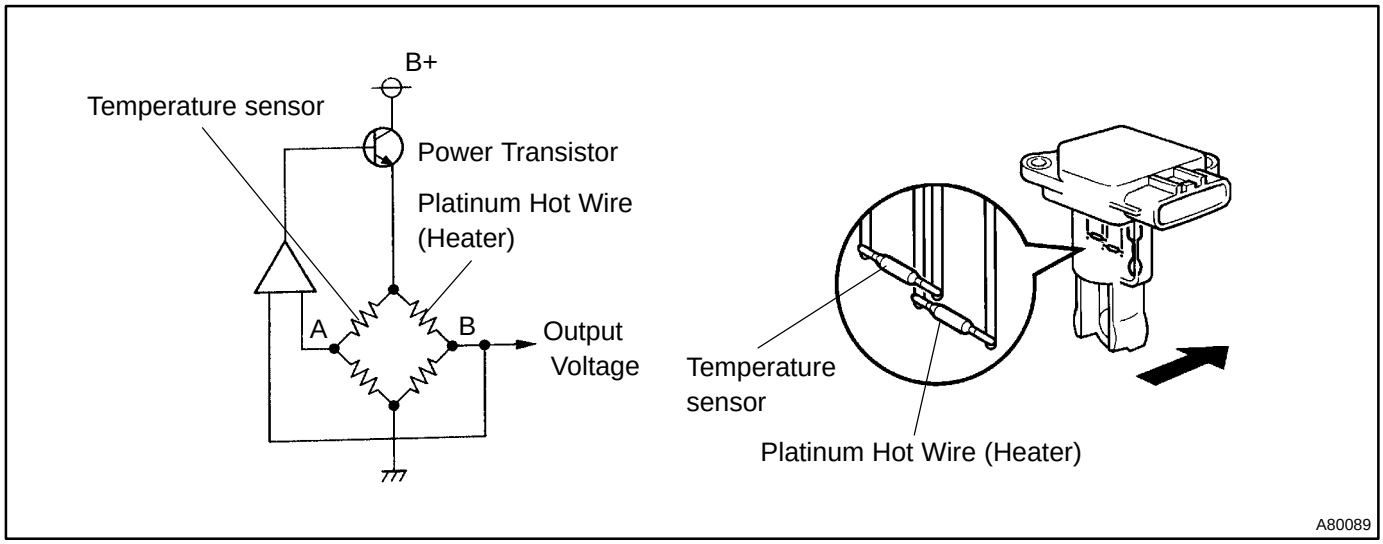
DTC	P0103	MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

The MAF (Mass Air Flow) sensor measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and provide a proper air–fuel ratio. Inside the MAF sensor, there is a heated platinum wire exposed to the flow of intake air.

By applying a specific current to the wire, the ECM heats this wire to a given temperature. The flow of incoming air cools the wire and an internal thermister, changing their resistance. To maintain a constant current value, the ECM varies the voltage applied to these components in the MAF sensor. The voltage level is proportional to the airflow through the sensor and the ECM interprets this voltage as the intake air amount.

The circuit is constructed so that the platinum hot wire and the temperature sensor provides a bridge circuit, with the power transistor controlled so that the potential of A and B remains equal to maintain the set temperature.



DTC No.	DTC Detection Condition	Trouble Area
P0100	When the mass air flow sensor circuit has an open or short for more than 3 seconds.	• Open or short in mass air flow sensor circuit • Mass air flow sensor • ECM
P0102	When the mass air flow sensor circuit has an open for more than 3 seconds.	
P0103	When the mass air flow sensor circuit has a short for more than 3 seconds.	

HINT:

After confirming DTC P0100, P0102 or P0103, confirm the mass air flow ratio in the ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL” using the hand–held tester or the OBD II scan tool.

Air Flow Value (gm/s)	Malfunction
Approx. 0.0	• Mass air flow sensor power source circuit open • VG circuit open or short
271.0 or more	• EVG circuit open

MONITOR DESCRIPTION

If there is a defect in the sensor or an open or short circuit, the voltage level will deviate outside the normal operating range. The ECM interprets this deviation as a defect in the MAF sensor and sets a DTC.
Example:
When the sensor voltage output is less than 0.2 V or more than 4.9 V and if either the condition continues for more than 3 seconds.

MONITOR STRATEGY

Related DTCs	P0100	Mass air flow sensor circuit range check (fluttering)
	P0102	Mass air flow sensor circuit range check (low voltage)
	P0103	Mass air flow sensor circuit range check (high voltage)
Required sensors/components	Mass air flow sensor	
Frequency of operation	Continuous	
Duration	3 seconds	
MIL operation	Immediately (when engine speed at 4,000rpm or less) 2 driving cycles (when engine speed at 4,000 rpm or more)	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)

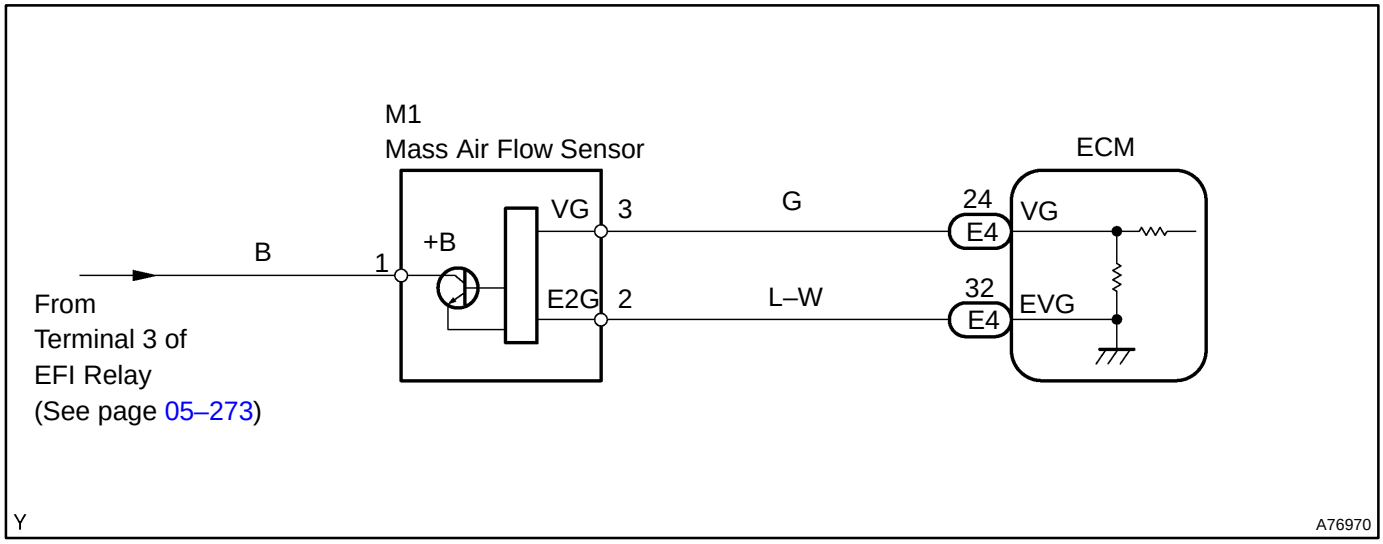
TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0100:	
Mass air flow sensor voltage	Less than 0.2 V or more than 4.9 V
P0102:	
Mass air flow sensor voltage	Less than 0.2 V
P0103:	
Mass air flow sensor voltage	More than 4.9 V

COMPONENT OPERATING RANGE

Parameter	Standard Value
Mass air flow sensor voltage	0.4 to 2.2 V

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.

1	**READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(MASS AIR FLOW RATE)**

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Start the engine.
(c) Push the hand–held tester or the OBD II scan tool main switch ON.
(d) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / MAF” and read its value displayed on the hand–held tester or the OBD II scan tool.

Result:

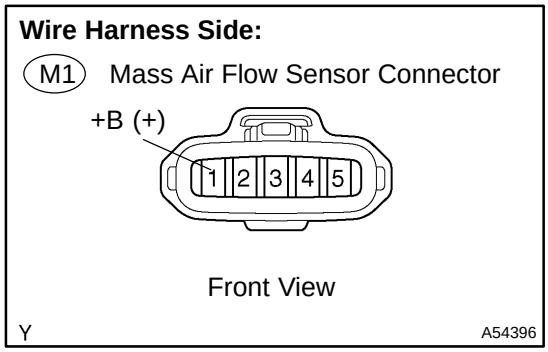
Air Flow Rate (gm/s)	Proceed to
0.0	A
271.0 or more	B
Between 1.0 and 270.0 (*1)	C

*1: The value must be changed when the throttle valve is opened or closed.

B	**Go to step 6**
C	**CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

A

2 INSPECT MASS AIR FLOW SENSOR(POWER SOURCE)



(a) Turn the ignition switch ON.
(b) Disconnect the M1 mass air flow sensor connector.
(c) Measure the voltage between the terminal of the wire harness side connector and body ground.

Standard:

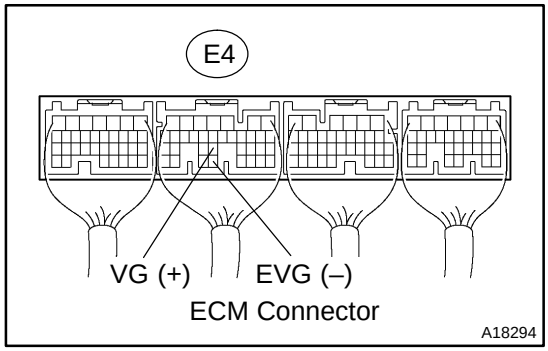
Tester Connection	Specified Condition
+B (M1–1) – Body ground	9 to 14 V

(d) Reconnect the mass air flow sensor connector.

NG → **Go to step 5**

OK

3 INSPECT ECM(VG VOLTAGE)



(a) Start the engine.
(b) Measure the voltage between the terminals of the E4 ECM connector.

HINT:
The shift position should be P or N and the A/C switch should be turned OFF.

Standard:

Tester Connection	Condition	Specified Condition
VG (E4–24) – EVG (E4–32)	Engine is idling	1.1 to 1.5 V

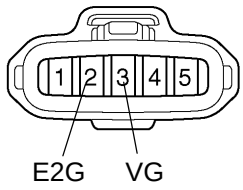
NG → **REPLACE ECM (See page 10–11)**

OK

4	CHECK HARNESS AND CONNECTOR(MASS AIR FLOW SENSOR – ECM)

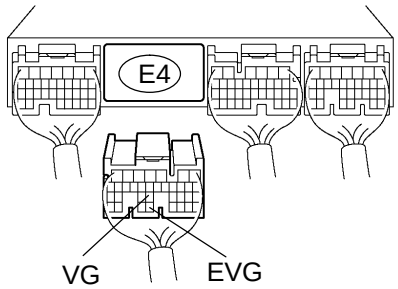
Wire Harness Side:

M1 Mass Air Flow Sensor Connector



Front View

Y A54396



Y ECM Connector A65745

(a) Disconnect the M1 mass air flow sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VG (M1–3) – VG (E4–24)	Below 1 Ω
E2G (M1–2) – EVG (E4–32)	

Standard (Check for short):

Tester Connection	Specified Condition
VG (M1–3) or VG (E4–24) – Body ground	10 kΩ or higher

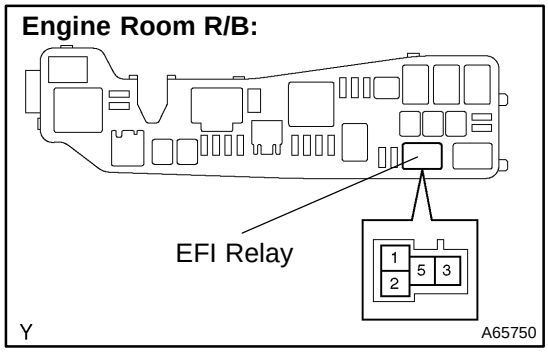
(d) Reconnect the mass air flow sensor connector.
(e) Reconnect the ECM connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE MASS AIR FLOW SENSOR

5 CHECK HARNESS AND CONNECTOR(MASS AIR FLOW SENSOR – EFI RELAY)



(a) Remove the EFI relay from the engine room R/B.
(b) Disconnect the M1 mass air flow sensor connector.
(c) Check the resistance between the wire harness side connectors.

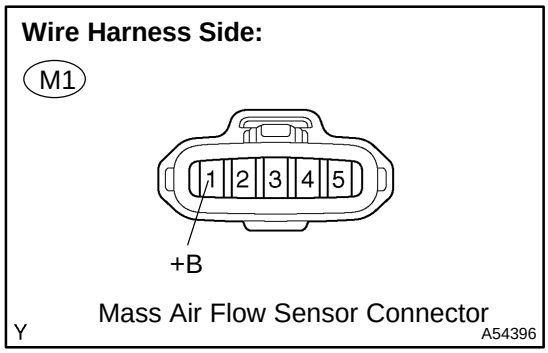
Standard (Check for open):

Tester Connection	Specified Condition
+B (M1–1) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
+B (M1–1) or EFI relay (3) – Body ground	10 kΩ or higher

(d) Reconnect the mass air flow sensor connector.
(e) Reinstall the EFI relay.

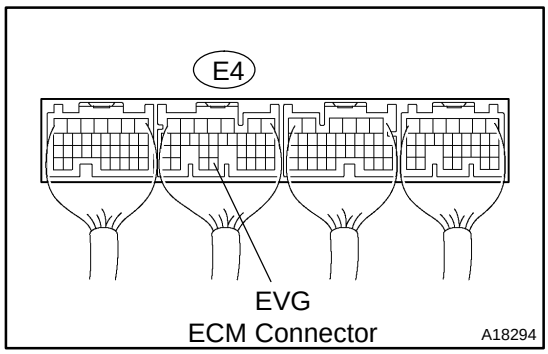


NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

CHECK FOR ECM POWER SOURCE CIRCUIT (See page 05–273)

6 INSPECT ECM(SENSOR GROUND)



(a) Check the resistance between the terminals of the E4 ECM connector.

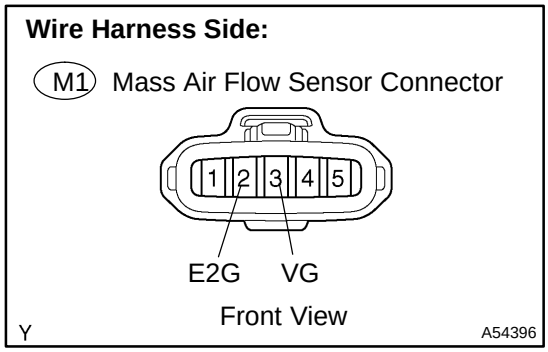
Standard:

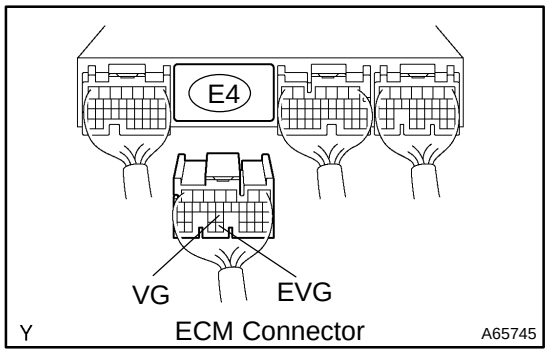
Tester Connection	Specified Condition
EVG (E4–32) – Body ground	Below 1 Ω

NG → **REPLACE ECM (See page 10–11)**

OK

7	CHECK HARNESS AND CONNECTOR(MASS AIR FLOW SENSOR – ECM)





(a) Disconnect the M1 mass air flow sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VG (M1–3) – VG (E4–24)	Below 1 Ω
E2G (M1–2) – EVG (E4–32)	

Standard (Check for short):

Tester Connection	Specified Condition
VG (M1–3) or VG (E4–24) – Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the mass air flow sensor connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE MASS AIR FLOW SENSOR

DTC	P0101	MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE PROBLEM

CIRCUIT DESCRIPTION

Refer to DTCs P0100 on page 05–65.

DTC No.	DTC Detection Condition	Trouble Area
P0101	After engine is warmed up, conditions (a) to (d) continue for more than 10 seconds (2 trip detection logic): (a) Engine speed less than 900 rpm (b) Throttle valve fully closed (c) Mass air flow sensor output greater than 2.2 V (d) Engine coolant temperature higher than 70°C (158°F)	• Mass air flow sensor
	Conditions (a) and (b) continue for more than 6 seconds: (2 trip detection logic) (a) VTA greater than 0.1 V (b) Mass air flow sensor output less than 0.4 V	

MONITOR DESCRIPTION

The MAF (Mass Air Flow) sensor helps the ECM calculates the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and provides a proper air–fuel ratio. Inside the MAF sensor, there is a heated platinum wire exposed to the flow of intake air. By applying a specific current to the wire, the ECM heats this wire to a given temperature. The flow of incoming air cools the wire and an internal thermister, changing their resistance. To maintain a constant current value, the ECM varies the voltage applied to these components in the MAF sensor. The voltage level is proportional to the air flow through the sensor and the ECM interprets this voltage as the intake air amount. If there is a defect in the sensor or an open or short circuit, the voltage level will deviate outside the normal operating range. The ECM interprets this deviation as a defect in the MAF sensor and sets a DTC.
Example: If the voltage is more than 2.2 V at idle, or less than 0.4 V at idle off, the ECM interprets this as a defect in the MAF sensor and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0101	Mass air flow sensor rationality
Required sensors/components	Main sensors	Mass air flow sensor
	Related sensors	Engine speed sensor, engine coolant temperature sensor, throttle position sensor
Frequency of operation	Continuous	
Duration	10 seconds (high voltage) 6 seconds (Low voltage)	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
High voltage:		
Engine speed	–	900 rpm
Idle	ON	
Engine coolant temperature	70°C (158°F)	–
Low voltage:		
Engine speed	0 rpm	–
Throttle position	0.1 V	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Mass air flow sensor voltage (high voltage)	More than 2.2 V
Mass air flow sensor voltage (low voltage)	Less than 0.4 V

WIRING DIAGRAM

Refer to DTC P0100 on page 05–65.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.

1	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0101)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item "DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES".
(d) Read the DTCs.

Result:

Display (DTC output)	Proceed to
P0101 and other DTCs	A
P0101	B

HINT:

If any other codes besides P0101 are output, perform the troubleshooting for those DTCs first.

B → **REPLACE MASS AIR FLOW SENSOR**

A

GO TO RELEVANT DTC CHART (See page 05–35)

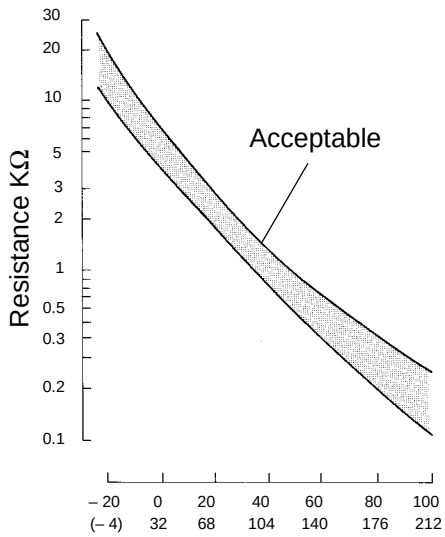
DTC	P0110	INTAKE AIR TEMPERATURE CIRCUIT

DTC	P0112	INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT

DTC	P0113	INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

(Fig.1)



The intake air temperature (IAT) sensor, mounted on the mass air flow (MAF) sensor, monitors the intake air temperature. The IAT sensor has a thermistor that varies its resistance depending on the temperature of the intake air. When the air temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. The variations in resistance are reflected as voltage changes to the ECM terminal. (See Fig. 1).

The intake air temperature sensor is connected to the ECM. The 5 V power source voltage in the ECM is applied to the intake air temperature sensor from terminal THA (THAR) via resistor R.

That is, the resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes in accordance with changes in the intake air temperature, the potential at terminal THA (THAR) also changes. Based on this signal, the ECM increases the fuel injection volume to improve the drive ability during cold engine operation.

DTC No.	Proceed to	DTC Detection Condition	Trouble Area
P0110	Step 1	Open or short in intake air temperature sensor circuit for 0.5 seconds	• Open or short in intake air temperature sensor circuit • Intake air temperature sensor (built in mass air flow sensor) • ECM
P0112	Step 4	Short in intake air temperature sensor circuit for 0.5 seconds	
P0113	Step 2	Open in intake air temperature sensor circuit for 0.5 seconds	

HINT:

After confirming DTC P0110, P0112 or P0113, confirm the intake air temperature in the ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL” using the hand–held tester or the OBD II scan tool.

Temperature Displayed	Malfunction
–40˚C (–40˚F)	Open circuit
140˚C (284˚F) or more	Short circuit

MONITOR DESCRIPTION

The ECM monitors the sensor voltage and uses this value to calculate the intake air temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the IAT sensor and sets a DTC.

Example:

When the sensor voltage output equal to –40°C (–40°F) or more than 140°C (284°F).

MONITOR STRATEGY

Related DTCs	P0110	Intake air temperature sensor range check (fluttering)
	P0112	Intake air temperature sensor range check (low resistance)
	P0113	Intake air temperature sensor range check (high resistance)
Required sensors/components	Intake air temperature sensor	
Frequency of operation	Continuous	
Duration	0.5 seconds	
MIL operation	Immediately	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)

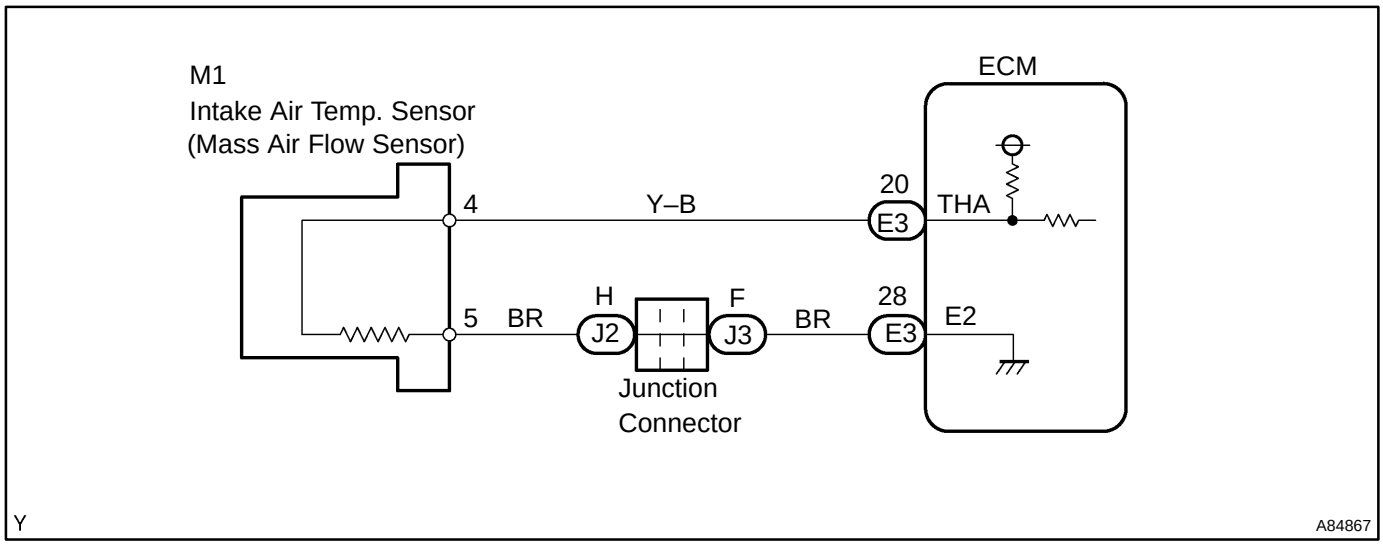
TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0110:	
Intake air temperature sensor resistance (Intake air temperature)	Less than 98.5 Ω or more than 156 kΩ (more than 140°C (284°F) or less than –40°C (–40°F)
P0112:	
Intake air temperature sensor resistance (Intake air temperature)	Less than 98.5 Ω (more than 140°C (284°F))
P0113:	
Intake air temperature sensor resistance (Intake air temperature)	More than 156 kΩ (less than –40°C (–40°F))

COMPONENT OPERATING RANGE

Parameter	Standard Value
Intake air temperature sensor resistance	98.5 Ω (140°C (281°F)) to 156 kΩ (–40°C (–40°F)

WIRING DIAGRAM



2004 COROLLA (RM1037U)

INSPECTION PROCEDURE

HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(INTAKE AIR TEMPERATURE)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item "DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / INTAKE AIR" and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature: Same value as the actual intake air temperature.
Result:

Temperature Displayed	Proceed to
–40˚C (–40˚F)	A
140˚C (284˚F) or more	B
OK (Same as present temperature)	C

HINT:

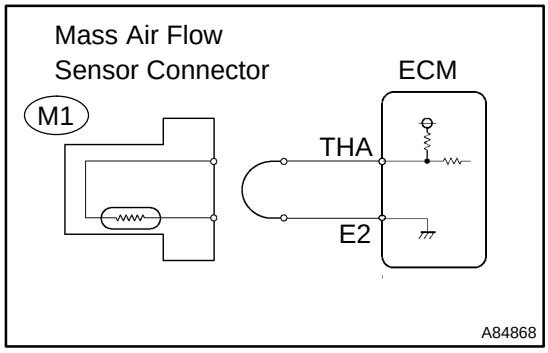
- If there is an open circuit, the hand–held tester or the OBD II scan tool indicates –40˚C (–40˚F).
- If there is a short circuit, the hand–held tester or the OBD II scan tool indicates 140˚C (284˚F) or more.

B → **Go to step 4**

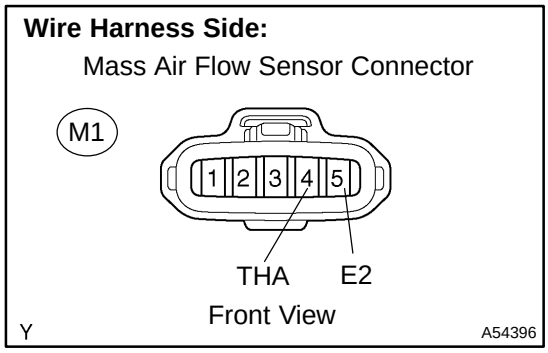
C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

A

2	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(CHECK FOR OPEN IN WIRE HARNESS)



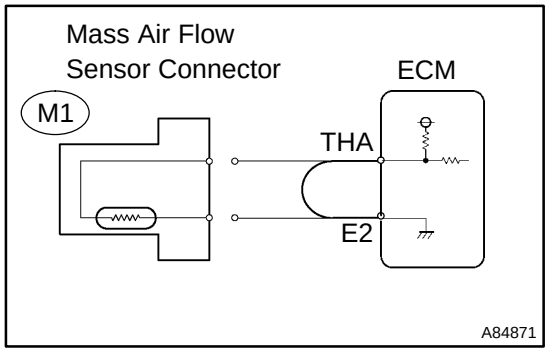
(a) Disconnect the M1 mass air flow sensor connector.
(b) Connect terminals THA and E2 of the mass air flow sensor wire harness side connector.
(c) Turn the ignition switch ON.
(d) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / INTAKE AIR” and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature value: 140°C (284°F) or more
(e) Reconnect the mass air flow sensor connector.

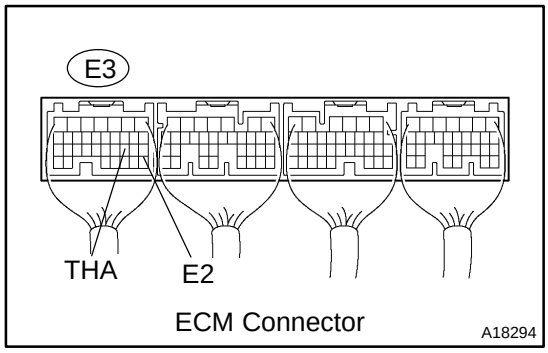


OK → **CONFIRM GOOD CONNECTION AT SENSOR. IF OK, REPLACE MASS AIR FLOW SENSOR**

NG

3	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(CHECK FOR OPEN IN ECM)





(a) Disconnect the M1 mass air flow sensor connector.
(b) Connect the terminals THA and E2 of the E3 ECM connector.

HINT:
Before checking, do a visual and contact pressure check on the ECM connector.

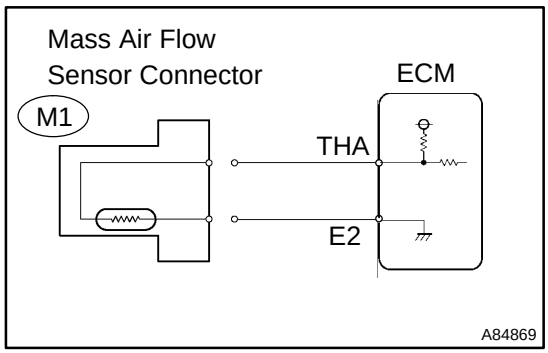
(c) Turn the ignition switch ON.
(d) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / INTAKE AIR” and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature value: 140°C (284°F) or more
(e) Reconnect the mass air flow sensor connector.

OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

CONFIRM GOOD CONNECTION AT ECM. IF OK, REPLACE ECM (See page 10–11)

4	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(CHECK FOR SHORT IN WIRE HARNESS)

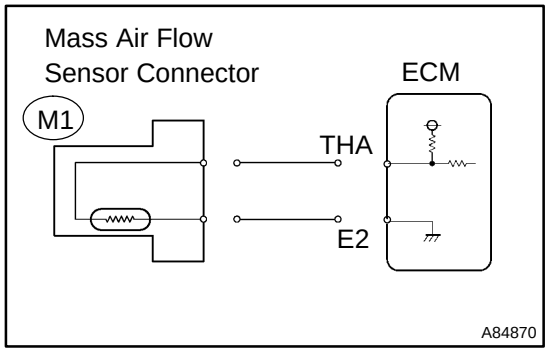


(a) Disconnect the M1 mass air flow sensor connector.
(b) Turn the ignition switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / INTAKE AIR” and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature value: –40°C (–40°F)
(d) Reconnect the mass air flow sensor connector.

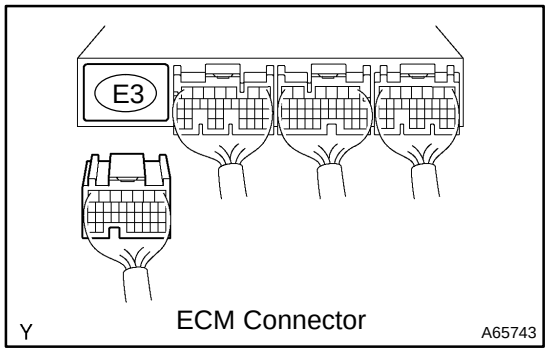
OK → **REPLACE MASS AIR FLOW SENSOR**

NG

5	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(CHECK FOR SHORT IN ECM)



(a) Disconnect the E3 ECM connector.
(b) Turn the ignition switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / INTAKE AIR” and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature value: –40°C (–40°F)
(d) Reconnect the ECM connector.



OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

REPLACE ECM (See page 10–11)

DTC	P0115	ENGINE COOLANT TEMPERATURE CIRCUIT

DTC	P0117	ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

DTC	P0118	ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

A thermistor is built in the engine coolant temperature sensor and changes the resistance value according to the engine coolant temperature.

The structure of the sensor and connection to the ECM is the same as those of the intake air temperature sensor.

HINT:

If the ECM detects the DTC P0115, P0117 or P0118, it operates the fail–safe function in which the engine coolant temperature is assumed to be 80 °C (176 °F).

DTC No.	Proceed to	DTC Detection Condition	Trouble Area
P0115	Step 1	Open or short in engine coolant temperature sensor circuit for 0.5 seconds	• Open or short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0117	Step 4	Short in engine coolant temperature sensor circuit for 0.5 seconds	
P0118	Step 2	Open in engine coolant temperature sensor circuit for 0.5 seconds	

HINT:

After confirming DTC P0115, P0117 or P0118, confirm the engine coolant temperature in the ”DIAGNOSIS/ ENHANCED OBD II/DATA LIST/ALL” using the hand–held tester or the OBD II scan tool.

Temperature Displayed	Malfunction
–40˚C (–40˚F)	Open circuit
140˚C (284˚F) or more	Short circuit

MONITOR DESCRIPTION

The engine coolant temperature (ECT) sensor is used to monitor the engine coolant temperature. The ECT sensor has a thermistor that varies its resistance depending on the temperature of the engine coolant. When the coolant temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. The variations in resistance are reflected in the voltage output from the sensor. The ECM monitors the sensor voltage and uses this value to calculate the engine coolant temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the ECT sensor and sets a DTC.

Example:

When the ECM calculates that the ECT is –40°C (–40°F), or more than 140°C (284°F), and if either the condition continues for 0.5 sec or more, the ECM will set a DTC.

MONITOR STRATEGY

Related DTCs	P0115	Engine coolant temperature sensor range check (fluttering)
	P0117	Engine coolant temperature sensor range check (low resistance)
	P0118	Engine coolant temperature sensor range check (high resistance)
Required sensors/components	Engine coolant temperature sensor	
Frequency of operation	Continuous	
Duration	0.5 seconds	
MIL operation	Immediately	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)

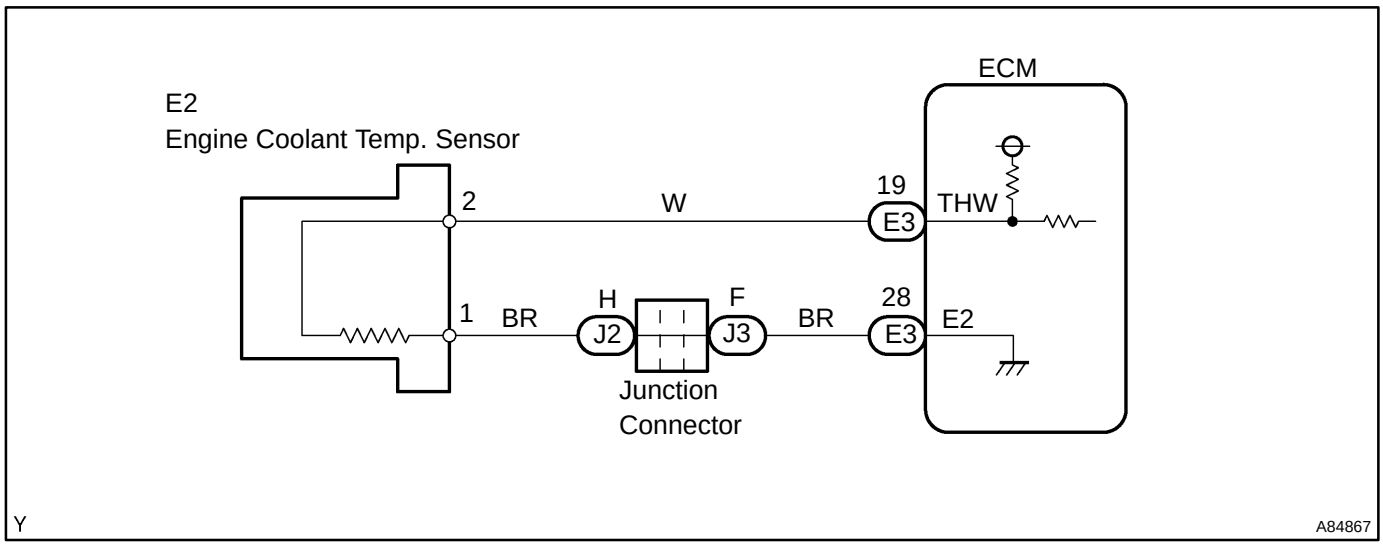
TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0115:	
Engine coolant temperature sensor resistance (coolant temperature)	Less than 79 Ω or more than 156 kΩ (more than 140°C (284°F) or less than –40°C (–40°F))
P0117:	
Engine coolant temperature sensor resistance (coolant temperature)	Less than 79 Ω (more than 140°C (284°F))
P0118:	
Engine coolant temperature sensor resistance (coolant temperature)	More than 156 kΩ (less than –40°C (–40°F))

COMPONENT OPERATING RANGE

Parameter	Standard Value
Engine coolant temperature sensor resistance	79 Ω (140°C (281°F)) to 156 kΩ (–40°C (–40°F))

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(ENGINE COOLANT TEMPERATURE)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / COOLANT TEMP” and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature: Same value as the actual intake air temperature.
Result:

Temperature Displayed	Proceed to
–40˚C (–40˚F)	A
140˚C (284˚F) or more	B
OK (Same as present temperature)	C

HINT:

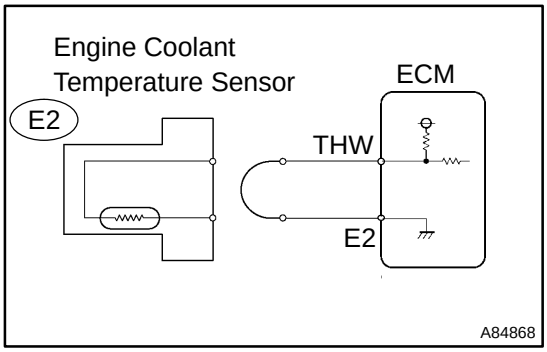
- If there is an open circuit, the hand–held tester or the OBD II scan tool indicates –40˚C (–40˚F).
- If there is a short circuit, the hand–held tester or the OBD II scan tool indicates 140˚C (284˚F) or more.

B → **Go to step 4**

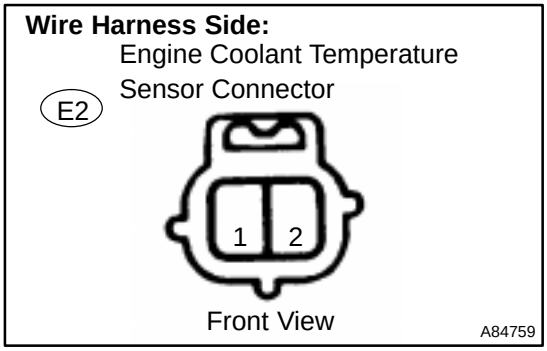
C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

A

2	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(CHECK FOR OPEN IN WIRE HARNESS)



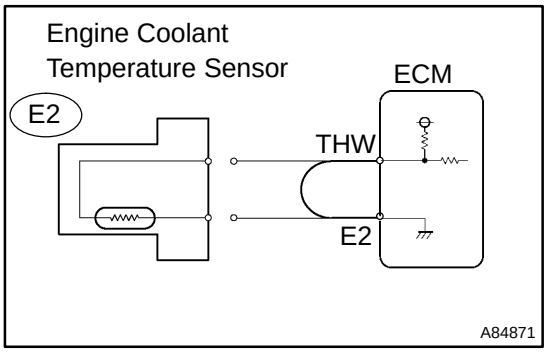
(a) Disconnect the E2 engine coolant temperature sensor connector.
(b) Connect terminals 1 and 2 of the engine coolant temperature sensor connector on the wire harness side.
(c) Turn the ignition switch ON.
(d) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / COOLANT TEMP” and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature value: 140°C (284°F) or more
(e) Reconnect the engine coolant temperature sensor connector.



OK → **CONFIRM GOOD CONNECTION AT SENSOR. IF OK, REPLACE ENGINE COOLANT TEMP. SENSOR**

NG

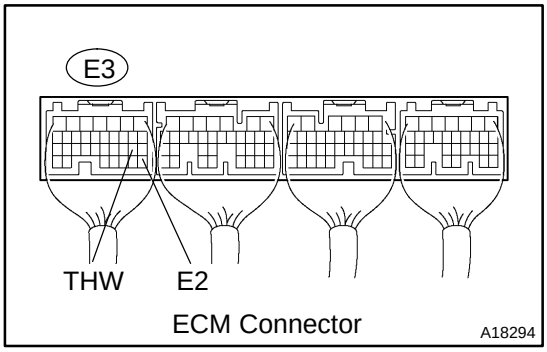
3	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(CHECK FOR OPEN IN ECM)



(a) Disconnect the E2 engine coolant temperature sensor connector.
(b) Connect the terminals THW and E2 of the E3 ECM connector.

HINT:
Before checking, do a visual and contact pressure check on the ECM connector.

(c) Turn the ignition switch ON.
(d) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / COOLANT TEMP” and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature value: 140°C (284°F) or more
(e) Reconnect the engine coolant temperature sensor connector.

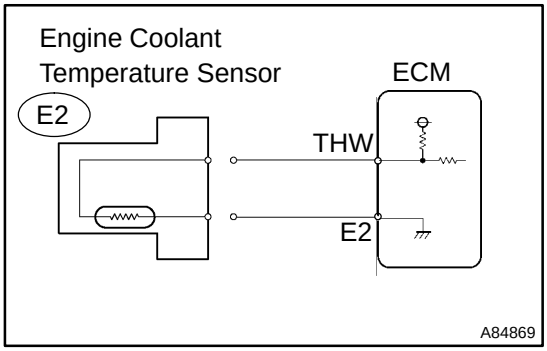


OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

CONFIRM GOOD CONNECTION AT ECM. IF OK, REPLACE ECM (See page 10–11)

4	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(CHECK FOR SHORT IN WIRE HARNESS)

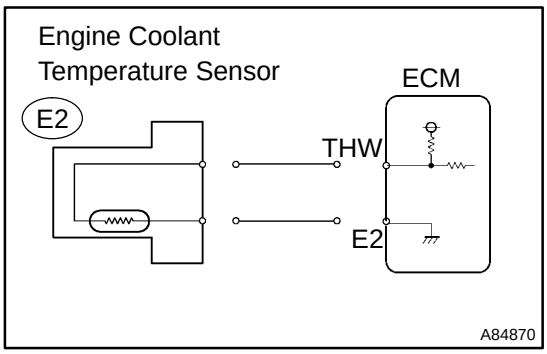


(a) Disconnect the E2 engine coolant temperature sensor connector.
(b) Turn the ignition switch ON.
(c) Select the item "DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / COOLANT TEMP" and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature value: –40°C (–40°F)
(d) Reconnect the engine coolant temperature sensor connector.

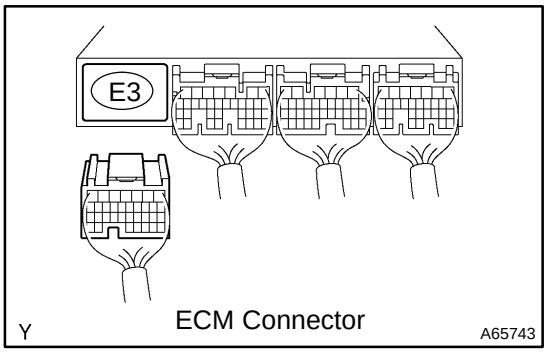
OK → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

NG

5	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(CHECK FOR SHORT IN ECM)



(a) Disconnect the E3 ECM connector.
(b) Turn the ignition switch ON.
(c) Select the item "DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / COOLANT TEMP" and read its value displayed on the hand–held tester or the OBD II scan tool.
Temperature: –40°C (–40°F)
(d) Reconnect the ECM connector.



OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

REPLACE ECM (See page 10–11)

DTC	P0116	ENGINE COOLANT TEMP. CIRCUIT RANGE/PERFORMANCE PROBLEM

CIRCUIT DESCRIPTION

Refer to DTC P0115 on page 05–80.

DTC No.	DTC Detection Condition	Trouble Area
P0116	If engine coolant temperature (ECT) was between 35°C (95°F) and 60°C (140°F) when starting the engine, and also conditions (a) and (b) are met: (a) Vehicle has run with acceleration and deceleration (b) ETC still remains within 3°C (5.4°F) of the starting temperature (2 trip detection logic)	• Engine coolant temperature sensor
	If engine coolant temperature (ECT) was more than 60°C when starting the engine, and also conditions (a) and (b) are met: (a) Vehicle has run with acceleration and deceleration (b) ECT still remains within 1°C (1.8°F) of the starting temperature (6 trip detection logic)	

MONITOR DESCRIPTION

The engine coolant temperature (ECT) sensor is used to monitor the engine coolant temperature. The ECT sensor has a thermistor that varies its resistance depending on the temperature of the engine coolant. When the coolant temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. The variations in resistance are reflected in the voltage output from the sensor. The ECM monitors the sensor voltage and uses this value to calculate the engine coolant temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the ECT sensor and sets a DTC.

Examples:

1) Upon starting the engine, the coolant temperature (ECT) was between 35°C (95°F) and 60°C (140°F). If after driving for 250 seconds, the ECT still remains within 3°C (5.4°F) of the staring temperature, a DTC will be set. (2 trip detection logic)

2) Upon starting the engine, the coolant temperature (ECT) was over 60°C (140°F). If after driving for 250 seconds, the ECT still remains within 1°C (1.8°F) of the starting temperature, a DTC will be set. (6 trip detection logic)

MONITOR STRATEGY

Related DTCs	P0116	Engine coolant temperature sensor range check (stuck)
Required sensors/components	Main sensors	Engine coolant temperature sensor
	Related sensors	Intake air temperature sensor, crankshaft position sensor, mass air flow sensor
Frequency of operation	Continuous	
Duration	250 seconds	
MIL operation	2 driving cycles (when temperature is fixed between 35°C (95°F) and 60°C (140°F)) 6 driving cycles (when temperature is fixed at 60°C (140°F) or more)	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
Case 1 (when temperature is fixed between 35°C (95°F) and 60°C (140°F)):		
Cumulative idle off period	250 seconds	–
Speed increased more than 19 mph (30 km/h)	10 times	–
Engine coolant temperature	35°C (95°F)	60°C (140°F)
Intake air temperature	–6.7°C (20°F)	–
Case 2 (When temperature is fixed at 60°C (140°F) or more):		
Engine coolant temperature	60°C (140°F)	104.4°C (220°F)
Intake air temperature	–6.7°C (20°F)	–
Stop and go	Stop for 20 seconds or more and accelerate to more than 44 mph (70 km/h)	
44 mph (70 km/h) in less than 40 seconds	Decrease from 40 mph (65 km/h) to 2 mph (3 km/h) in 35 seconds and stop for 10 seconds	

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Case1 (When temperature is fixed between 35°C (95°F) and 60°C (140°F)):	
Change of engine coolant temperature value	Less than 3°C (5.4°F)
Case2 (When temperature is fixed at 60°C (140°F) or more):	
Change of engine coolant temperature value	1°C (1.8°F) or less

COMPONENT OPERATING RANGE

Parameter	Standard Value
Engine coolant temperature (ECT) sensor's output	Indicating the same temperature as the actual ECT

WIRING DIAGRAM

Refer to DTC P0115 on page 05–80.

INSPECTION PROCEDURE

HINT:

- If DTCs P0115, P0116, P0117, P0118 and P0125 are output simultaneously, the engine coolant temperature sensor circuit may be open or short. Perform the troubleshooting of DTC P0115, P0117 or P0118 first.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

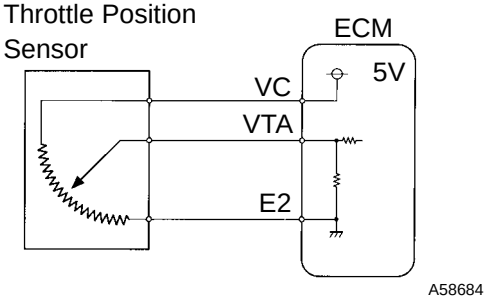
DTC	P0120	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”A” CIRCUIT

DTC	P0122	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”A” CIRCUIT LOW INPUT

DTC	P0123	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”A” CIRCUIT HIGH INPUT

HINT:
This is the purpose for the ”throttle position sensor”.

CIRCUIT DESCRIPTION



The throttle position sensor is mounted in the throttle body and detects the throttle valve opening angle.
When the throttle valve is fully closed, a voltage of approximately 0.3 to 1.0 V is applied to terminal VTA of the ECM. The voltage applied to terminal VTA of the ECM increases in proportion to the opening angle of the throttle valve and becomes approximately 3.2 to 4.9 V when the throttle valve is fully opened. The ECM judges the vehicle driving conditions from these signals input from terminal VTA, uses them as one of the conditions for deciding the air–fuel ratio correction, power increase correction and fuel–cut control etc.

DTC No.	DTC Detection Condition	Trouble Area
Condition (a) of DTC P0120, P0122 or P0123 continues for 5 seconds (Open or short in throttle position sensor circuit)		
P0120	Detection conditions for DTCs P0122 and P0123 are not satisfied but condition (a) is satisfied (a) VTA less than 0.1 V or VTA more than 4.9 V	• Open or short in throttle position sensor circuit • Throttle position sensor (built in throttle body) • ECM
P0122	(a) VTA stays less than 0.1 V for 5 seconds or more	• Throttle position sensor (built in throttle body) • Short in VTA circuit • Open in VC circuit • ECM
P0123	(a) VTA stays more than 4.9 V for 5 seconds or more	• Throttle position sensor (built in throttle body) • Open in VTA circuit • Open in E2 circuit • VC and VTA circuit are short–circuited • ECM

HINT:
After confirming DTCs, confirm the throttle valve opening percentage and closed throttle position switch condition using the hand–held tester or the OBD II scan tool.

Throttle valve opening position expressed as percentage		Trouble Area
Throttle valve fully closed	Throttle valve fully open	
0 %	0 %	VC circuit open VTA circuit open or short
Approx. 100 %	Approx. 100 %	E2 circuit open

MONITOR DESCRIPTION

The throttle position sensor varies its resistance with the throttle valve angle. The ECM applies a regulated reference voltage to the throttle position sensor “+: VC” terminal and calculates the angle of the throttle valve based on the voltage present at the throttle position sensor “signal: VTA” terminal.
When the throttle valve is near the fully closed position, the output voltage of the throttle position sensor is low. When it is near the fully open position, the output voltage is high.
If the ECM detects that the output voltage of the throttle position sensor is out of the normal range, the ECM interprets this as a malfunction in the throttle position sensor and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0120	Throttle position sensor range check (fluttering)
	P0122	Throttle position sensor range check (low voltage)
	P0123	Throttle position sensor range check (high voltage)
Required sensors/components	Throttle position sensor	
Frequency of operation	Continuous	
Duration	5 seconds	
MIL operation	Immediately	
Sequence of operation	None	

TYPICAL ENABLING CONDITION

The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)

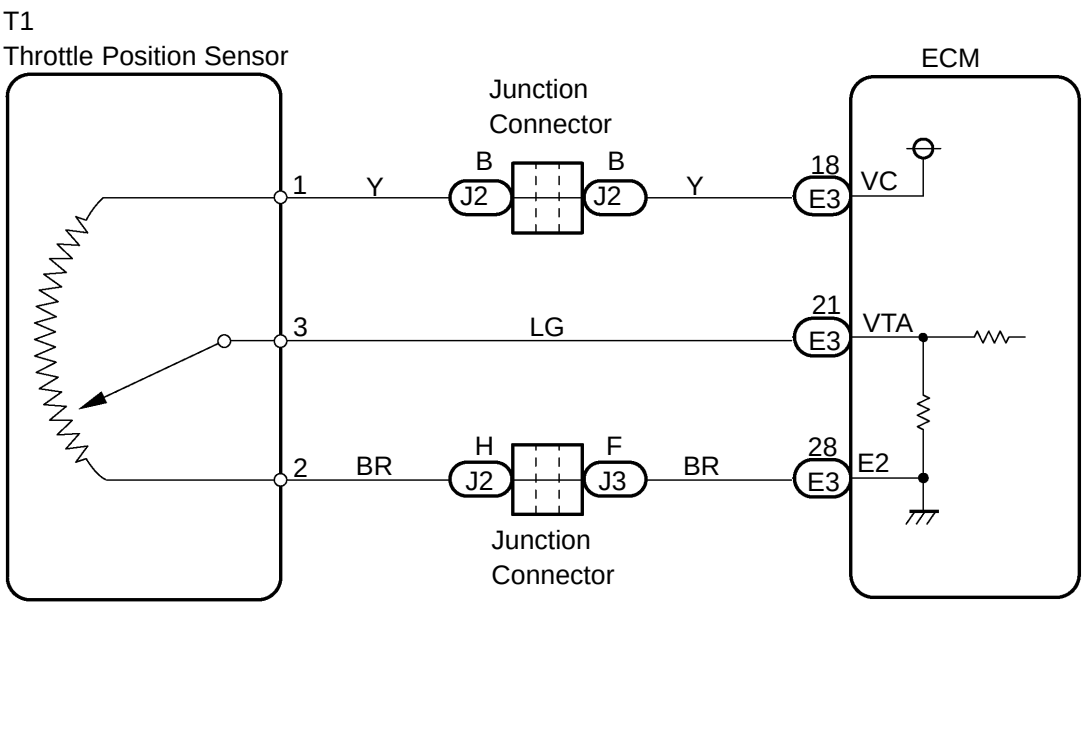
TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0120:	
VTA voltage	Flutters beyond the normal range
P0122:	
VTA voltage	less than 0.1 V
P0123:	
VTA voltage	more than 4.9 V

COMPONENT OPERATING RANGE

Parameter	Standard Value
Throttle position sensor voltage	0.1 to 4.9 V

WIRING DIAGRAM



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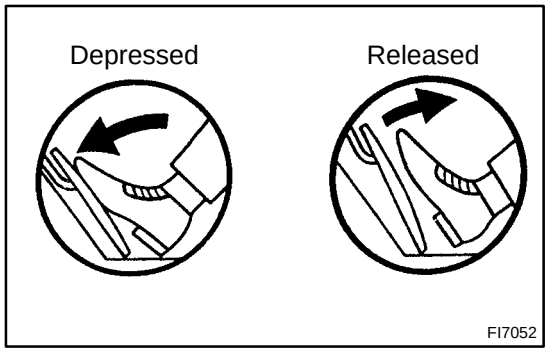
INSPECTION PROCEDURE

HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.

Hand–held tester:

1	READ VALUE OF HAND–HELD TESTER(THROTTLE VALVE OPENING PERCENTAGE)



(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Select the item "DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / THROTTLE POS" and read its value displayed on the hand–held tester.

Result:

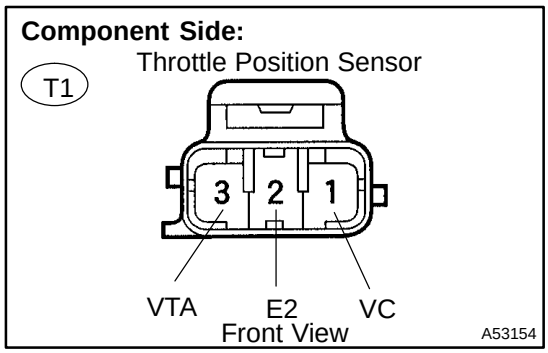
Accelerator Pedal Operation	Throttle Valve Opening Position (%)	Proceed to
Releasing and depressing	0	A
	From approx. 0 to 75	B
	Approx. 100	C

B → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

C → **Go to step 4**

A

2	INSPECT THROTTLE POSITION SENSOR



(a) Disconnect the T1 throttle position sensor connector.
(b) Measure the resistance between the terminals of the throttle position sensor.

Standard:

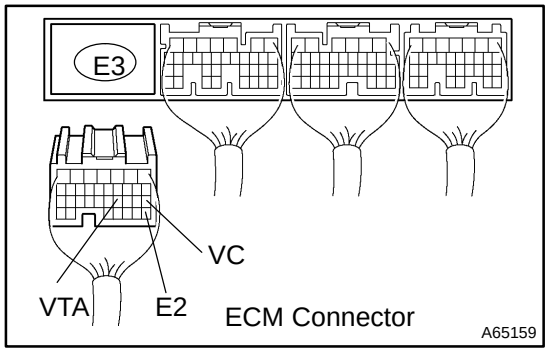
Tester Connection	Throttle Valve	Specified Condition
VC (T1–1) – E2 (T1–2)	—	2.5 to 5.9 kΩ
VTA (T1–3) – E2 (T1–2)	Fully closed	0.2 to 5.7 kΩ
	Fully open	2.0 to 10.2 kΩ

(c) Reconnect the throttle position sensor connector.

NG → **REPLACE THROTTLE POSITION SENSOR**

OK

3 CHECK HARNESS AND CONNECTOR(ECM – THROTTLE POSITION SENSOR)



(a) Disconnect the E3 ECM connector.

(b) Measure the resistance between the terminals of the E3 ECM connector.

Standard:

Tester Connection	Throttle Valve	Specified Condition
VC (E3–18) – E2 (E3–28)	—	2.5 to 5.9 kΩ
VTA(E3–21) – E2 (E3–28)	Fully closed	0.2 to 5.7 kΩ
	Fully open	2.0 to 10.2 kΩ

(c) Check the resistance between the terminals of the E3 ECM connector.

Standard (Check for short):

Tester Connection	Specified Condition
VC (E3–18) – Body ground	10 kΩ or higher
VTA (E3–28) – Body ground	

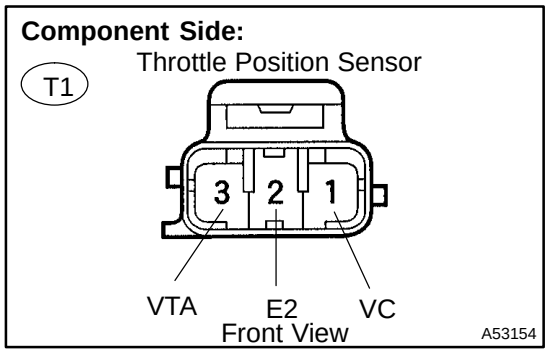
(d) Reconnect the ECM connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page10–11)

4 INSPECT THROTTLE POSITION SENSOR



(a) Disconnect the T1 throttle position sensor connector.

(b) Measure the resistance between the terminals of the throttle position sensor.

Standard:

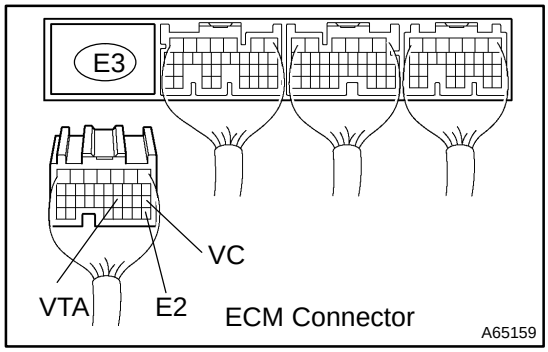
Tester Connection	Throttle Valve	Specified Condition
VC (T1–1) – E2 (T1–2)	—	2.5 to 5.9 kΩ
VTA (T1–3) – E2 (T1–2)	Fully closed	0.2 to 5.7 kΩ
	Fully open	2.0 to 10.2 kΩ

(c) Reconnect the throttle position sensor connector.

NG → **REPLACE THROTTLE POSITION SENSOR**

OK

5	CHECK HARNESS AND CONNECTOR(ECM – THROTTLE POSITION SENSOR)



(a) Disconnect the E3 ECM connector.
(b) Disconnect the T1 throttle position sensor connector.
(c) Check the resistance between the wire harness side connectors.

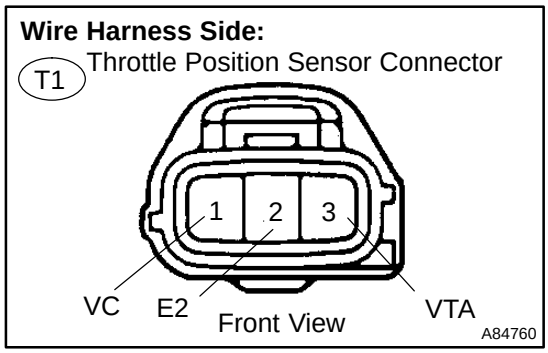
Standard (Check for open):

Tester Connection	Specified Condition
VC (T1–1) – VC (E3–18)	Below 1 Ω
VTA (T1–3) – VTA (E3–21)	
E2 (T1–2) – E2 (E3–28)	

Standard (Check for short):

Tester Connection	Specified Condition
VC (T1–1) or VC (E3–18) – Body ground	10 kΩ or higher
VTA (T1–3) or VTA (E3–21) – Body ground	

(d) Reconnect the throttle position sensor connector.
(e) Reconnect the ECM connector.



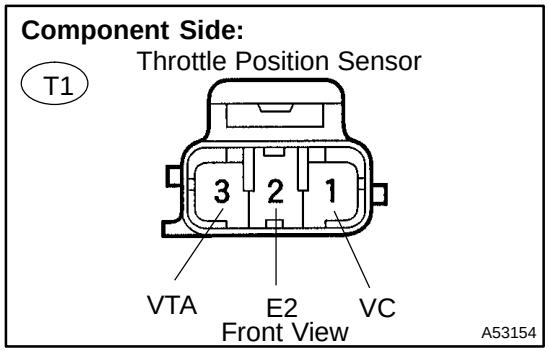
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

OBD II scan tool (excluding hand–held tester):

1	INSPECT THROTTLE POSITION SENSOR



(a) Disconnect the T1 throttle position sensor connector.
(b) Measure the resistance between the terminals of the throttle position sensor.

Standard:

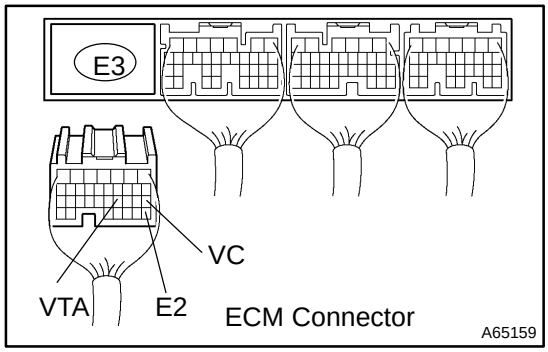
Tester Connection	Throttle Valve	Specified Condition
VC (T1–1) – E2 (T1–2)	—	2.5 to 5.9 kΩ
VTA (T1–3) – E2 (T1–2)	Fully closed	0.2 to 5.7 kΩ
	Fully open	2.0 to 10.2 kΩ

(c) Reconnect the throttle position sensor connector.

NG → **REPLACE THROTTLE POSITION SENSOR**

OK

2 CHECK HARNESS AND CONNECTOR(THROTTLE POSITION SENSOR – ECM)



(a) Disconnect the E3 ECM connector.

(b) Measure the resistance between the terminals of the E3 ECM connector.

Standard:

Tester Connection	Throttle valve	Specified Condition
VC (E3–18) – E2 (E3–28)	—	2.5 to 5.9 kΩ
VTA(E3–21) – E2 (E3–28)	Fully closed	0.2 to 5.7 kΩ
	Fully open	2.0 to 10.2 kΩ

(c) Check the resistance between the terminals of the E3 ECM connector.

Standard (Check for short):

Tester Connection	Specified Condition
VC (E3–18) – Body ground	10 kΩ or higher
VTA (E3–28) – Body ground	

(d) Reconnect the ECM connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

DTC	P0121	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”A” CIRCUIT RANGE/PERFORMANCE PROBLEM

HINT:
This is the purpose of the ”throttle position sensor”.

CIRCUIT DESCRIPTION

Refer to DTC P0120 on page 05–87.

DTC No.	DTC Detection Condition	Trouble Area
P0121	The following condition is met 4 times. After the vehicle speed has exceeded 19 mph (30 km/h) once, the throttle position sensor output value is out of normal range when the throttle valve is closed at 0 km/h	• Throttle position sensor (built in throttle body)

MONITOR DESCRIPTION

The throttle position sensor varies its resistance with the angle of the throttle valve. The ECM applies a regulated reference voltage to the throttle position sensor “+” terminal and calculates the angle of the throttle valve based on the voltage present at the throttle position sensor “signal” terminal.
When the throttle valve is near the fully closed position, the output voltage of the throttle position sensor is low. When it is near the fully open position, the output voltage is high.
The ECM checks the indicated angle of the throttle valve during “stop and go” conditions. If the indicated angle (or voltage) in the “closed throttle” position is out of the specified range, the ECM interprets this as a malfunction in the throttle position sensor and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0121	Throttle position sensor rationality
Required sensors/components	Main sensors	Throttle position sensor
	Related sensors	Vehicle speed sensor
Frequency of operation	Continuous	
Duration	Within 10 seconds	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITION

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Throttle valve position	Closed angle position	
”Stop and Go”	4 times	–

”Stop and go” is defined as follows:
”Stop” indicates a vehicle speed of 0 mph (0 km/h). ”Go” indicates a vehicle speed of 18.6 mph (30 km/h).

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Throttle valve at closed angle position	26.2° or more
	Less than 7.4°

COMPONENT OPERATING RANGE

Parameter	Standard Value
Throttle valve at closed angle position	Between 7.5° and 21°

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.

1	CHECK OTHER DTC OUTPUT(IN ADDITION P0121)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.

Result:

Display (DTC output)	Proceed to
”P0121” and other DTCs	A
P0121	B

HINT:

If any other codes besides P0121 is output, perform the troubleshooting for those DTCs first.

B → **REPLACE THROTTLE POSITION SENSOR**

A

GO TO RELEVANT DTC CHART (See page 05–35)

DTC	P0125	INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

CIRCUIT DESCRIPTION

Refer to DTC P0115 on page 05–80.

DTC No.	DTC Detection Condition	Trouble Area
P0125	If the engine coolant temperature (ECT) was less than –6.6˚C (20°F) when starting the engine, and 20 minutes after the engine start, the ECT sensor still indicates below 20˚C (68°F)	• Cooling system • Engine coolant temperature sensor • Thermostat
	If the ECT was between –6.6˚C (20°F) and 10˚C (50°F) when start, 5 minutes after the start, the ECT sensor still indicates below 20˚C (68°F)	
	If the ECT was greater than 10˚C (50°F) when starting the engine, and 2 minutes after the engine start, ECT sensor still indicates below 20˚C (68°F)	

MONITOR DESCRIPTION

The engine coolant temperature (ECT) sensor is used to monitor the temperature of the engine coolant. The resistance of the sensor varies with the actual coolant temperature. The ECM applies a voltage to the sensor and the varying resistance of the sensor causes the signal voltage to vary. The ECM monitors the ECT signal voltage after engine start–up. If, after sufficient time has passed, the sensor still reports that the engine is not warm enough for closed–loop fuel control, the ECM interprets this as a fault in the sensor or cooling system.

Example:

The engine coolant temperature was 0°C (32°F) at engine start. After 5 minutes running time, the coolant temperature sensor still indicates that the engine is not warm enough to begin air–fuel ratio feedback control. The ECM interprets this as a fault in the sensor or cooling system and will set a DTC.

MONITOR STRATEGY

Related DTCs	P0125	Insufficient coolant temperature for closed loop fuel control
Required sensors/components	Main sensors	Engine coolant temperature sensor, cooling system, thermostat
	Related sensors	Mass air flow sensor
Frequency of operation	Continuous	
Duration	• 20 minutes • 5 minutes • 2 minutes (Depending on ECT at engine start)	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” table (On page 05–25)	
Intake air amount per second	0.1 g/sec	–
Fuel cut	OFF	

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Time until detected engine coolant temperature (ECT) reaches the closed–loop enabling temperature	(a), (b) or (c)
(a) ECT at engine start is 10°C (50°F) or more	2 minutes or more
(b) ECT at engine start is between –6.7°C (20°F) and 10°C (50°F)	5 minutes or more
(c) ETC at engine start is –6.7°C (20°F) or less	20 minutes or more

WIRING DIAGRAM

Refer to DTC P0115 on page 05–80.

INSPECTION PROCEDURE

HINT:

- If DTCs P0115, P0116, P0117, P0118 and P0125 are output simultaneously, the engine coolant temperature sensor circuit may be open or short. Perform the troubleshooting of DTC P0115, P0117 or P0118 first.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1 CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0125)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.

Result:

Display (DTC output)	Proceed to
P0125	A
P0125 and other DTCs	B

HINT:

If any other codes besides P0125 are output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–35)**

A

2 INSPECT THERMOSTAT (See page 16–3)

NG → **REPLACE THERMOSTAT (See page 16–11)**

OK

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

DTC	P0128	COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

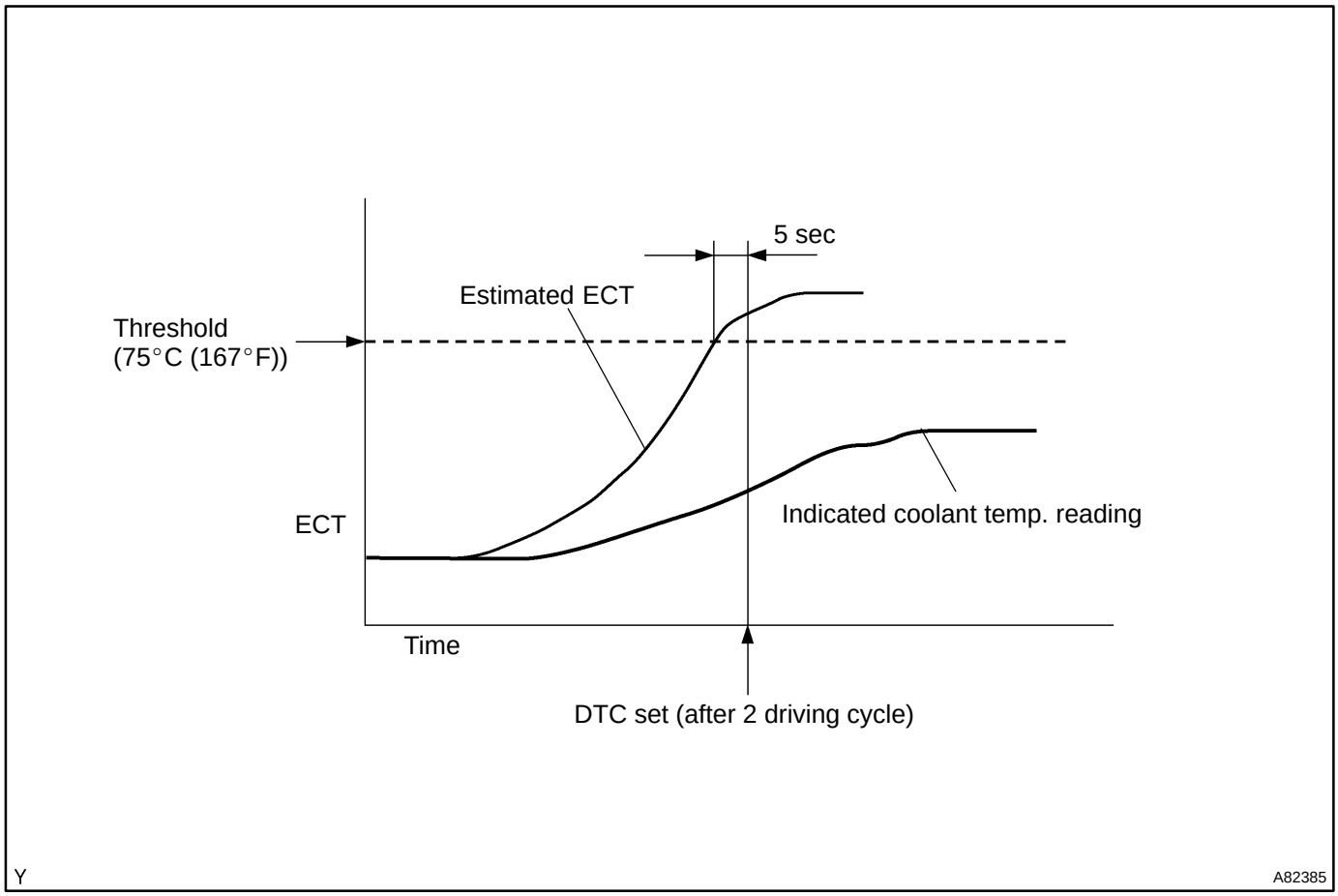
HINT:
This is the purpose of the ”thermostat” malfunction detection.

CIRCUIT DESCRIPTION

If the engine coolant temperature (ECT) does not reach 75˚C (167˚F) despite sufficient warm – up time has elapsed.

DTC No.	DTC Detection Condition	Trouble Area
P0128	Condition (a), (b) and (c): (a) Cold start (b) After engine is warmed up (c) Engine coolant temperature is less than 75˚C (167˚F)	• Thermostat • Cooling system • Engine coolant temperature sensor • ECM

MONITOR DESCRIPTION



The ECM estimates the engine coolant temperature (ECT) based on starting temperature, engine loads, and engine speeds. The ECM then compares the estimated ECT with the actual ECT. When the estimated ECT reaches 75°C (167°F) the ECM checks the actual ECT. If the actual ECT is less than 75°C (167°F), the ECM will interpret this as a fault in the thermostat or engine cooling system or thermostat and set a DTC.

MONITOR STRATEGY

Related DTCs	P0128	Thermostat
Required sensors/components	Main sensors	Engine coolant temperature sensor, engine cooling system, thermostat
	Related sensors	Intake air temperature sensor, vehicle speed sensor
Frequency of operation	Once per drive cycle	
Duration	15 minutes	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
Battery voltage	11.0 V	–
Intake air temperature (at engine start)	–10°C (14°F)	35°C (95°F)
Engine coolant temperature (at engine start)	–10°C (14°F)	35°C (95°F)
Engine coolant temperature – Intake air temperature (at engine start)	–15°C (–27°F)	7°C (12.6°F)

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
(1) Estimated engine coolant temperature	75°C (167°F) or more
(2) Engine coolant temperature sensor output value	Less than 75°C (167°F)
Duration period of both (1) and (2)	5 seconds or more

COMPONENT OPERATING RANGE

Parameter	Standard Value
Engine coolant temperature sensor output value after warm–up	75°C (167°F) or more

MONITOR RESULT (MODE 06 DATA)

Test ID	Comp ID	Description of Test Data	Description of Test Limit	Unit	Conversion Factor
$08	$81	Difference between estimated and actual engine coolant temperatures is calculated by ECM. The value stored when estimated coolant temperature =75°C (167°F)	Malfunction criteria for thermostat	Degree C	Multiply by 0.625 and minus 40

Refer to page 05–27 for the detailed information on Checking Monitor Status.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1	CHECK COOLING SYSTEM

(a) Check that there is a defect in the cooling system which causes overcool, such as abnormal radiator fan operation, modified cooling system and so on.

NG → REPAIR OR REPLACE COOLING SYSTEM

OK

2	INSPECT THERMOSTAT (See page 16–3)

NG → REPLACE THERMOSTAT (See page 16–11)

OK

3	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0128)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.

Result:

Display (DTC output)	Proceed to
P0128	A
P0128 and other DTCs	B

HINT:
If any other codes besides P0128 is output, perform the troubleshooting for those DTCs first.

B → GO TO RELEVANT DTC CHART (See page 05–35)

A

REPLACE ECM (See page 10–11)

DTC	P0130	OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 1 SENSOR 1)

DTC	P2195	OXYGEN SENSOR SIGNAL STUCK LEAN (BANK 1 SENSOR 1)

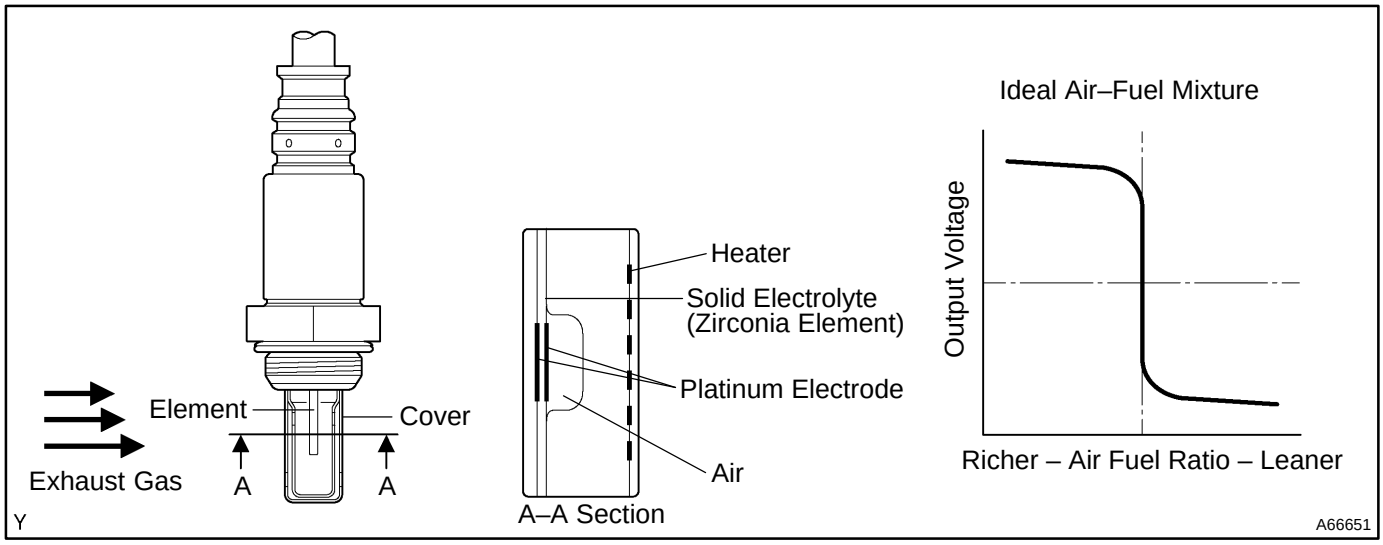
DTC	P2196	OXYGEN SENSOR SIGNAL STUCK RICH (BANK 1 SENSOR 1)

CIRCUIT DESCRIPTION

The rear heated oxygen sensor is used to monitor oxygen concentration in the exhaust gas. For optimum catalytic converter operation, the air fuel mixture must be maintained near the ideal ”stoichiometric” ratio. The heated oxygen sensor output voltage changes suddenly in the vicinity of the stoichiometric ratio. The ECM adjusts the fuel injection time so that the air–fuel ratio is nearly stoichiometric.

When the air–fuel ratio becomes LEAN, the oxygen concentration in the exhaust gas increases. And the heated oxygen sensor informs the ECM of the LEAN condition (low voltage, i.e. less than 0.45 V).

When the air–fuel ratio is RICHER than the stoichiometric air–fuel ratio, the oxygen will be vanished from the exhaust gas. And the heated oxygen sensor informs the ECM of the RICH condition (high voltage, i.e. more than 0.45 V).

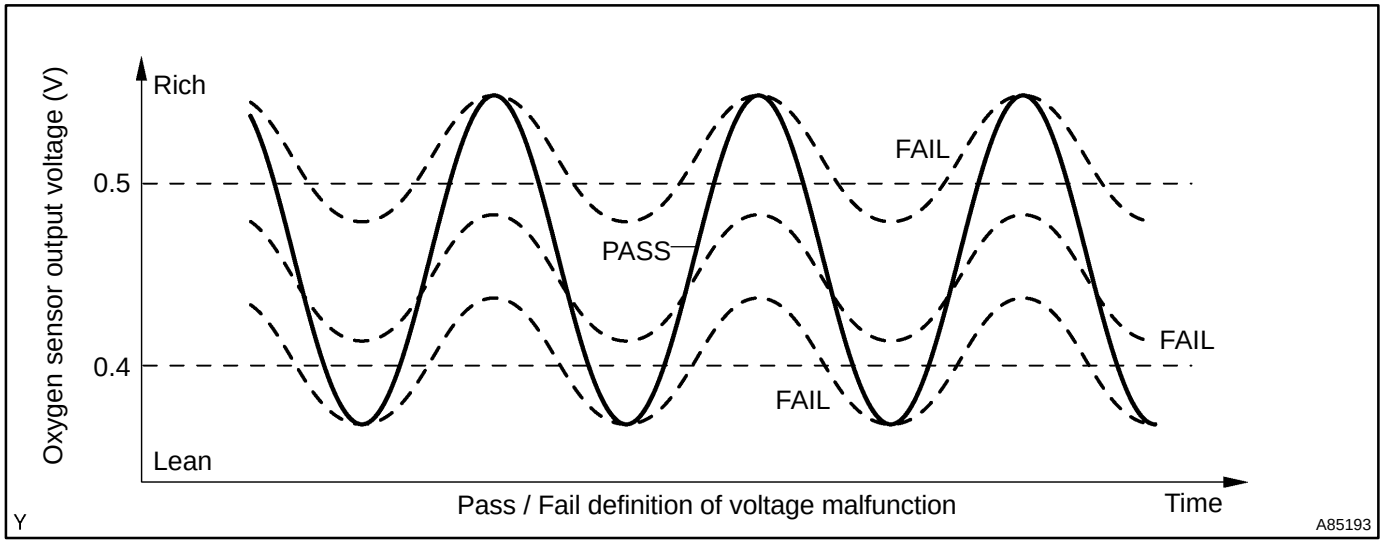


DTC No.	DTC Detection Condition	Trouble Area
P0130	Output voltage of heated oxygen sensor remains at 0.4 V or more, or 0.5 V or less, during idling after engine is warmed up (2 trip detection logic)	• Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Heated oxygen sensor (bank 1 sensor 1) • Heated oxygen sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM
P2195	Output voltage of heated oxygen sensor remains at 0.5 V or less, during idling after engine is warmed up (2 trip detection logic)	
P2196	Output voltage of heated oxygen sensor remains at 0.4 V or more, during idling after engine is warmed up (2 trip detection logic)	

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- The output voltage of the heated oxygen sensor and the short–term fuel trim value can be read using the hand–held tester or the OBD ll scan tool.

MONITOR DESCRIPTION



The engine control module (ECM) uses the heated oxygen sensor information to regulate the air–fuel ratio near to the stoichiometric air–fuel ratio. The sensor detects oxygen levels in the exhaust gases and sends this signal to the ECM. This maximizes the catalytic converter's ability to purify the exhaust gases.
The heated oxygen sensor element consists of the platinum coated zirconia and heating element. The inner surface of sensor element is exposed to the outside air, and the outer surface of sensor element is exposed to the exhaust gases. The sensor generates between 0 V and 1 V of the voltage output in response to the oxygen concentration in the exhaust gases. The sensor's output voltage varies suddenly in the vicinity of the stoichiometric air–fuel ratio.
Under normal condition, the output voltage from the heated oxygen sensor alternates between RICH and LEAN sides periodically. When it is 0.4 V or less, the air–fuel ratio is judged as LEAN.
If the heated oxygen sensor outputs RICH signal (or LEAN signal) constantly, or if the heated oxygen sensor cannot output enough voltage to reach the minimum specification, the ECM interprets this as a malfunction in the heated oxygen sensor and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0130	Front heated oxygen sensor voltage is constant
	P2195	Front heated oxygen sensor voltage is constant at lean side
	P2196	Front heated oxygen sensor voltage is constant at rich side
Required sensors/components	Main sensors	Front heated oxygen senor
	Related sensors	Crank shaft position sensor, vehicle speed sensor
Frequency of operation	Once per drive cycles	
Duration	18 to 36 seconds x 3	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITION

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
There is history of following condition (a) and (b) a met:	20 seconds (Continuously)	–
(a) Vehicle speed	25 mph (40 km/h)	–
(b) Engine speed	900 rpm	–
Time after engine start	120 seconds	–
Idle	ON	
Fuel system status	Closed loop	

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0130:	
Sensor voltage is 0.5 V or less for 18 seconds or more	3 times or more
Sensor voltage is 0.4 V or more for 18 seconds or more	
P2195:	
Front heated oxygen sensor voltage is 0.5 V or less for 18 seconds or more	3 times or more
P2196:	
Front heated oxygen sensor voltage is 0.4 V or more for 18 seconds or more	3 times or more

COMPONENT OPERATING RANGE

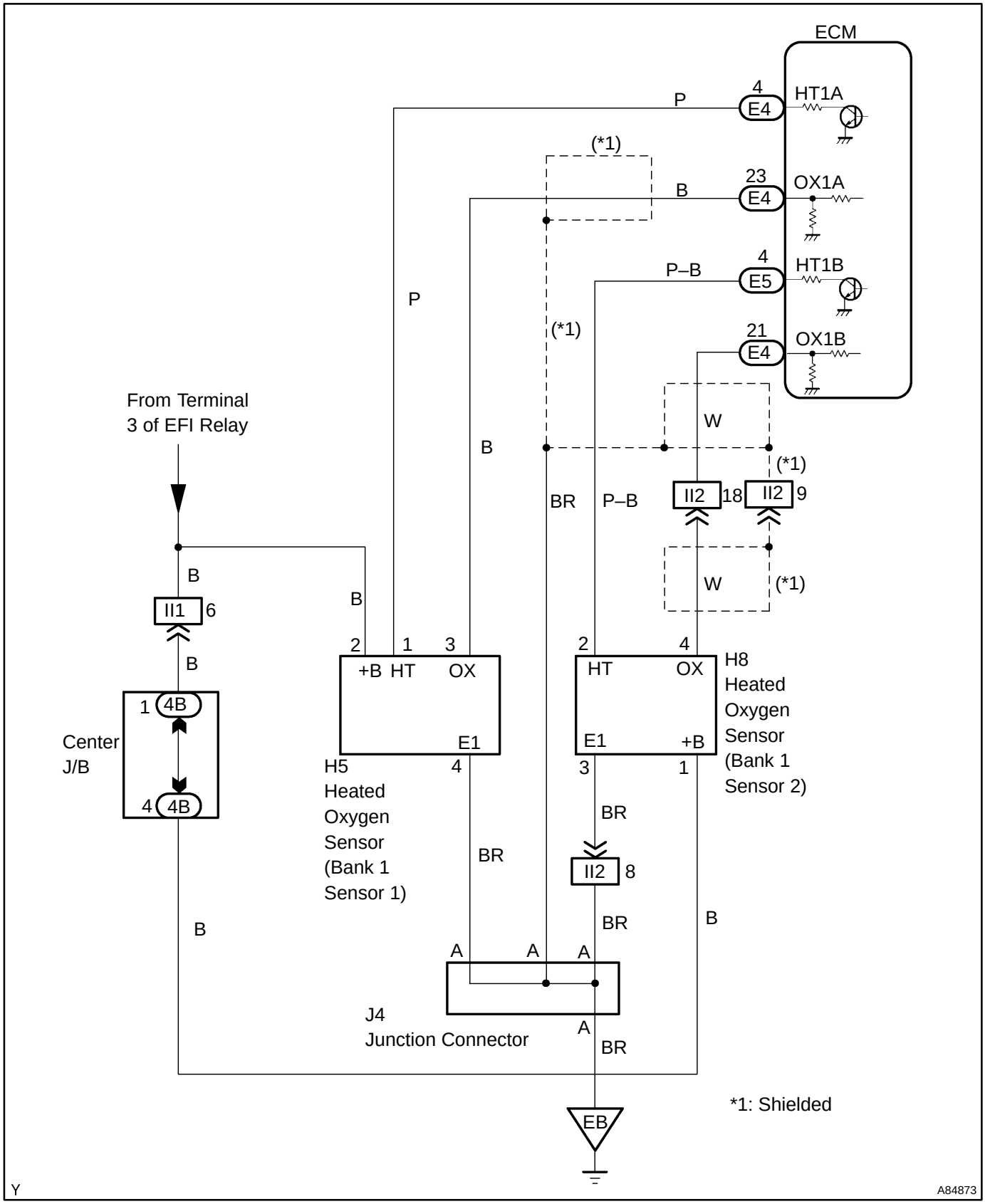
Parameter	Standard Value
In the normal condition, the heated oxygen sensor voltage	0 to 1 V

MONITOR RESULT (MODE 06 DATA)

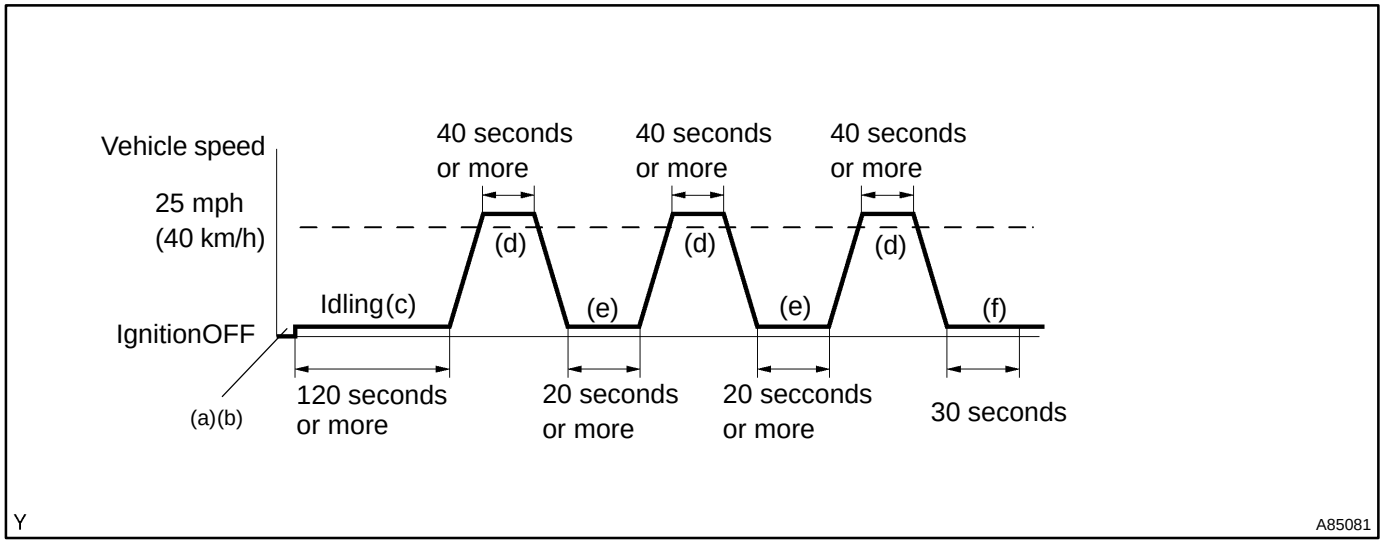
Test ID	Comp ID	Description of test data	Description of test limit	Unit	Conversion factor
$03	–	Not supported by mode $06, but by mode $05	–	–	–

Refer to page 05–27 for detailed information on Checking Monitor Status.

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN



(a) Connect the hand–held tester to the DLC3.
(b) Switch the hand–held tester from the ”normal mode” to the ”check mode” (See page 05–11).
(c) Start the engine and let the engine idle for 120 seconds or more.
(d) Drive the vehicle at 25 mph (40 km/h) or more for 40 seconds or more.
(e) Let the engine idle for 20 seconds or more. Perform steps (d) and (e) at least 3 times.
(f) Let the engine idle for 30 seconds.

HINT:
If a malfunction exists, the MIL will be illuminated on the multi information display during step (f).

NOTICE:
If the conditions in this test are not strictly followed, detection of a malfunction will not occur.
If you do not have the hand–held tester, turn the ignition switch OFF after performing steps from (c) to (f), then perform steps from (c) to (f) again.

INSPECTION PROCEDURE

HINT:
Hand–held tester only:
Narrowing down the trouble area is possible by performing ”A/F CONTROL” ACTIVE TEST (heated oxygen sensor or other trouble areas can be distinguished).

(a) Perform ACTIVE TEST using hand–held tester (A/F CONTROL).

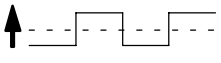
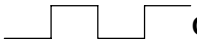
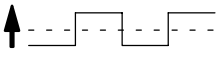
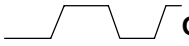
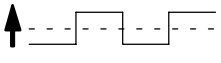
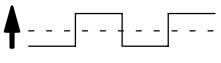
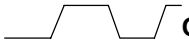
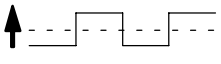
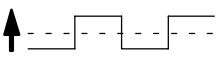
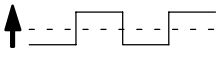
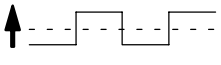
HINT:
”A/F CONTROL” is the ACTIVE TEST which changes the injection volume to –12.5 % or +25 %.

(1) Connect the hand–held tester to the DLC3 on the vehicle.
(2) Turn the ignition switch ON.
(3) Warm up the engine by running the engine speed at 2,500 rpm for approximately 90 seconds.
(4) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL”.
(5) Perform ”A/F CONTROL” with the engine in an idle condition (press the right or left button).

Result:

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume
+25 % → rich output: More than 0.5 V,
–12.5 % → lean output: Less than 0.4 V

NOTICE:
There is a delay of few seconds in the sensor 1 (front sensor) output, and there is about 20 seconds delay at maximum in the sensor 2 (rear sensor).

	Output voltage of heated oxygen sensor (sensor 1: front sensor)	Output voltage of heated oxygen sensor (sensor 2: rear sensor)	Mainly suspect trouble area
Case 1	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4 V  **OK**	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4 V  **OK**	—
Case 2	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4 V  **OK**	Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4 V  **OK**	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Sensor 2: rear sensor (sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following of A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the heated oxygen sensors.
For displaying the graph indication, enter ”ACTIVE TEST / A/F CONTROL / USER DATA”, then select ”O2S B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.
NOTICE:
If the vehicle is short of fuel, the air–fuel ratio becomes LEAN and heated oxygen sensor DTCs will be recorded, and the MIL then comes on.
HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.
- A high heated oxygen sensor (sensor 1) voltage (0.5 V or more) could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

1	CHECK OTHER DTC OUTPUT(IN ADDITION TO HEATED OXYGEN SENSOR DTCS)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.
Result:

Display (DTC output)	Proceed to
”P0130, P2195 and/or P2196”	A
”P0130, P2195 and/or P2196” and other DTCs	B

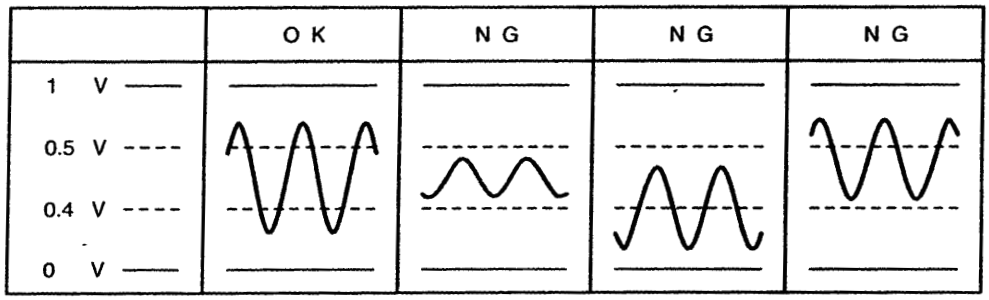
HINT:
If any other codes besides P0130, P2195 and/or P2196 are output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–35)**

A

2	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Start the engine and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / O2S B1S1”.
(d) Warm up the heated oxygen sensor with the engine speed at 2,500 rpm for approximately 90 seconds.
(e) Read the output voltage of the heated oxygen sensor during idling.
Heated oxygen sensor output voltage:
Alternates repeatedly between less than 0.4 V and more than 0.5 V (See the following table).

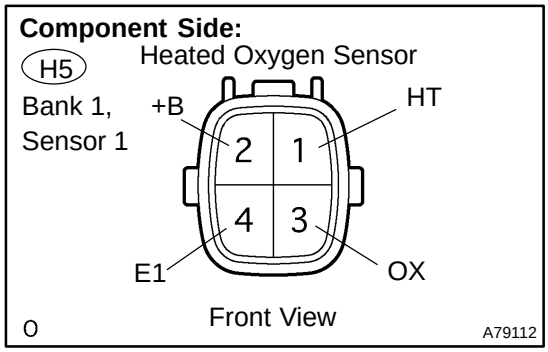


A85076

OK → **Go to step 9**

NG

3 INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)



(a) Disconnect the H5 heated oxygen sensor connector.

(b) Measure the resistance between the terminals of the heated oxygen sensor connector.

Standard:

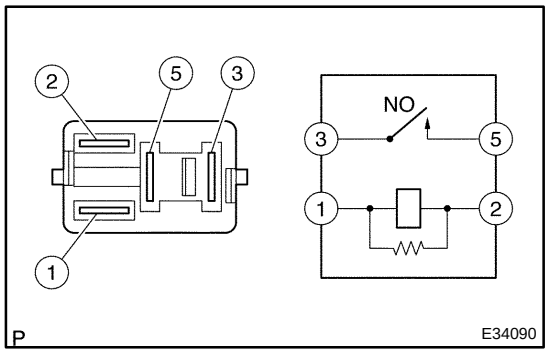
Tester Connection	Specified Condition
HT (H5–1) – +B (H5–2)	5 to 10 Ω at 20 °C (68 °F)
HT (H5–1) – E1 (H5–4)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

4 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B.

(b) Check for continuity in the EFI relay.

Standard:

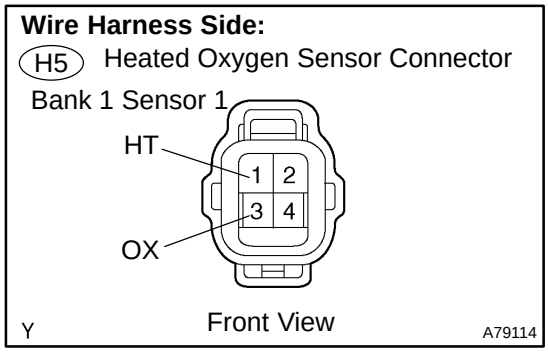
Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No continuity
	Continuity (Apply battery voltage to terminals 1 and 2)

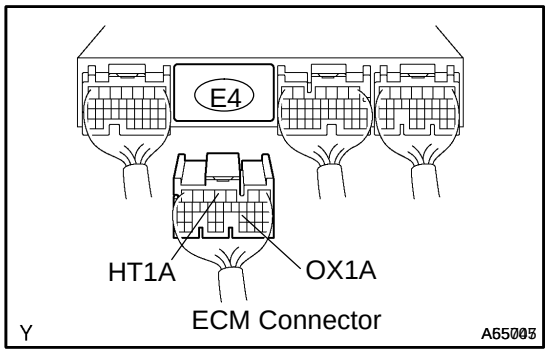
(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

5 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)





(a) Disconnect the H5 heated oxygen sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

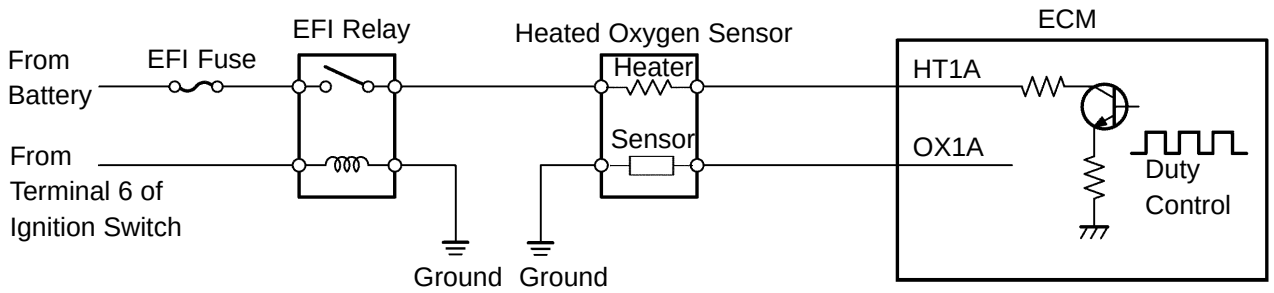
Tester Connection	Specified Condition
HT (H5–1) – HT1A (E4–4)	Below 1 Ω
OX (H5–3) – OX1A (E4–23)	

Standard (Check for short):

Tester Connection	Specified Condition
HT (H5–1) or HT1A (E4–4) – Body ground	10 kΩ or higher
OX (H5–3) or OX1A (E4–23) – Body ground	

(d) Reconnect the ECM connector.
(e) Reconnect the heated oxygen sensor connector.

Reference (Bank 1 Sensor 1 System Drawing)



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK →

6	CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leaks.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7	CHECK FUEL PRESSURE (See page 11–5)

(a) Check the fuel pressure (high or low pressure).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8	INSPECT FUEL INJECTOR ASSY(INJECTION AND VOLUME) (See page 11–7)

NG → REPLACE FUEL INJECTOR ASSY

OK

REPLACE HEATED OXYGEN SENSOR

9	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

GO

10	READ OUTPUT DTC(HEATED OXYGEN SENSOR DTCS ARE OUTPUT AGAIN)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Read the DTC using the hand–held tester or the OBD II scan tool.
Result:

Display (DTC output)	Proceed to
”P0130, P2195 and/or P2196”	A
”P0130, P2195 and/or P2196” are not output	B

B → CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

A

REPLACE HEATED OXYGEN SENSOR

DTC	P0133	OXYGEN SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

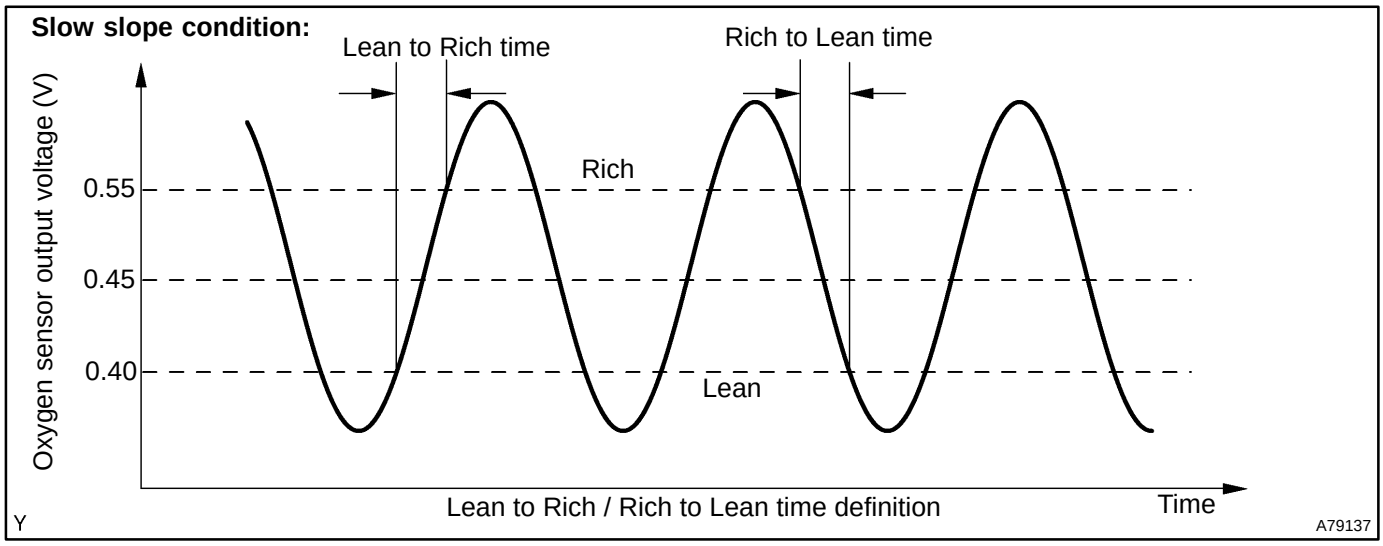
CIRCUIT DESCRIPTION

Refer to DTC P0130 on page 05–101.

DTC No.	DTC Detection Condition	Trouble Area
P0133	After engine has been warmed up, if response time that heated oxygen sensor's output voltage reaches from RICH to LEAN. or from LEAN to RICH, is 0.6 second or more during idling. (2 trip detection logic)	• Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Heated oxygen sensor (bank 1 sensor 1) • Heated oxygen sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM •
	If response time of heated oxygen sensor's output voltage in one RICH–LEAN cycle is 6 seconds or more during idling. (2 trip detection logic)	

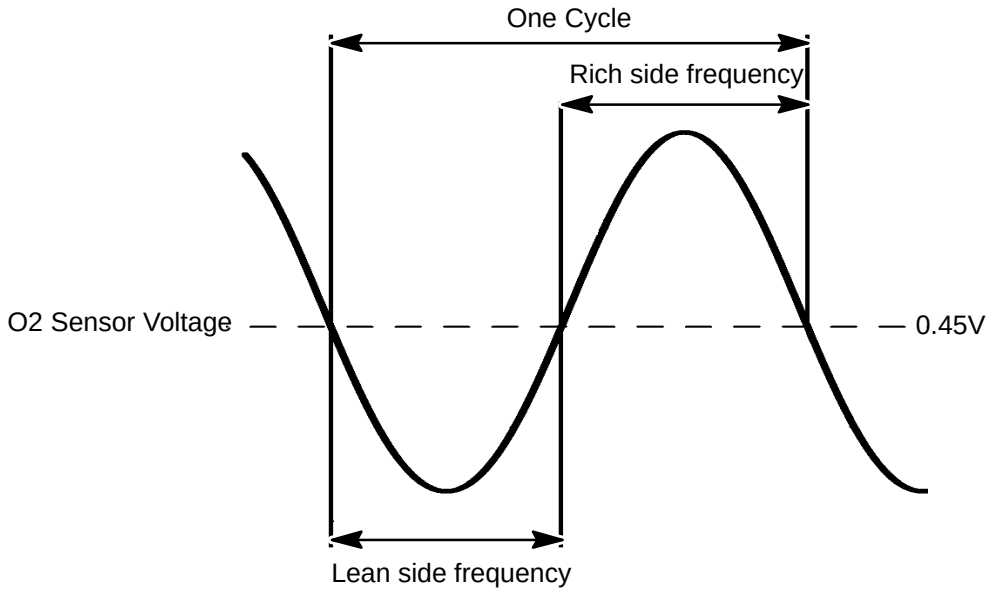
HINT:
Sensor 1 refers to the sensor closest to the engine assembly.

MONITOR DESCRIPTION



The engine control module (ECM) uses the heated oxygen sensor information to regulate the air–fuel ratio close to a stoichiometric ratio. This maximizes the catalytic converter's ability to purify the exhaust gases. The sensor detects oxygen levels in the exhaust gas and sends this signal to the ECM.
The inner surface of the sensor element is exposed to the outside air. The outer surface of the sensor element is exposed to the exhaust gas. The sensor element is made of the platinum coated zirconia and includes an integrated heating element. The heated oxygen sensor has the characteristic whereby its output voltage change suddenly in the vicinity of the stoichiometric air–fuel ratio. The heated oxygen sensor generates waveform of a voltage between 0 V and 1 V in response to the oxygen concentration in exhaust gas. When the output voltage of the heated oxygen sensor is 0.55 V or more, the ECM judges that the air–fuel ratio is RICH. When it is 0.40 V or less, the ECM judges that the air–fuel ratio is LEAN.
The ECM monitors the response feature of the heated oxygen sensor. If the response time of the sensor output status change from RICH to LEAN or vice versa becomes longer, the ECM interprets this as a malfunction in the heated oxygen sensor and sets a DTC.

Frequency condition:



MONITOR STRATEGY

Related DTCs	P0133	Front heated oxygen sensor response monitor
Required sensors/components	Main sensors	Front heated oxygen sensor
	Related sensors	Crank shaft position sensor, vehicle speed sensor, mass air flow sensor
Frequency of operation	Once per drive cycles	
Duration	Within 60 seconds	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITION

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
Frequency idle condition:		
There is a history that the following condition (a) and (b) were met for 20seconds		
(a) Vehicle speed	25 mph (40 km/h)	–
(b) Engine speed	900 rpm	–
Time after engine start	120 seconds	–
Idle	ON	
Vehicle speed	–	3 mph (5 km/h)
Fuel system status	Closed loop	
Engine coolant temperature	40°C (104°F)	–
Frequency cruise condition:		
There is a history that the following condition (a) and (b) were met for 20seconds		
(a) Vehicle speed	25 mph (40 km/h)	–
(b) Engine speed	900 rpm	–
Intake air amount	5 g/s	14.5 g/s
Time after engine start	120 sec	–
Idle	OFF	
Fuel system status	Closed loop	

Engine speed	1,000 rpm	3,500 rpm
Engine coolant temperature	70°C (104°F)	–
Slow slope condition:		
There is a history that the following condition (a) and (b) were met for 20seconds		
(a) Vehicle speed	25 mph (40 km/h)	–
(b) Engine speed	900 rpm	–
Time after engine start	120 seconds	–
Idle	ON	
Vehicle speed	–	3 mph (5 km/h)
Fuel system status	Closed loop	
Engine coolant temperature	40°C (104°F)	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Frequency idle condition	
Time required by the voltage output to change in one cycle	w/ AT: 6 sec or more w/ MT: 5.5 sec or more
Frequency cruise condition	
Time required by the voltage output to change in one cycle	a specific time or more
Slow slope condition	
Time that output voltage of front heated oxygen sensor increase from 0.4V to 0.55V and drops from 0.55V to 0.4V	0.6 seconds or more

COMPONENT OPERATING RANGE

Parameter	Standard Value
Voltage output of the front heated oxygen sensor fluctuates between 0.40 V and 0.5 V in an instant.	

WIRING DIAGRAM

Refer to DTC P0130 on page 05–101.

INSPECTION PROCEDURE

HINT:

Hand–held tester only:

Narrowing down the trouble area is possible by performing ”A/F CONTROL” ACTIVE TEST (heated oxygen sensor or other trouble areas can be distinguished). Perform ACTIVE TEST using hand–held tester (A/F CONTROL).

(a) Perform ACTIVE TEST using the hand–held tester (A/F CONTROL).

HINT:

”A/F CONTROL” is the ACTIVE TEST which changes the injection volume to –12.5 % or +25 %.

(1) Connect the hand–held tester to the DLC3 on the vehicle.
(2) Turn the ignition switch ON.
(3) Warm up the engine by running the engine speed at 2,500 rpm for approximately 90 seconds.
(4) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL”.
(5) Perform ”A/F CONTROL” with the engine in an idle condition (press the right or left button).

Result:

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume
+25 % → rich output: More than 0.5 V,
–12.5 % → lean output: Less than 0.4 V

NOTICE:

There is a delay of few seconds in the sensor 1 (front sensor) output, and there is about 20 seconds delay at maximum in the sensor 2 (rear sensor)

	Output voltage of heated oxygen sensor (sensor 1: front sensor)	Output voltage of heated oxygen sensor (sensor 2: rear sensor)	Mainly suspect trouble area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	—
Case 2	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Sensor 2: rear sensor (sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following of A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the heated oxygen sensors.
For displaying the graph indication, enter ”ACTIVE TEST / A/F CONTROL / USER DATA”, then select ”O2S B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.

NOTICE:

If the vehicle is short of fuel, the air–fuel ratio becomes LEAN and DTC P0133 will be recorded, and the MIL then comes on.

HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.
- A high heated oxygen sensor (sensor 1) voltage (0.5 V or more) could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

1	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0133)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Read the DTCs using the hand–held tester or the OBD II scan tool.
Result:

Display (DTC output)	Proceed to
P0133	A
P0133 and other DTCs	B

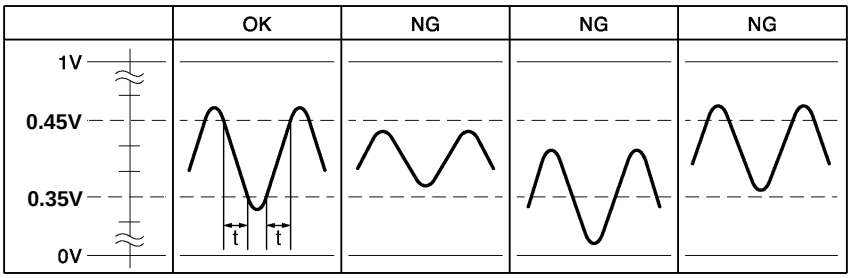
HINT:
If any other codes besides P0133 are output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–35)**

A

2	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(HEATED OXYGEN SENSOR DURING IDLING)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Start the engine and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / O2S B1S1”.
(d) Warm up the heated oxygen sensor with the engine speed at 2,500 rpm for approximately 90 seconds.
(e) Read the output voltage of the heated oxygen sensor during idling.
Heated oxygen sensor output voltage:
Alternates between less than 0.35 V and more than 0.45 V, and period of ”t” must exist less than 0.6 sec. (See the following table).

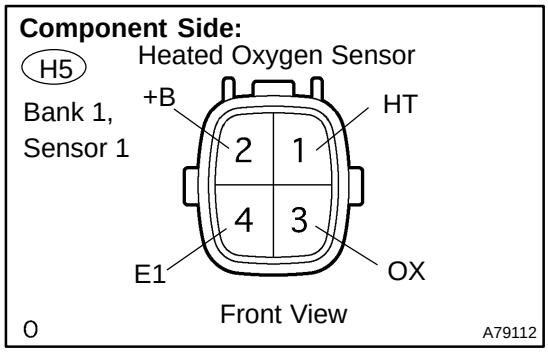


N A85082

OK → **Go to step 9**

NG

3	INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)



(a) Disconnect the H5 heated oxygen sensor connector.
(b) Measure the resistance between the terminals of the heated oxygen sensor connector.
Standard:

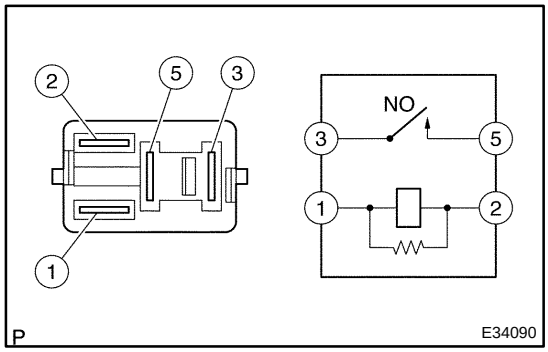
Tester Connection	Specified Condition
HT (H5–1) – +B (H5–2)	5 to 10 Ω at 20 °C (68 °F)
HT (H5–1) – E1 (H5–4)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

4	INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B.

(b) Check for continuity in the EFI relay.

Standard:

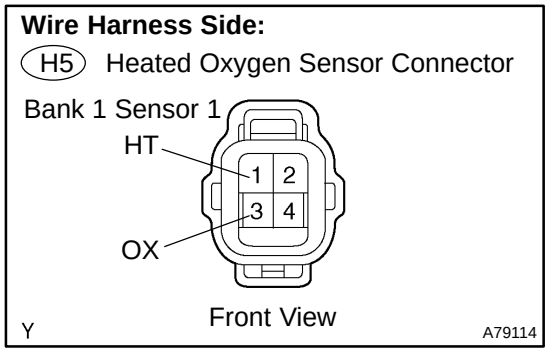
Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No continuity
	Continuity (Apply battery voltage to terminals 1 and 2)

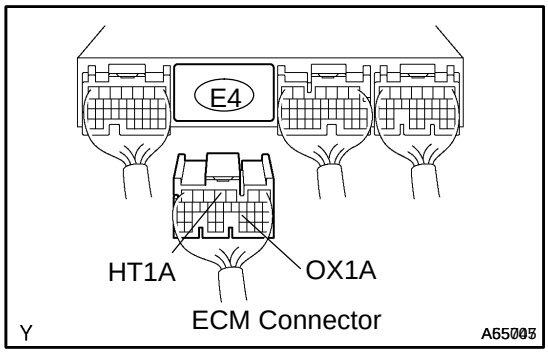
(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

5 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)





(a) Disconnect the H5 heated oxygen sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

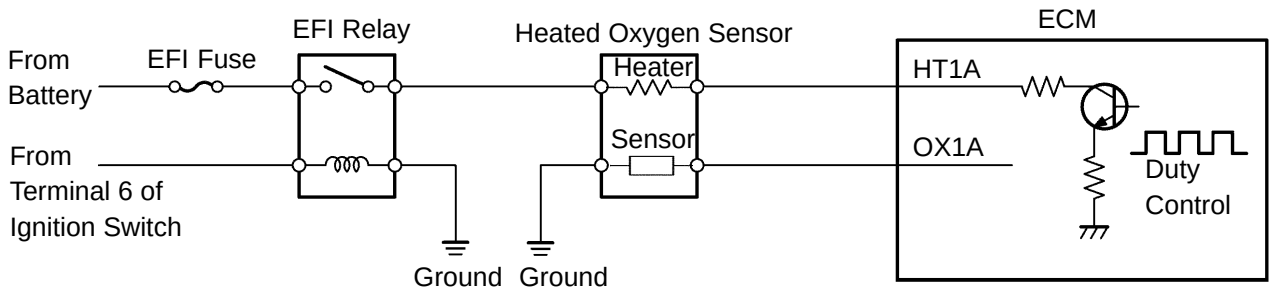
Tester Connection	Specified Condition
HT (H5–1) – HT1A (E4–4)	Below 1 Ω
OX (H5–3) – OX1A (E4–23)	

Standard (Check for short):

Tester Connection	Specified Condition
HT (H5–1) or HT1A (E4–4) – Body ground	10 kΩ or higher
OX (H5–3) or OX1A (E4–23) – Body ground	

(d) Reconnect the ECM connector.
(e) Reconnect the heated oxygen sensor connector.

Reference (Bank 1 Sensor 1 System Drawing):



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK →

6	CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leaks.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7	CHECK FUEL PRESSURE (See page 11–5)

(a) Check the fuel pressure (high or low pressure).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8	INSPECT FUEL INJECTOR ASSY(INJECTION AND VOLUME) (See page 11–7)

NG → REPLACE FUEL INJECTOR ASSY

OK

REPLACE HEATED OXYGEN SENSOR

9	PERFORM CONFIRMATION DRIVING PATTERN (See page 05–101)

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

GO

10	READ OUTPUT DTC(DTC P0133 IS OUTPUT AGAIN)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Read the DTCs using the hand–held tester or the OBD II scan tool.
Result:

Display (DTC output)	Proceed to
P0133	A
No output	B

B → CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

A

REPLACE HEATED OXYGEN SENSOR

DTC	P0134	OXYGEN SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

CIRCUIT DESCRIPTION

Refer to DTC P0130 on page 05–101.

DTC No.	DTC Detecting Condition	Trouble Area
P0134	After engine is warmed up, heated oxygen sensor (bank 1 sensor 1) output does not indicate RICH (greater than 0.45 V) even once when conditions (a), (b), (c), (d) and (e) continue for more than 65 seconds (1 trip detection logic) : (a) Engine speed: 1,400 rpm or more (b) Vehicle speed: 24.8 mph (40 km/h) or more (c) Throttle valve is not fully closed (d) 180 seconds or more after starting engine (e) Engine coolant temperature is more than 40 °C (104 °F)	• Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Heated oxygen sensor (bank 1 sensor 1) • Heated oxygen sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • PCV hose connection • PCV valve and hose • Injector • Gas leakage in exhaust system • PCV piping • ECM

HINT:
After confirming DTC P0134, check the output voltage of the heated oxygen sensor (bank 1 sensor 1) in the ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL” using the hand−held tester or the OBD II scan tool. If the output voltage of the heated oxygen sensor is always less than 0.1 V, the sensor circuit may be open or short.

MONITOR DESCRIPTION

The ECM uses the heated oxygen sensor to optimize the air–fuel mixture in the closed–loop fuel control. This control helps decrease exhaust emissions by providing the catalyst with a nearly stoichiometric mixture. The sensor detects the oxygen level in the exhaust gas and the ECM uses this data to control the air–fuel ratio. The sensor output voltage ranges from 0 V to 1 V. If the signal voltage is less than 0.4 V, the air–fuel ratio is LEAN. If the signal voltage is more than 0.5 V, the air–fuel ratio is RICH. If the sensor does not indicate RICH even once despite the conditions for the closed–loop fuel control being met and a specified time period has passed, the ECM will conclude that the closed–loop fuel control is malfunctioning. The ECM will illuminate the MIL and a DTC is set.

MONITOR STRATEGY

Related DTCs	P0134	Excessive time to enter closed loop
Required sensors/components	Main sensors	Front heated oxygen sensor
	Related sensors	Crank shaft position sensor, engine coolant temperature sensor, vehicle speed sensor
Frequency of operation	Once per drive cycles	
Duration	65 seconds	
MIL operation	1 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITION

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
Time after following conditions are met:	50 seconds	–
Engine coolant temperature	40°C	–
Engine speed	1,400 rpm	–
Vehicle speed	25 mph (40 km/h)	–
Idle	OFF	
Time after engine start	180 seconds	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Front heated oxygen sensor voltage	less than 0.45 V

COMPONENT OPERATING RANGE

Parameter	Standard Value
In the normal condition, the font heated oxygen sensor voltage	0 to 1 V

WIRING DIAGRAM

Refer to DTC P0130 on page 05–101.

INSPECTION PROCEDURE

HINT:

Hand–held tester only:

Narrowing down the trouble area is possible by performing "A/F CONTROL" ACTIVE TEST (heated oxygen sensor or other trouble areas can be distinguished).

(a) Perform ACTIVE TEST using hand–held tester (A/F CONTROL).

HINT:

"A/F CONTROL" is the ACTIVE TEST which changes the injection volume to –12.5 % or +25 %.

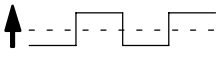
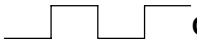
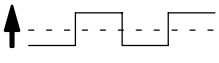
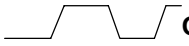
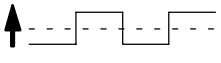
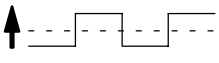
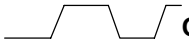
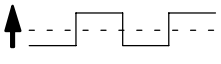
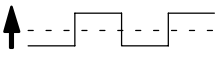
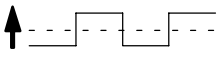
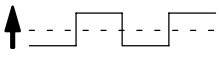
(1) Connect the hand–held tester to the DLC3 on the vehicle.
(2) Turn the ignition switch ON.
(3) Warm up the engine by running the engine speed at 2,500 rpm for approximately 90 seconds.
(4) Select the item "DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL".
(5) Perform "A/F CONTROL" with the engine in an idle condition (press the right or left button).

Result:

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume
+25 % → rich output: More than 0.5 V,
–12.5 % → lean output: Less than 0.4 V

NOTICE:

There is a delay of few seconds in the sensor 1 (front sensor) output, and there is about 20 seconds delay at maximum in the sensor 2 (rear sensor).

	Output voltage of heated oxygen sensor (sensor 1: front sensor)	Output voltage of heated oxygen sensor (sensor 2: rear sensor)	Mainly suspect trouble area
Case 1	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  **OK**	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  **OK**	—
Case 2	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  **OK**	Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  **OK**	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Sensor 2: rear sensor (sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following of A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the heated oxygen sensors.

For displaying the graph indication, enter ”ACTIVE TEST / A/F CONTROL / USER DATA”, then select ”O2S B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.

HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.
- A high heated oxygen sensor (sensor 1) voltage (0.5 V or more) could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

1	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0134)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.

Result:

Display (DTC output)	Proceed to
P0134	A
P0134 and other DTCs	B

HINT:
If any other codes besides P0134 are output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–35)**

A

2	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / O2S B1S1”.
(d) Warm up the engine to the normal operating temperature above 75°C (169°F).
(e) Read the output voltage of the heated oxygen sensor when the engine speed is suddenly increased.

HINT:
Quickly accelerate the engine to 4,000 rpm 3 times by using the accelerator pedal.

Standard:

Heated oxygen sensor outputs a RICH signal (0.45 V or more) at least once.

OK → **Go to step 12**

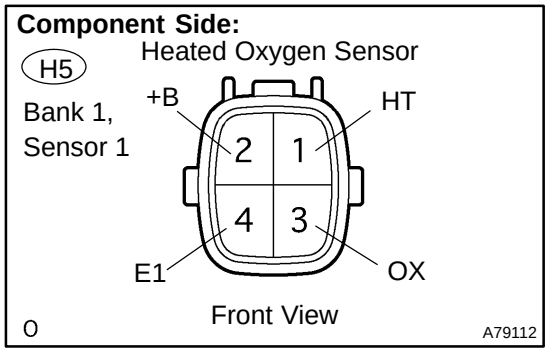
NG

3	CHECK CONNECTION OF PCV HOSE

NG → **REPAIR OR REPLACE PCV HOSE**

OK

4 INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)



(a) Disconnect the H5 heated oxygen sensor connector.
(b) Measure the resistance between the terminals of the heated oxygen sensor connector.
Standard:

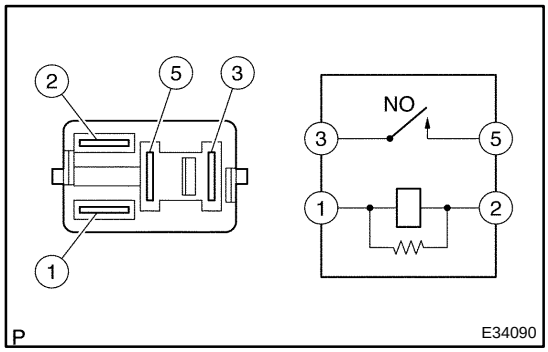
Tester Connection	Specified Condition
HT (H5–1) – +B (H5–2)	5 to 10 Ω at 20 °C (68 °F)
HT (H5–1) – E1 (H5–4)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

5 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B.
(b) Check for continuity in the EFI relay.
Standard:

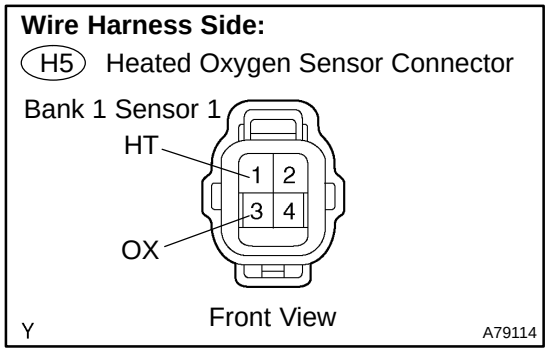
Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No continuity
	Continuity (Apply battery voltage to terminals 1 and 2)

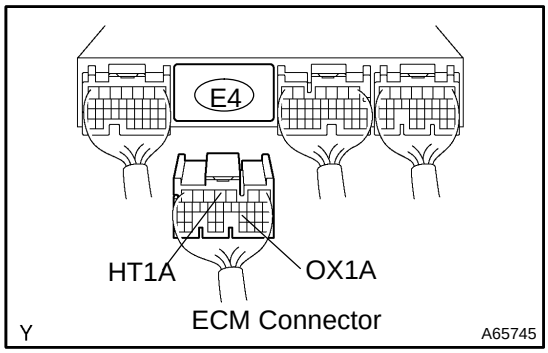
(c) Install the EFI relay.

NG → **REPLACE EFI RELAY**

OK

6	CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)





(a) Disconnect the H5 heated oxygen sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

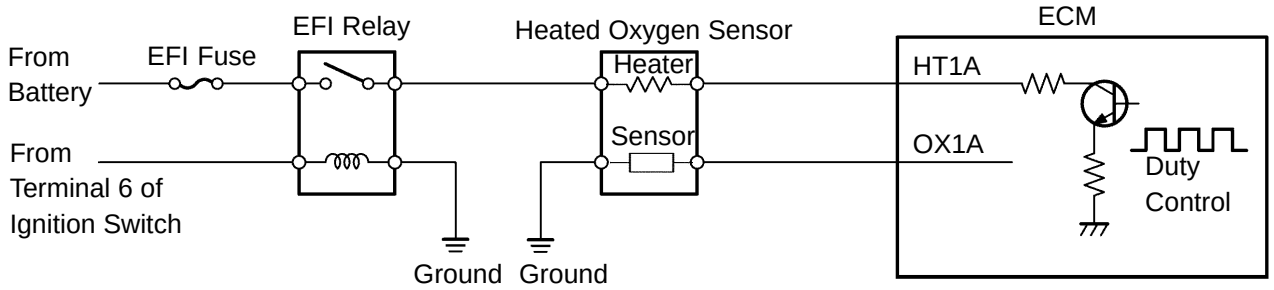
Tester Connection	Specified Condition
HT (H5–1) – HT1A (E4–4)	Below 1 Ω
OX (H5–3) – OX1A (E4–23)	

Standard (Check for short):

Tester Connection	Specified Condition
HT (H5–1) or HT1A (E4–4) – Body ground	10 kΩ or higher
OX (H5–3) or– OX1A (E4–23) – Body ground	

(d) Reconnect the ECM connector.
(e) Reconnect the heated oxygen sensor connector.

Reference (Bank 1 Sensor 1 System Drawing):



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

7	CHECK WHETHER MISFIRE IS OCCURRED OR NOT BY MONITORING DTC AND DATA LIST

NG → **PERFORM TROUBLESHOOTING FOR MISFIRE (See page 05–149)**

OK

8	CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leaks.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

9	CHECK FUEL PRESSURE (See page 11–5)

(a) Check the fuel pressure (high or low pressure).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

10	INSPECT FUEL INJECTOR ASSY(INJECTION AND VOLUME) (See page 11–7)

NG → REPLACE FUEL INJECTOR ASSY

OK

11	CHECK FOR EXHAUST GAS LEAKS

NG → REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

OK

REPLACE HEATED OXYGEN SENSOR

12	PERFORM CONFIRMATION DRIVING PATTERN (See page 05–101)

HINT:
Clear all DTCs prior to performing the confirmation pattern.

GO

13	READ OUTPUT DTC(DTC P0134 IS OUTPUT AGAIN)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.
Result:

Display (DTC output)	Proceed to
No output	A
P0134	B

B → REPLACE ECM (See page 10–11)

A

14	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

YES

DTC IS CAUSED BY RUNNING OUT OF FUEL

DTC	P0136	OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 1 SENSOR 2)

CIRCUIT DESCRIPTION

Refer to DTC P0130 on page 05–101.

DTC No	DTC Detection Condition	Trouble Area
P0136	The following condition (a) or (b) continues for 300 seconds or more: (a) During driving with the engine warmed up, heated oxygen sensor output does not change. (b) Heated oxygen sensor output is very low most of the time.	• Open or short in heated oxygen sensor (bank 1 sensor 2) circuit • Heated oxygen sensor (bank 1 sensor 2) • Heated oxygen sensor heater (bank 1 sensor 2) • EFI relay

HINT:
Sensor 2 refers to the sensor farthest away from the engine assembly.

MONITOR DESCRIPTION

The heated oxygen sensor generates waveform of a voltage between 0 V and 1 V in response to the oxygen concentration in the exhaust gases. When the output voltage of the heated oxygen sensor is 0.5 V or more, the ECM judges that the air–fuel ratio is RICH. When it is 0.40 V or less, the ECM judges that the air–fuel ratio is LEAN.
If the rear heated oxygen sensor output dose not change between RICH and LEAN during ”Stop and GO” driving, the ECM interprets this as a malfunction in the rear heated oxygen sensor and sets a DTC. Also, if the sensor output remains at less than 0.05 V for more than 156 seconds when ECM monitored the heated oxygen sensor for 260 seconds while the air fuel feedback is being performed (the detecting condition differs depending on the type of vehicles), the ECM will interpret this as a fault. In either case, the ECM will turn on the MIL and set a DTC.

MONITOR STRATEGY

Related DTCs	P0136	Heated oxygen sensor output voltage (bank 1)
Required sensors/components	Main sensors	Rear heated oxygen sensor
	Related sensors	Mass air flow sensor, vehicle speed sensor
Frequency of operation	Once per drive cycles	
Duration	300 seconds	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
Case 1:		
Vehicle speed	2 mph (3 km/h)	–
Idle	OFF	
Fuel cut	OFF	
Time after fuel cut ON to OFF	5 seconds	–
Intake air amount per revolution	0.3 g/rev (AT) 0.22 g/rev (MT)	–
Case 2 (Output voltage):		
Time while the following conditions A and B are met	290 seconds (Engine coolant temperature is less than 75°C (167°F)) 240 seconds (Engine coolant temperature is 75°C (167°F) or more)	–
A. Fuel system status	Closed–loop	
B. Idle	OFF	
Deceleration count (The number of times accelerating and decelerating)	30 times	–
Deceleration is counted up when vehicle decelerates	3 mph (5 km/h) / 2 seconds	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Case 1:	
Following conditions are met:	1, 2 and 3
1. Cumulative heated oxygen sensor monitor time	260 seconds or more (AT) 190 seconds or more (MT)
2. Time while heated oxygen sensor voltage is less than 0.05V	156 seconds or more (AT) 114 seconds or more (MT)
3. Maximum heated oxygen sensor rich time (0.45V or more)	Less than 20 seconds
Case 2:	
Number of heated oxygen sensor voltage "switching"	0 times or less
"Switching" is counted when the sensor signal crosses the minimum or maximum voltage	
Minimum voltage	0.4 V or less
Maximum voltage	0.5 V or more

COMPONENT OPERATING RANGE

Parameter	Standard Value
Heated oxygen sensor voltage	0 to 1 V

MONITOR RESULT (MODE 06 DATA)

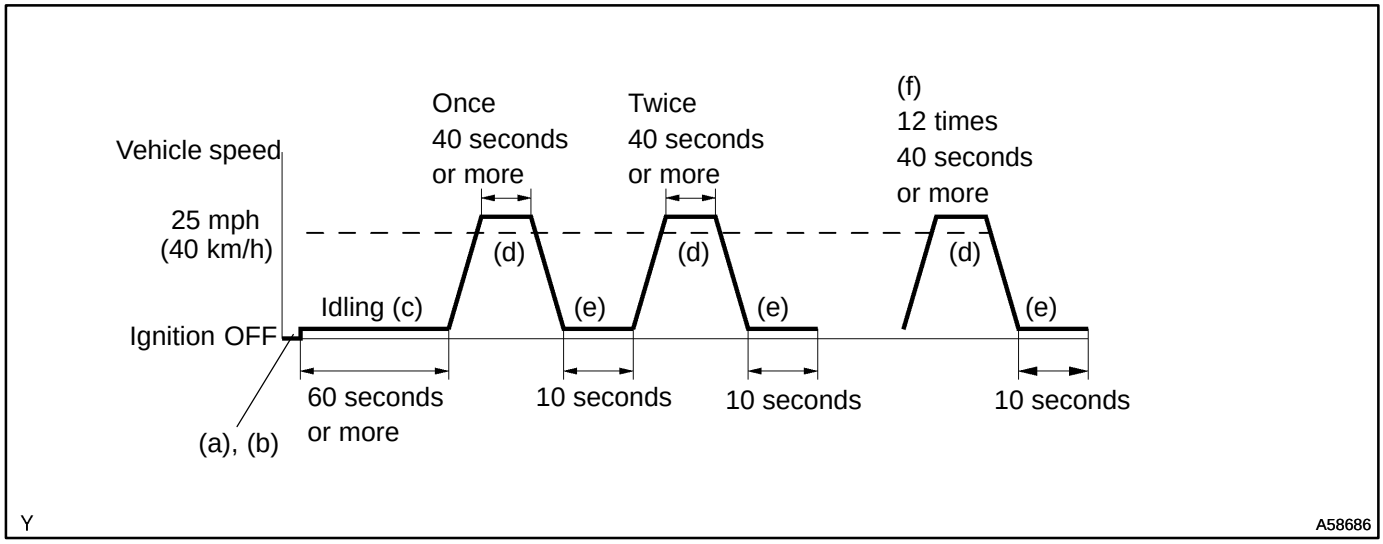
Test ID	Comp ID	Description of test data	Description of test limit	Unit	Conversion factor
$03	–	Not supported by mode $06, but by mode $05	–	–	–

Refer to page 05–27 for detailed information on Checking Monitor Status.

WIRING DIAGRAM

Refer to DTC P0130 on page 05–101.

CONFIRMATION DRIVING PATTERN



(a) Connect the hand–held tester to the DLC3.
(b) Switch the hand–held tester from the normal mode to the check mode (See page 05–11).
(c) Start the engine and let it idle for 60 seconds or more.
(d) Drive the vehicle at 25 mph (40 km/h) or more for 40 seconds or more.
(e) Let the engine idle for 10 seconds or more.
(f) Perform steps (d) and (e) 12 times.

HINT:

If a malfunction exists, the MIL will be illuminated on the multi information display during step (f).

NOTICE:

If the conditions in this test are not strictly followed, a malfunction detection will not occur. If you do not have a hand–held tester, turn the ignition switch OFF after performing steps from (c) to (f), then perform steps from (c) to (f) again.

INSPECTION PROCEDURE

HINT:

Hand–held tester only:

Narrowing down the trouble area is possible by performing ”A/F CONTROL” ACTIVE TEST (heated oxygen sensor or other trouble areas can be distinguished).

(a) Perform ACTIVE TEST using hand–held tester (A/F CONTROL).

HINT:

”A/F CONTROL” is the ACTIVE TEST which changes the injection volume to –12.5 % or +25 %.

(1) Connect the hand–held tester to the DLC3 on the vehicle.
(2) Turn the ignition switch ON.
(3) Warm up the engine by running the engine speed at 2,500 rpm for approximately 90 seconds.
(4) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL”.
(5) Perform ”A/F CONTROL” with the engine in an idle condition (press the right or left button).

Result:

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume
+25 % → rich output: More than 0.5 V,
–12.5 % → lean output: Less than 0.4 V

NOTICE:

There is a delay of few seconds in the sensor 1 (front sensor) output, and there is about 20 seconds delay at maximum in the sensor 2 (rear sensor).

	Output voltage of heated oxygen sensor (sensor 1: front sensor)	Output voltage of heated oxygen sensor (sensor 2: rear sensor)	Mainly suspect trouble area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	—
Case 2	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Sensor 2: rear sensor (sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following of A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the heated oxygen sensors.
For displaying the graph indication, enter ”ACTIVE TEST / A/F CONTROL / USER DATA”, then select ”O2S B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.
HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0136)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.
Result:

Display (DTC output)	Proceed to
P0136	A
P0136 and other DTCs	B

HINT:
If any other codes besides P0136 are output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–35)**

A

2	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Start the engine and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / O2S B1S2”.
(d) After warming up the engine, run the engine at 2,500 rpm for 3 minutes.
(e) Read the output voltage of the heated oxygen sensor (sensor 2) when the engine rpm is suddenly increased.

HINT:
Quickly accelerate the engine to 4,000 rpm 3 times by using the accelerator pedal.
Standard:
The output voltage of heated oxygen sensor (sensor 2): Alternates from 0.4 V or less to 0.5 V or more.

OK → **Go to step 6**

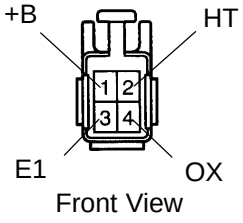
NG

3 INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)

Component Side:

H8 Heated Oxygen Sensor

Bank 1, Sensor 2



(a) Disconnect the H8 heated oxygen sensor connector.

(b) Measure the resistance between the terminals of the heated oxygen sensor connector.

Standard:

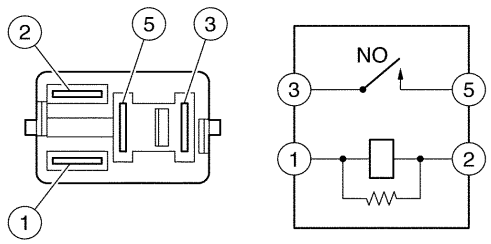
Tester Connection	Specified Condition
HT (H8–2) – +B (H8–1)	5 to 10 Ω at 20 °C (68 °F)
HT (H8–2) – E1 (H8–3)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

4 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B.

(b) Check for continuity in the EFI relay.

Standard:

Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No continuity
	Continuity (Apply battery voltage to terminals 1 and 2)

(c) ReInstall the EFI relay.

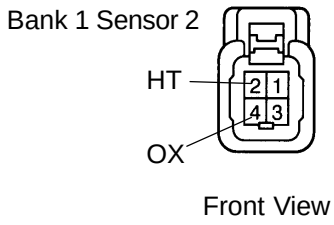
NG → **REPLACE EFI RELAY**

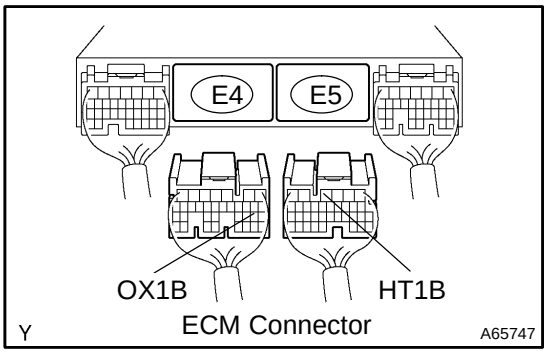
OK

5 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)

Wire Harness Side:

H8 Heated Oxygen Sensor Connector





(a) Disconnect the H8 heated oxygen sensor connector.
(b) Disconnect the E4 and E5 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

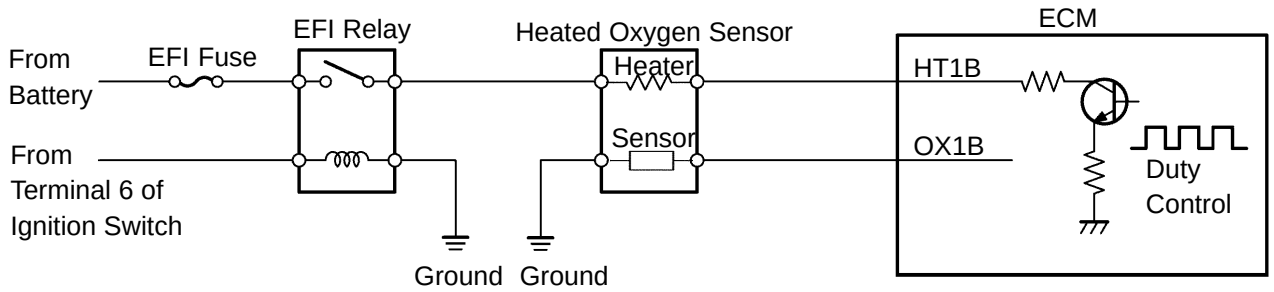
Tester Connection	Specified Condition
HT (H8–2) – HT1B (E5–4)	Below 1 Ω
OX (H8–4) – OX1B (E4–21)	

Standard (Check for short):

Tester Connection	Specified Condition
HT (H8–2) or HT1B (E5–4) – Body ground	10 kΩ or higher
OX (H8–4) or OX1B (E4–21) – Body ground	

(d) Reconnect the ECM connector.
(e) Reconnect the heated oxygen sensor connector.

Reference (Bank 1 Sensor 2 System Drawing):



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK →

REPLACE HEATED OXYGEN SENSOR

6	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

GO

7	READ OUTPUT DTC(DTC P0136 IS OUTPUT AGAIN)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.
Result:

Display (DTC output)	Proceed to
P0136	A
No output	B

B → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

A

REPLACE HEATED OXYGEN SENSOR

DTC	P0171	SYSTEM TOO LEAN (BANK 1)

DTC	P0172	SYSTEM TOO RICH (BANK 1)

CIRCUIT DESCRIPTION

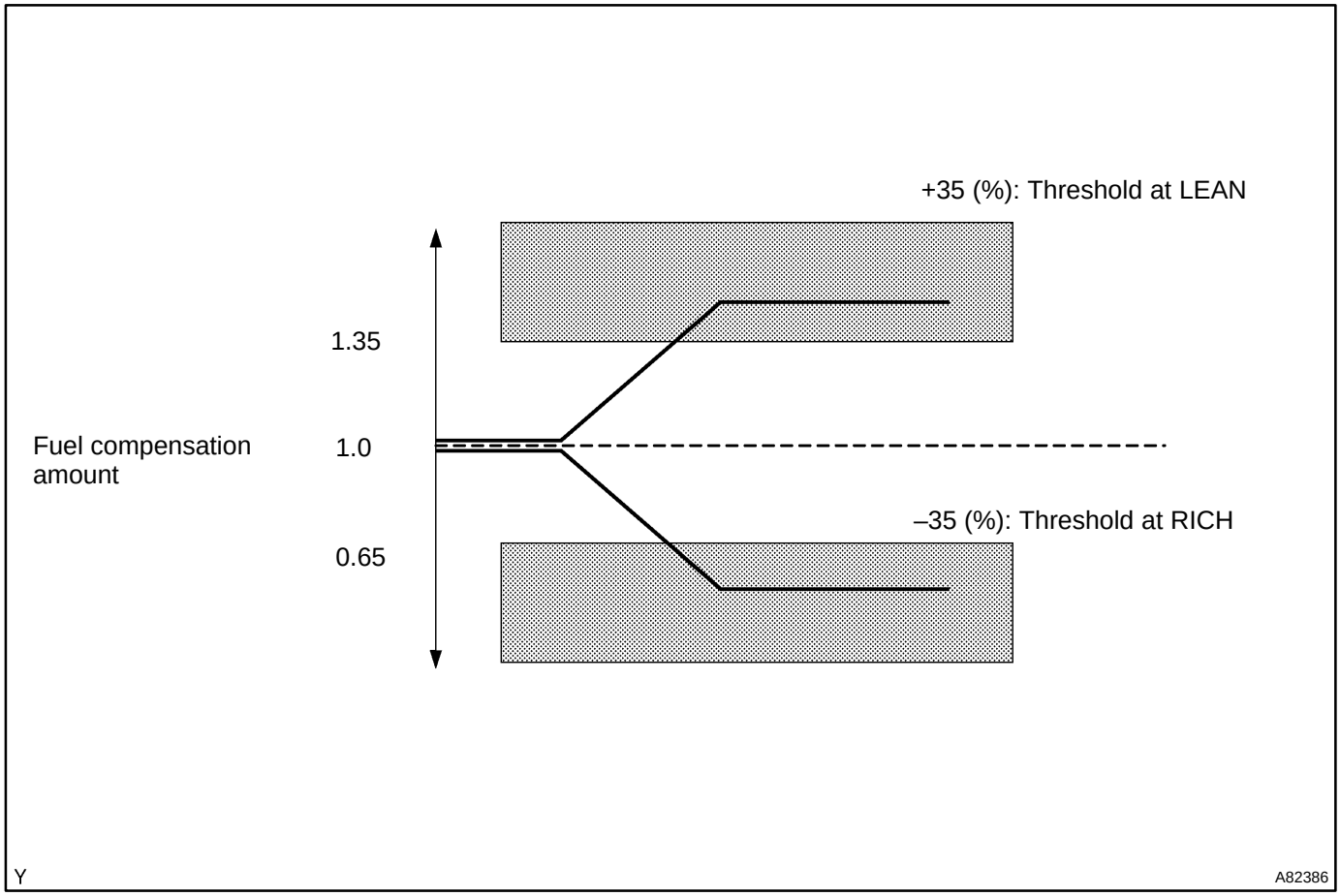
The fuel trim is related to the feedback compensation value, not to the basic injection time. The fuel trim includes the short–term fuel trim and the long–term fuel trim.
The short–term fuel trim is the short–term fuel compensation used to maintain the air–fuel ratio at stoichiometric air–fuel ratio. The signal from the heated oxygen sensor indicates whether the air–fuel ratio is RICH or LEAN compared to the stoichiometric air–fuel ratio. This variance triggers a reduction in the fuel volume if the air–fuel ratio is RICH, and an increase in the fuel volume if it is LEAN.
The long–term fuel trim is the overall fuel compensation carried out in long–term to compensate for a continual deviation of the short–term fuel trim from the central value, due to individual engine differences, wear overtime and changes in the operating environment.
If both the short–term fuel trim and the long–term fuel trim are LEAN or RICH beyond a certain value, it is detected as a malfunction and the MIL is illuminated.

DTC No.	DTC Detection Condition	Trouble Area
P0171	When air–fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on LEAN side (2 trip detection logic)	• Air induction system • Injector blockage • Mass air flow sensor • Engine coolant temperature sensor • Fuel pressure • Gas leakage in exhaust system • Open or short in heated oxygen sensor (bank 1, sensor 1) circuit • Heated oxygen sensor (bank 1, sensor 1) • Heated oxygen sensor heater (bank 1, sensor 1) • EFI relay • PCV valve and hose • PCV hose connection • ECM
P0172	When air–fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on RICH side (2 trip detection logic)	• Injector leak, blockage • Mass air flow sensor • Engine coolant temperature sensor • Ignition system • Fuel pressure • Gas leakage in exhaust system • Open or short in heated oxygen sensor (bank 1, sensor 1) circuit • Heated oxygen sensor (bank 1, sensor 1) • Heated oxygen sensor heater (bank 1, sensor 1) • EFI relay • ECM

HINT:

- When DTC P0171 is recorded, the actual air–fuel ratio is on the LEAN side. When DTC P0172 is recorded, the actual air–fuel ratio is on the RICH side.
- If the vehicle runs out of fuel, the air–fuel ratio is LEAN and DTC P0171 may be recorded. The MIL then comes on.
- If the total of the short–term fuel trim value and long–term fuel trim value is within ± 35 % (engine coolant temperature is more than 75 °C (167°F)), the system is functioning normally.

MONITOR DESCRIPTION



Under the closed–loop fuel control, fuel injection amounts that deviate from the ECM's estimated fuel amount will cause a change in the long–term fuel trim compensation value. This long–term fuel trim is adjusted when there are persistent deviations in the short–term fuel trim values. And the deviation from a simulated fuel injection amount by the ECM affects a smoothed fuel trim learning value which is the combination of smoothed short–term fuel trim (fuel feedback compensation value) and smoothed long–term fuel trim (learning value of the air–fuel ratio). When the smoothed fuel trim learning value exceeds the DTC threshold, the ECM interprets this as a fault in the fuel system and sets a DTC.
Example:
The smoothed fuel trim leaning value is more than +35% or less than –35%, the ECM interprets this as a fail in the fuel system.

MONITOR STRATEGY

Related DTCs	P0171	Fuel system lean (bank 1)
	P0172	Fuel system rich (bank 1)
Required sensors/components	Main sensors	Heated oxygen sensor
	Related sensors	Engine coolant temperature sensor, mass air flow sensor, crankshaft position sensor
Frequency of operation	Continuous	
Duration	10 seconds	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
Battery voltage	11 V	–
Fuel system: Closed loop	13 seconds	–
One of the following condition is met:	(a) or (b)	
(a) Engine speed	–	1,100 rpm
(b) Intake air amount per revolution	0.14 g/rev	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Following condition is continue for 3 seconds ("a" or "b")	
(a) Smoothed fuel trim learning value (lean)	35 % or more
(b) Smoothed fuel trim learning value (rich)	–35 % or less

WIRING DIAGRAM

Refer to DTC P0130 on page 05–101.

INSPECTION PROCEDURE

HINT:

Hand–held tester only:

Narrowing down the trouble area is possible by performing "A/F CONTROL" ACTIVE TEST (heated oxygen sensor or other trouble areas can be distinguished).

(a) Perform ACTIVE TEST using hand–held tester (A/F CONTROL).

HINT:

"A/F CONTROL" is the ACTIVE TEST which changes the injection volume to –12.5 % or +25 %.

(1) Connect the hand–held tester to the DLC3 on the vehicle.

(2) Turn the ignition switch ON.

(3) Warm up the engine by running the engine speed at 2,500 rpm for approximately 90 seconds.

(4) Select the item "DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL".

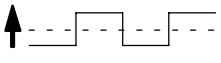
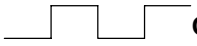
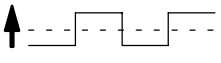
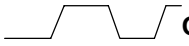
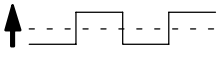
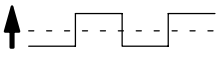
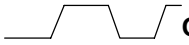
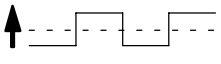
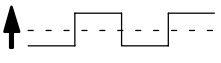
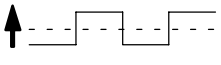
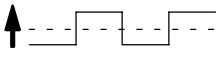
(5) Perform "A/F CONTROL" with the engine in an idle condition (press the right or left button).

Result:

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume
+25 % → rich output: More than 0.5 V,
–12.5 % → lean output: Less than 0.4 V

NOTICE:

There is a delay of few seconds in the sensor 1 (front sensor) output, and there is about 20 seconds delay at maximum in the sensor 2 (rear sensor).

	Output voltage of heated oxygen sensor (sensor 1: front sensor)	Output voltage of heated oxygen sensor (sensor 2: rear sensor)	Mainly suspect trouble area
Case 1	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  **OK**	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  **OK**	—
Case 2	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  **OK**	Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  **OK**	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Sensor 2: rear sensor (sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following of A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the heated oxygen sensors.

For displaying the graph indication, enter ”ACTIVE TEST / A/F CONTROL / USER DATA”, then select ”O2S B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.

HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.
- A high heated oxygen sensor (sensor 1) voltage (0.5 V or more) could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

1	CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leaks.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

2	CHECK CONNECTION OF PCV HOSE

NG → REPAIR OR REPLACE PCV HOSE

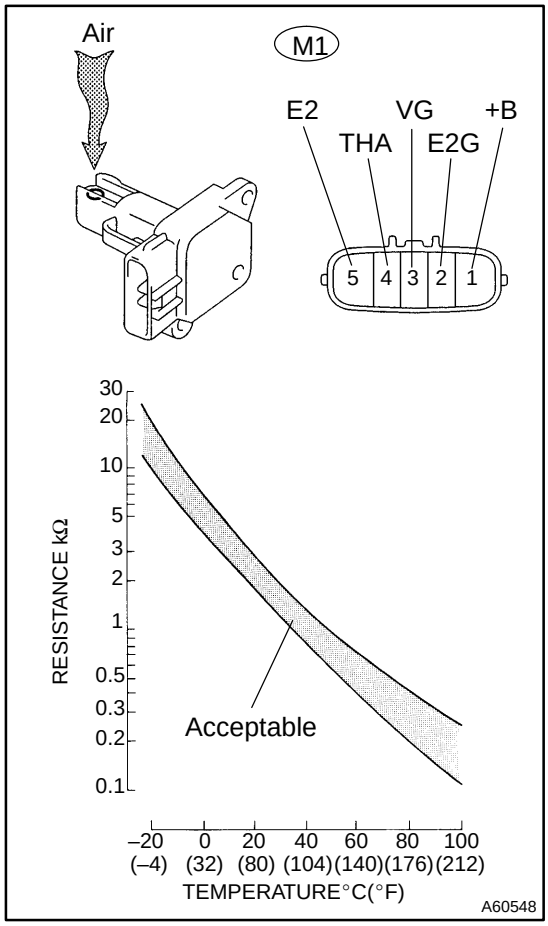
OK

3	INSPECT FUEL INJECTOR ASSY(INJECTION AND VOLUME) (See page 11–5)

NG → REPLACE FUEL INJECTOR ASSY (See page 11–10)

OK

4 INSPECT MASS AIR FLOW SENSOR



(a) Remove the mas air flow sensor.

(b) Inspect output voltage.

(1) Apply battery voltage across terminals +B and E2G.

(2) Connect the positive (+) tester prove to terminal VG, and negative (–) tester prove to terminal E2G.

(3) Blow air into the mass air flow sensor, and check that the voltage fluctuates.

(c) Resistance inspection.

(1) Measure the resistance between the terminals of the intake air temperature sensor.

Standard:

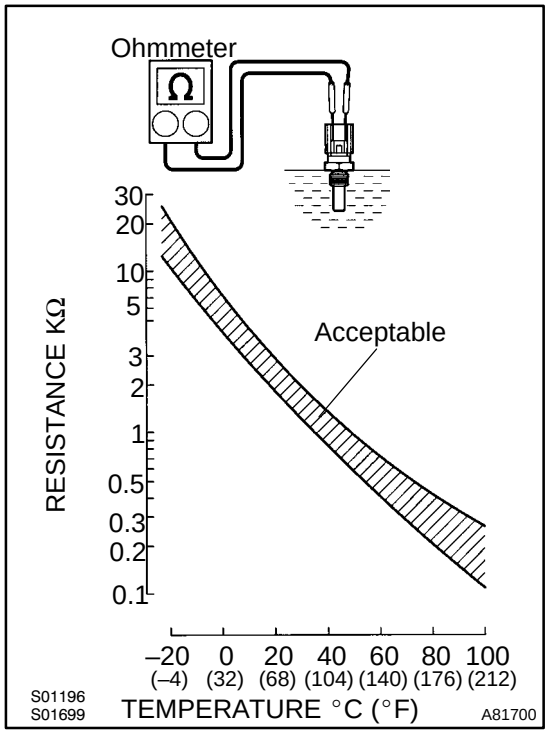
Tester Connection	Temperature	Specified Condition
THA (M1–4) – E2 (M1–5)	–20 °C (–4 °F)	13.6 to 18.4 kΩ
	20 °C (68 °F)	2.21 to 2.69 kΩ
	60 °C (140 °F)	0.49 to 0.67 kΩ

(d) Reinstall the mas air flow sensor.

NG → **REPLACE MASS AIR FLOW SENSOR**

OK

5	INSPECT ENGINE COOLANT TEMPERATURE SENSOR(RESISTANCE)



(a) Remove the engine coolant temperature sensor.

(b) Measure the resistance between the terminals of the engine coolant temperature sensor.

Standard:

Tester Connection	Temperature	Specified Condition
1 – 2	20°C (68°F)	2.32 to 2.59 kΩ
	80°C (176°F)	0.310 to 0.326 kΩ

NOTICE:

If you checking the engine coolant temperature sensor in water, be careful not to allow water to go into the terminals. After checking, dry the sensor.

HINT:

Alternate procedure: Connect an ohmmeter to the installed engine coolant temperature sensor and read the resistance. Use an infrared thermometer to measure the engine temperature in the immediate vicinity of the sensor. Compare these values to the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

(c) Reinstall the engine coolant temperature sensor.

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

6	CHECK FOR SPARK AND IGNITION (See page 18–1)

NG → **REPAIR OR REPLACE**

OK

7	CHECK FUEL PRESSURE (See page 11–5)

(a) Check the fuel pressure (high or low pressure).

NG → **CHECK AND REPLACE FUEL SYSTEM**

OK

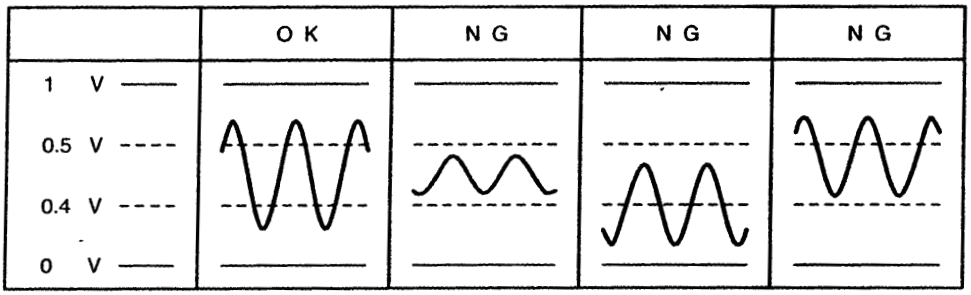
8	CHECK FOR EXHAUST GAS LEAKAGE

NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT (See page 15–2)**

OK

9	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR (BANK 1 SENSOR 1))

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Start the engine and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / O2S B1S1”.
(d) Warm up the heated oxygen sensor with the engine speed at 2,500 rpm for approximately 90 seconds.
(e) Read the output voltage of the heated oxygen sensor during idling.
Heated oxygen sensor output voltage:
Alternates repeatedly between less than 0.4 V and more than 0.5 V (See the following table).

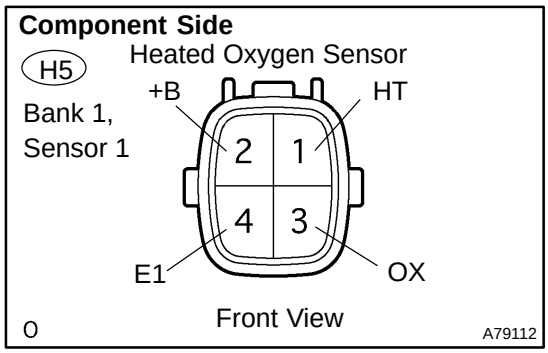


A85076

OK → **Go to step 17**

NG

10	INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)



(a) Disconnect the H5 heated oxygen sensor connector.
(b) Measure the resistance between the terminals of the heated oxygen sensor connector.
Standard:

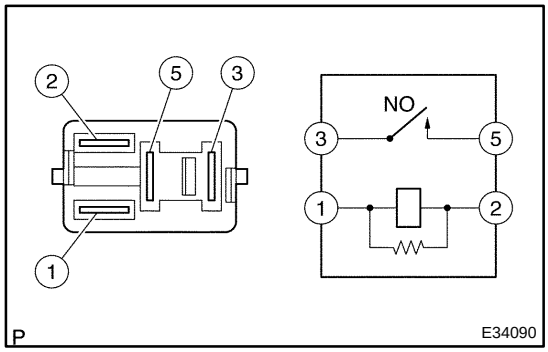
Tester Connection	Specified Condition
HT (H5–1) – +B (H5–2)	5 to 10 Ω at 20 °C (68 °F)
HT (H5–1) – E1 (H5–4)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

11	INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B.
(b) Check for continuity in the EFI relay.
Standard:

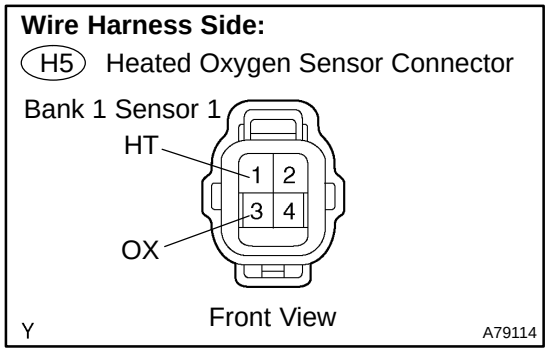
Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No continuity
	Continuity (Apply battery voltage to terminals 1 and 2)

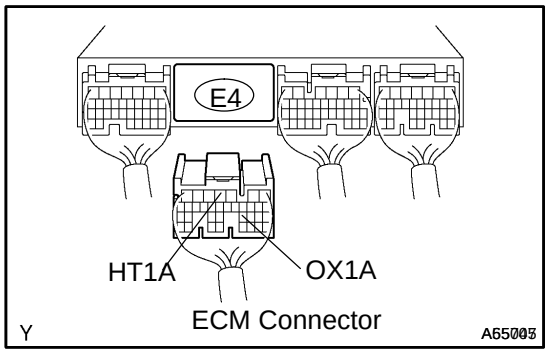
(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

12 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)





(a) Disconnect the H5 heated oxygen sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

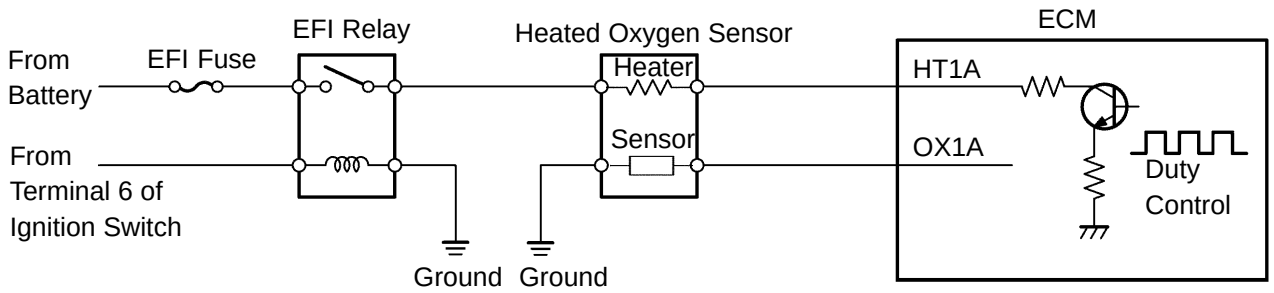
Tester Connection	Specified Condition
HT (H5–1) – HT1A (E4–4)	Below 1 Ω
OX (H5–3) – OX1A (E4–23)	

Standard (Check for short):

Tester Connection	Specified Condition
HT (H5–1) or HT1A (E4–4) – Body ground	10 kΩ or higher
OX (H5–3) or OX1A (E4–23) – Body ground	

(d) Reconnect the ECM connector.
(e) Reconnect the heated oxygen sensor connector.

Reference (Bank 1 Sensor 1 System Drawing):



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

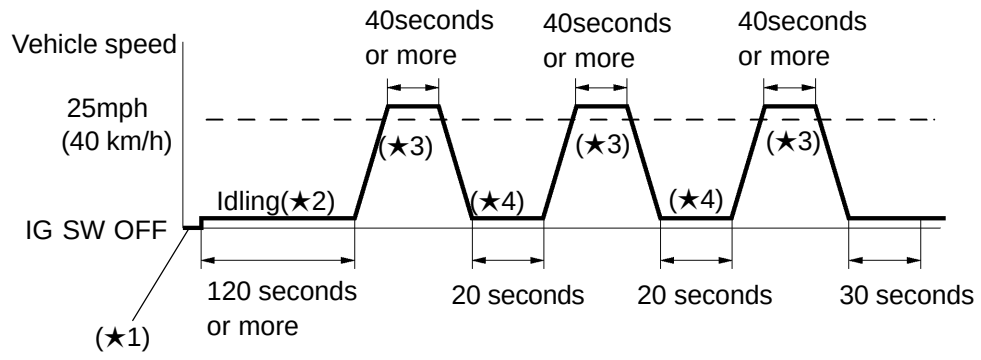
OK →

13	REPLACE HEATED OXYGEN SENSOR

HINT:
Check the air induction system for vacuum leaks.

GO

14	PERFORM CONFIRMATION DRIVING PATTERN



(a) Connect the hand–held tester to the DLC3. (★1)
(b) Switch the hand–held tester from the normal mode to the check mode (See page 05–11). (★1)
(c) Start the engine and let it idle for 120 seconds or more. (★2)
(d) Drive the vehicle at 25 mph (40 km/h) or more for 40 seconds or more. (★3)
(e) Let the engine idle for 20 seconds or more. (★4)
(f) Perform steps (d) and (e) at least 3 times.

HINT:
If a malfunction exists, the MIL will be illuminated on the multi–information display during step (f).

NOTICE:
If the conditions in this test are not strictly followed, detection of a malfunction will not occur. If you do not have the hand–held tester, turn the ignition switch OFF after performing steps from (c) to (f), then perform steps from (c) to (f) again.

GO

15	READ OUTPUT DTC(DTC P0171 AND/OR P0172 ARE OUTPUT AGAIN)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.

Result:

Display (DTC output)	Proceed to
”P0171 and/or P0172” are not output	A
”P0171 and/or P0172”	B

B → **REPLACE ECM (See page 10–11) AND PERFORM CONFIRMATION DRIVING PATTERN (Refer to step 14)**

A

16	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

YES

DTC IS CAUSED BY RUNNING OUT OF FUEL (DTCS P0171 AND/OR P0172)

17	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern. (Refer to step 14)

GO

18	READ OUTPUT DTC(DTC P0171 AND/OR P0172 ARE OUTPUT AGAIN)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.

Result:

Display (DTC output)	Proceed to
”P0171 and/or P0172”	A
”P0171 and/or P0172” are not output	B

B → **Go to step 22**

A

19	REPLACE HEATED OXYGEN SENSOR

GO

20	PERFORM CONFIRMATION DRIVING PATTERN (See page 05–29)

HINT:
Clear all DTCs prior to performing the confirmation driving pattern. (Refer to step 14)

GO

21	READ OUTPUT DTC(DTC P0171 AND/OR P0172 ARE OUTPUT AGAIN)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.
Result:

Display (DTC output)	Proceed to
”P0171 and/or P0172” are not output	A
”P0171 and/or P0172”	B

B → **REPLACE ECM (See page 10–11) AND PERFORM CONFIRMATION DRIVING PATTERN (Refer to step 14)**

A

22	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

YES

DTC IS CAUSED BY RUNNING OUT OF FUEL

DTC	P0300	RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

DTC	P0301	CYLINDER 1 MISFIRE DETECTED

DTC	P0302	CYLINDER 2 MISFIRE DETECTED

DTC	P0303	CYLINDER 3 MISFIRE DETECTED

DTC	P0304	CYLINDER 4 MISFIRE DETECTED

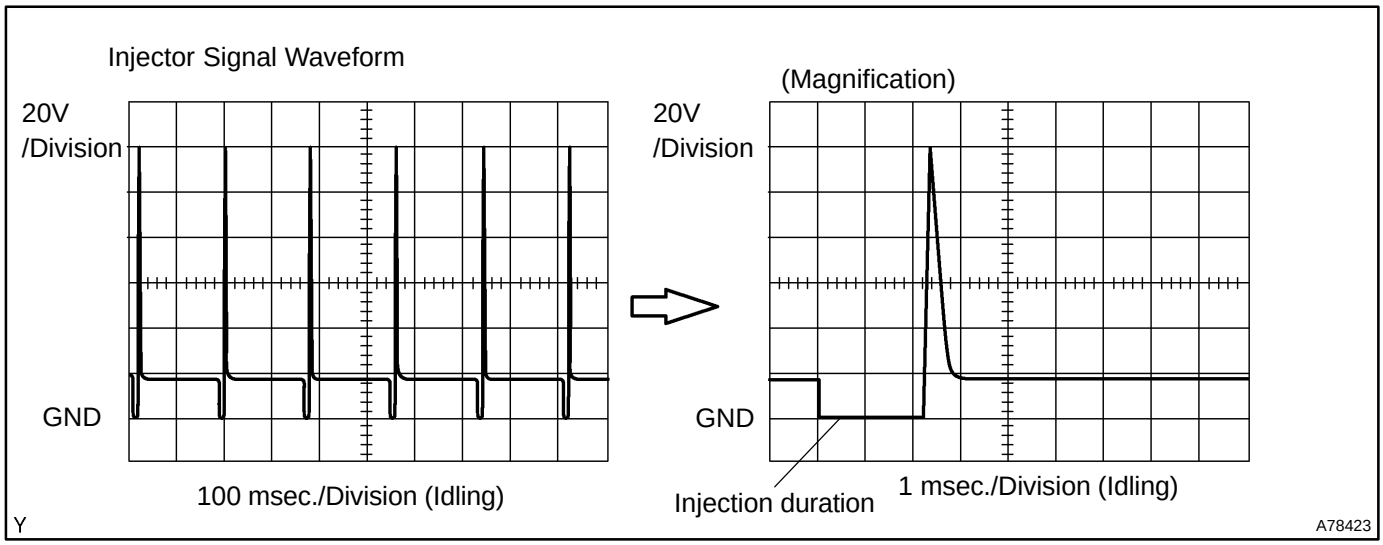
CIRCUIT DESCRIPTION

When a misfire occurs in the engine, hydrocarbons (HC) enter the exhaust in high concentrations. If this HC concentration is high enough, there could be an increase in exhaust emissions levels. High concentrations of HC passing through the catalyst also cause to temperature of the catalyst to increase, possibly damaging the catalyst. To prevent this increase in the emissions and limit the possibility of thermal damage, the ECM monitors the misfire rate. When the temperature of the catalyst reaches a point of thermal degradation, the ECM will blink the MIL. For monitoring misfire, the ECM uses both the camshaft position sensor and crankshaft position sensor. The camshaft position sensor is used to identify misfiring cylinders and the crankshaft position sensor is used to measure variations in the crankshaft rotation speed. The misfire counter increments when crankshaft rotation speed variations exceed threshold values.
The ECM illuminates the MIL if the misfiring rate exceeds a threshold value and could cause emissions deterioration.

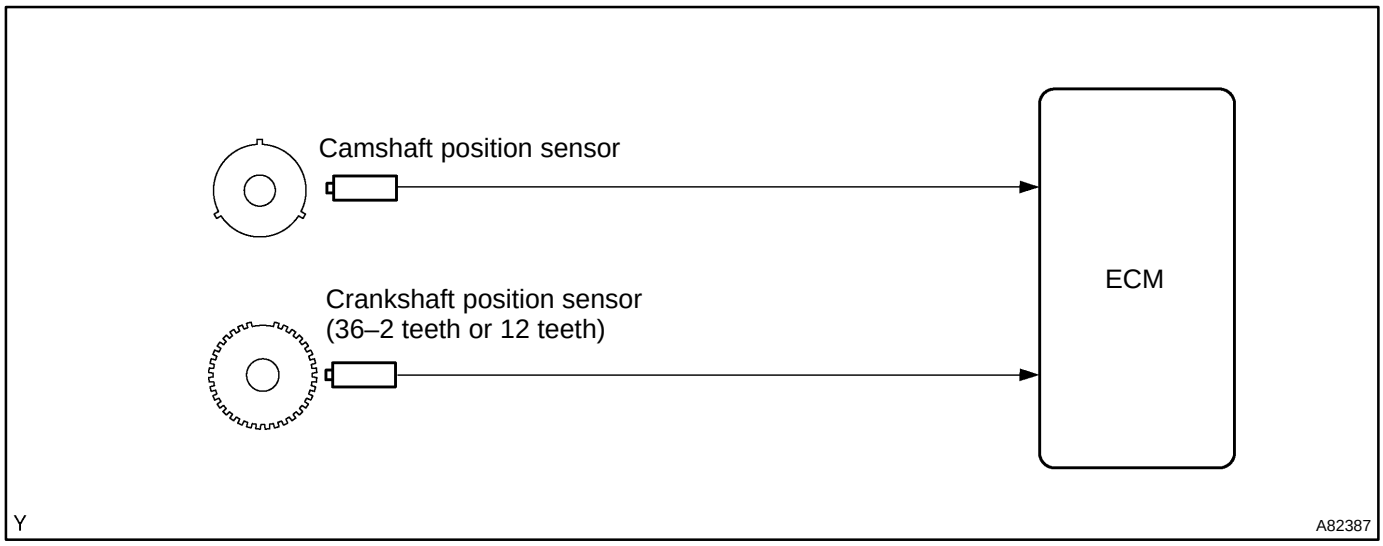
DTC No.	DTC Detection Condition	Trouble Area
P0300	Misfiring of random cylinders is detected	• Open or short in engine wire • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Mass air flow sensor • Engine coolant temperature sensor • Compression pressure • Valve clearance • Valve timing • PCV hose connection • PCV hose • ECM
P0301 P0302 P0303 P0304	Misfiring of each cylinder is detected	

HINT:
When codes for a misfiring cylinder are recorded repeatedly but no random misfire code is recorded, it indicates that the misfires have been detected and recorded at different times.

Reference: Inspection using oscilloscope
With the engine idling, check the waveform between terminals #10 to #40 and E01 of the ECM connectors.
HINT:
The correct waveform is as shown.



MONITOR DESCRIPTION



The ECM illuminates the MIL if the misfiring rate exceeds a threshold value and could cause emissions deterioration.
The ECM will illuminate the MIL when the percent misfire exceeds the specified limit per 1,000 engine revolutions. One occurrence of excessive misfire during engine start will set the MIL. Four occurrences are required to set the MIL 1,000 revolutions after engine start. (2 trip detection logic)
The MIL blinks when ”percent misfire causing catalyst damage” per 200 revolution met 3 times (1 time if the engine rpm is in high speed range). (MIL blinks immediately)

MONITOR STRATEGY

Related DTCs	P0300	Random/Multiple cylinder misfire detected
	P0301	Cylinder 1 misfire detected
	P0302	Cylinder 2 misfire detected
	P0303	Cylinder 3 misfire detected
	P0304	Cylinder 4 misfire detected
Required sensors/components	Main sensors	Camshaft position sensor, crankshaft position sensor
	Related sensors	Engine coolant temperature sensor, intake air temperature sensor, throttle position sensor
Frequency of operation	Continuous	
Duration	Every 1,000 revolutions (soon after engine is started: 1 time, other 4 times) (emission related misfire) Every 200 revolutions (1 or 3 times) (catalyst deteriorating misfire)	
MIL operation	2 driving cycles MIL ON Immediate MIL blinking (Catalyst deteriorating misfire)	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

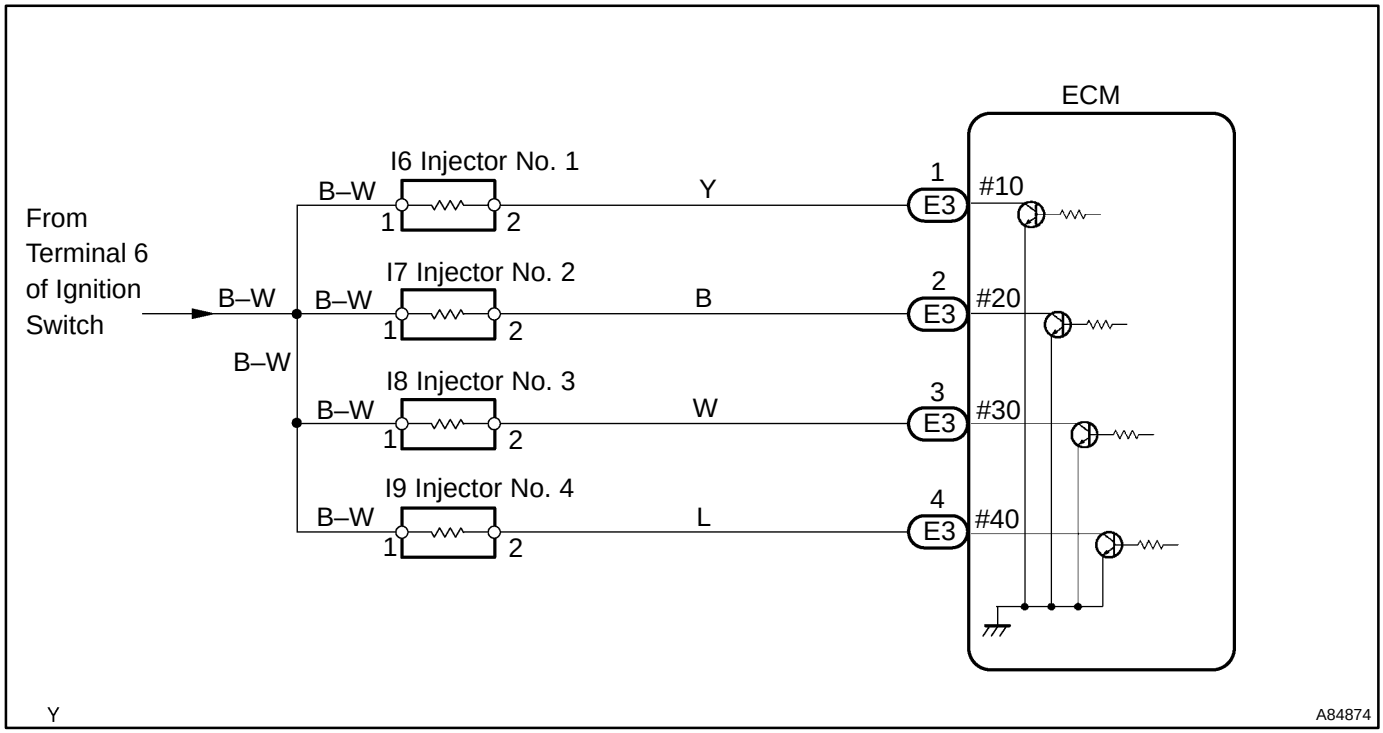
Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
Battery voltage	8 V	–
VVT	Normal operation (i. e. not under scan–tool control)	
Engine speed fluctuation	Engine speed should not have changed rapidly	
Engine speed (Two full revolutions (2 rev.) after engine has started)	450 rpm	6,700 rpm (AT) 6,600 rpm (MT)
Engine coolant temperature	–10°C (14°F)	–
Intake air temperature	–10°C (14°F)	–
Intake air amount per revolution (varies with engine speed)	0.14 g/rev	–
Throttle position learning	Completed	
Throttle position	Rapid throttle opening or closing operation has not occurred	
	–	Changing value of throttle position greater than 0.5° per 0.008 seconds
Transient spark retard (The spark timing delay control in a short time for preventing surge at the time of a sudden acceleration.)	Not commanded	
Rough road counter	–	10 times/1,000 revolutions (not running on rough road)

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Emission related misfire rate: 1. During the first 1,000 revolutions after engine start (1 time will set MIL) 2. After the first 1,000 revolutions have occurred (4 times will set MIL)	1.44 % per 1,000 revolutions
Catalyst damage misfire count: 1. Low engine rpm area (ex. less than 3,000 rpm): 200 rev. (3 times to set MIL) 2. High engine rpm area: Every 200 revolutions	75 count per 200 revolutions (threshold varies with engine speed, intake air amount per revolution)

WIRING DIAGRAM

Refer to DTC P0351 on page 05–177 for the wiring diagram of the ignition system.



CONFIRMATION DRIVING PATTERN

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Record DTCs and the freeze frame data.
(c) Set the check mode using the hand–held tester (See page 05–11).
(d) Read the value on the misfire counter for each cylinder when idling. If the value is displayed on the misfire counter, skip the following procedure of confirmation driving.
(e) Drive the vehicle several times with the engine speed, load and its surrounding range shown with ENGINE SPD, CALC LOAD in the freeze frame data or MISFIRE RPM, MISFIRE LOAD in the data list.

If you have no hand–held tester, turn the ignition switch OFF after the symptom is simulated once. Then repeat the simulation process again.

HINT:

Do not turn the ignition switch OFF during the confirmation driving pattern. This switches the diagnosis system from the check mode to the normal mode, so all the DTCs and freeze frame data will be erased.

Engine Speed	Time
Idling	3 minutes and 30 seconds or more
1,000 rpm	3 minutes or more
2,000 rpm	1 minute and 30 seconds or more
3,000 rpm	1 minute or more

(f) Check whether there is misfire or not by monitoring DTC and the freeze frame data. After that, record them.
(g) Turn the ignition switch OFF and wait for at least 5 seconds.

INSPECTION PROCEDURE

HINT:

- If DTCs besides misfire are memorized simultaneously, first perform the troubleshooting for them.
- Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.
- If the misfire does not occur when the vehicle is brought to the workshop, the misfire can be confirmed by reproducing the condition of the freeze frame data. After finishing the repair, confirm that there is no misfire (See confirmation driving pattern).
- When either of SHORT FT #1 or LONG FT #1 in the freeze frame data is over the range of ±20 %, there is a possibility that the air–fuel ratio is inclining either to RICH (–20 % or less) or LEAN (+20 % or more).
- When COOLANT TEMP in the freeze frame data is less than 80˚C (176˚F), there is a possibility of misfire only during engine warm up.
- If the misfire cannot be reproduced, the reason may be because of the driving the vehicle with lack of fuel, the use of improper fuel, a stain on the ignition plug, etc.
- Be sure to check the value on the misfire counter after the repair.

1 CHECK OTHER DTC OUTPUT(IN ADDITION TO MISFIRE DTCS)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(d) Read the DTCs.

Result:

Display (DTC output)	Proceed to
”P0300, P0301, P0302, P0303 and/or P0304”	A
”P0300, P0301, P0302, P0303 and/or P0304” and other DTCs	B

HINT:

If any other codes besides P0300, P0301, P0302, P0303 or P0304 are output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–35)**

A

2 CHECK WIRE HARNESS, CONNECTOR AND VACUUM HOSE IN ENGINE ROOM

(a) Check the connection conditions of the wire harness and connector.
(b) Check the vacuum hose piping for disconnection and break.

NG → **REPAIR OR REPLACE, THEN CONFIRM THAT THERE IS NO MISFIRE**

OK

3	CHECK CONNECTION OF PCV HOSE

NG → REPAIR OR REPLACE PCV HOSE

OK

4	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(NUMBER OF MISFIRE)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Start the engine.
(d) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / CYL#1 – CYL#4”.
(e) Read the number of misfire on the hand–held tester or the OBD II scan tool.

HINT:
When a misfire is not reproduced, be sure to branch below based on the stored DTC.

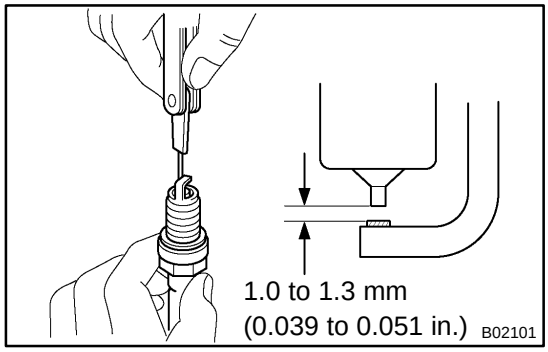
Result:

High Misfire Rate Cylinder	Proceed to
1 or 2 cylinders	A
More than 3 cylinders	B

B → Go to step 15

A

5	CHECK SPARK PLUG AND SPARK OF MISFIRING CYLINDER



(a) Remove the ignition coil assembly.
(b) Remove the spark plug.
(c) Check the spark plug type.
Recommended spark plug:

DENSO made	SK16R11
NGK made	IFR5A11

(d) Check the spark plug electrode gap.
Electrode gap: 1.0 to 1.3 mm (0.039 to 0.051 in.)

NOTICE:
If adjusting the gap of a new spark plug, bend only the base of the ground electrode. Do not touch the tip. Never attempt to adjust the gap on a used plug.

(e) Check the electrode for carbon deposits.
(f) Perform a spark test.

CAUTION:
Absolutely disconnect the each injector connectors.

NOTICE:
Do not crank the engine for more than 5 seconds at a time.

(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if spark occurs while the engine is being cranked.

Standard: Spark jumps across electrode gap.

(g) Reinstall the spark plug.
(h) Reinstall the ignition coil assy.

OK → **Go to step 8**

NG

6	CHANGE NORMAL SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER

(a) Change to the normal spark plug.
(b) Perform a spark test.

CAUTION:
Absolutely disconnect each injector connector.
NOTICE:
Do not crank the engine for more than 5 seconds at a time.

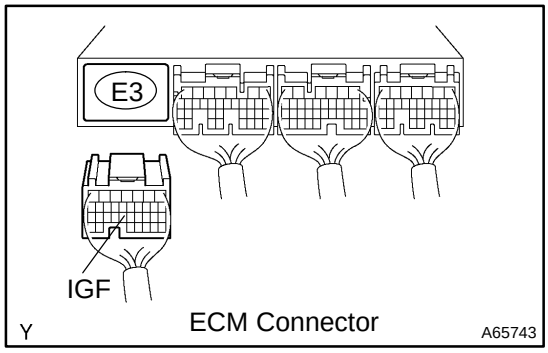
(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if spark occurs while the engine is being cranked.

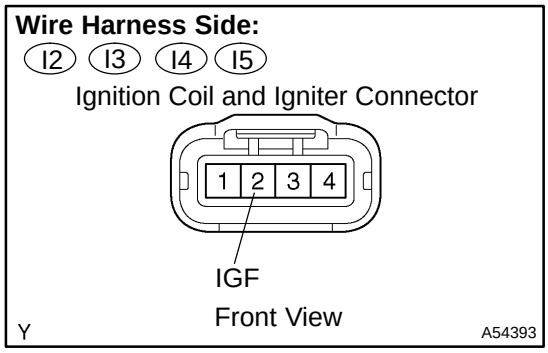
Standard: Spark jumps across electrode gap.

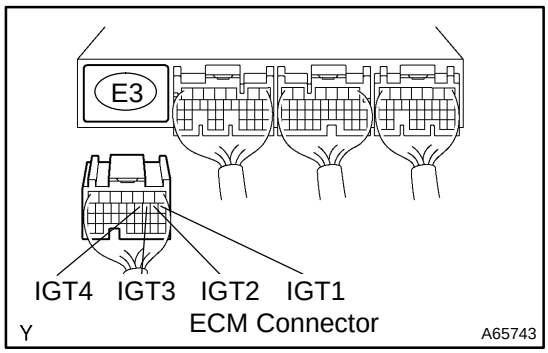
OK → **REPLACE SPARK PLUG**

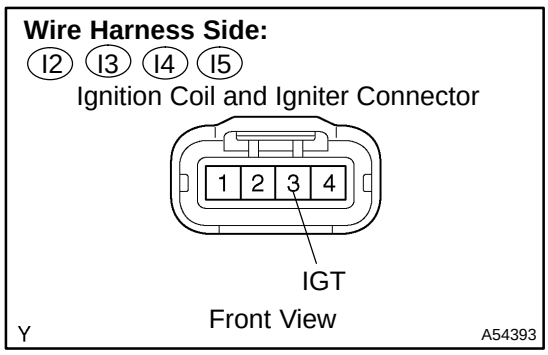
NG

7	CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER(IGNITION COIL – ECM)









(a) Check the harness and connector between the ignition coil and ECM (IGF terminal) connectors
  (1) Disconnect the I2, I3, I4 or I5 ignition coil and igniter connector.
  (2) Disconnect the ECM E3 connector.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
IGF (I2–2) – IGF (E3–23)	Below 1 Ω
IGF (I3–2) – IGF (E3–23)	
IGF (I4–2) – IGF (E3–23)	
IGF (I5–2) – IGF (E3–23)	

Standard (Check for short):

Tester Connection	Specified Condition
IGF (I2–2) or IGF (E3–23) – Body ground	10 kΩ or higher
IGF (I3–2) or IGF (E3–23) – Body ground	
IGF (I4–2) or IGF (E3–23) – Body ground	
IGF (I5–2) or IGF (E3–23) – Body ground	

  (4) Reconnect the ECM connector.
  (5) Reconnect the ignition coil and igniter connector.

(b) Check the harness and connector between the ignition coil and ECM (IGT terminal) connectors
  (1) Disconnect the I2, I3, I4 or I5 ignition coil and igniter connector.
  (2) Disconnect the ECM E3 connector.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
IGT (I2–3) – IGT1 (E3–8)	Below 1 Ω
IGT (I3–3) – IGT2 (E3–9)	
IGT (I4–3) – IGT3 (E3–10)	
IGT (I5–3) – IGT4 (E3–11)	

Standard (Check for short):

Tester Connection	Specified Condition
IGT (I2–3) or IGT1 (E3–8) – Body ground	10 kΩ or higher
IGT (I3–3) or IGT2 (E3–9) – Body ground	
IGT (I4–3) or IGT3 (E3–10) – Body ground	
IGT (I5–3) or IGT4 (E3–11) – Body ground	

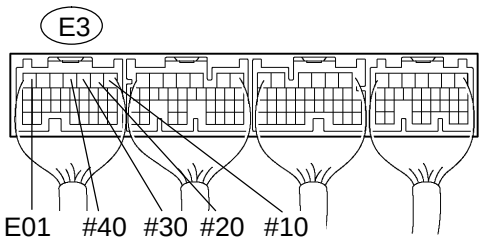
  (4) Reconnect the ECM connector.
  (5) Reconnect the ignition coil and igniter connector.

OK → **REPLACE IGNITION COIL ASSY (THEN CONFIRM THAT THERE IS NO MISFIRE)**

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

8	**INSPECT ECM TERMINAL OF MISFIRING CYLINDER(#10, #20, #30 OR #40 VOLTAGE)**



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E3 ECM connector.

Standard:

Symbols (Terminal No.)	Specified Condition
#10 (E3–1) – E01 (E3–7)	8 to 14 V
#20 (E3–2) – E01 (E3–7)	
#30 (E3–3) – E01 (E3–7)	
#40 (E3–4) – E01 (E3–7)	

OK → **Go to step 11**

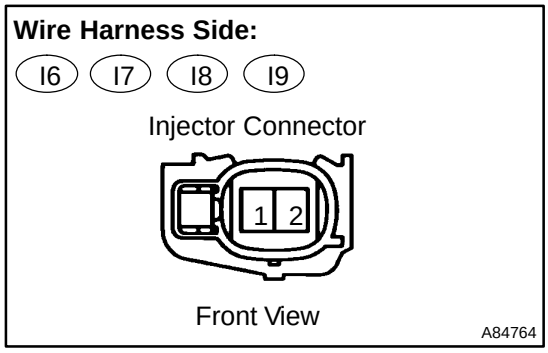
NG

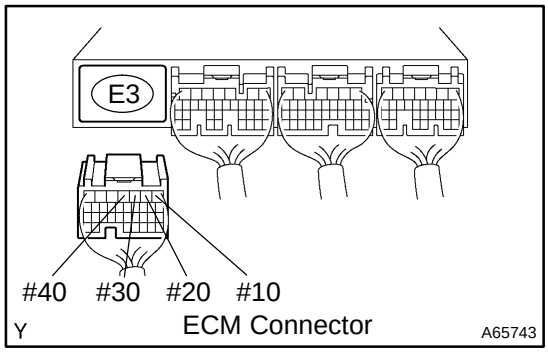
9	**INSPECT FUEL INJECTOR RESISTANCE OF MISFIRING CYLINDER (See page 11–7)**

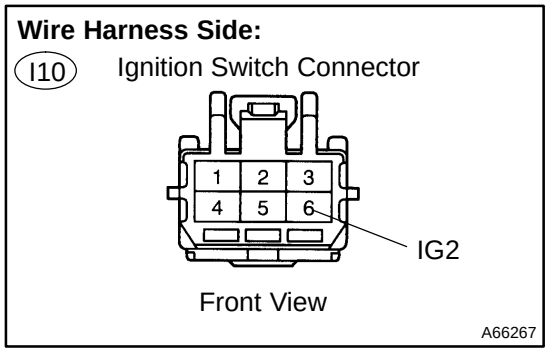
NG → **REPLACE FUEL INJECTOR ASSY (See page 11–10)**

OK

10	CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER(INJECTOR – ECM, INJECTOR – IGNITION SWITCH)







(a) Check the harness and connector between the injector connector and ECM connector.
  (1) Disconnect the I6, I7, I8 or I9 injector connector.
  (2) Disconnect the E3 ECM connector.
  (3) Measure the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
Injector (I6–2) – #10 (E3–1)	Below 1 Ω
Injector (I7–2) – #20 (E3–2)	
Injector (I8–2) – #30 (E3–3)	
Injector (I9–2) – #40 (E3–4)	

Standard (Check for short):

Tester Connection	Specified Condition
Injector (I6–2) or #10 (E3–1) – Body ground	10 kΩ or higher
Injector (I7–2) or #20 (E3–2) – Body ground	
Injector (I8–2) or #30 (E3–3) – Body ground	
Injector (I9–2) or #40 (E3–4) – Body ground	

  (4) Reconnect the ECM connector.
  (5) Reconnect the Iinjector connector.

(b) Check the harness and connector between the injector connector and ignition switch connector.
  (1) Disconnect the I6, I7, I8 or I9 injector connector.
  (2) Disconnect the I10 ignition switch connector.
  (3) Measure the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
Injector (I6–1) – IG2 (I10–6)	Below 1 Ω
Injector (I7–1) – IG2 (I10–6)	
Injector (I8–1) – IG2 (I10–6)	
Injector (I9–1) – IG2 (I10–6)	

Standard (Check for short):

Tester Connection	Specified Condition
Injector (I6–1) or IG2 (I10–6) – Body ground	10 kΩ or higher
Injector (I7–1) or IG2 (I10–6) – Body ground	
Injector (I8–1) or IG2 (I10–6) – Body ground	
Injector (I9–1) or IG2 (I10–6) – Body ground	

  (4) Reconnect the ignition switch connector.
  (5) Reconnect the injector connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

11	INSPECT FUEL INJECTOR INJECTION AND VOLUME OF MISFIRING CYLINDER (See page 11–7)

NG → REPLACE FUEL INJECTOR ASSY

OK

12	CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER (See page 14–1)

NG → REPAIR OR REPLACE

OK

13	CHECK VALVE CLEARANCE OF MISFIRING CYLINDER (See page 14–5)

NG → ADJUST VALVE CLEARANCE (See page 14–5)

OK

14	SWITCH STEP BY NUMBER OF MISFIRE CYLINDER(REFER RESULT OF STEP 4)

HINT:

- If the result of step 4 is ”1 or 2 cylinders” proceed to A.
- If the result of step 4 is ”more than 3 cylinders” proceed to B.

B → CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

A

15	CHECK VALVE TIMING(CHECK FOR LOOSENESS OR A JUMPED TOOTH OF THE TIMING CHAIN) (See page 14–82)

NG → ADJUST VALVE TIMING (See page 14–128) (REPAIR OR REPLACE TIMING CHAIN)

OK

16	CHECK FUEL PRESSURE (See page 11–5)

NG → CHECK AND REPLACE FUEL PUMP, PRESSURE REGULATOR, FUEL PIPE LINE AND FILTER

OK

17	READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL(INTAKE AIR TEMPERATURE AND MASS AIR FLOW RATE)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON.
(c) Check the intake air temperature.
  (1) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / INTAKE AIR” and read its value displayed on the hand–held tester or the OBD II scan tool.

  Temperature: Equivalent to ambient temperature
(d) Check the air flow rate.
  (1) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / MAF” and read its value displayed on the hand–held tester or the OBD II scan tool.

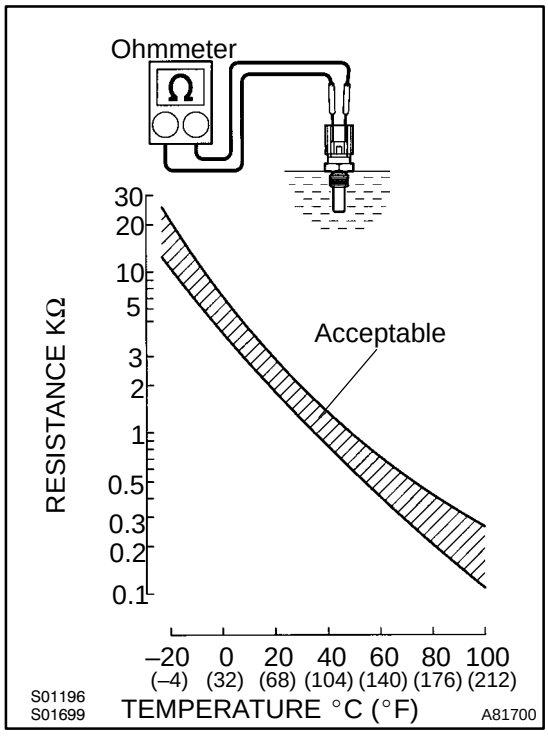
  Standard:

Condition	Air flow rate (gm/s)
Ignition switch ON (do not start engine)	0
Idling	4 to 6
Running without load (2,500 rpm)	13 to 20
From idling to quickly accelerating	Air flow rate fluctuates

NG → **REPLACE MASS AIR FLOW SENSOR**

OK

18	INSPECT ENGINE COOLANT TEMPERATURE SENSOR(RESISTANCE)



(a) Remove the engine coolant temperature sensor.
(b) Measure the resistance between the terminals of the engine coolant temperature sensor.

  Standard:

Tester Connection	Temperature	Specified Condition
1 – 2	20°C (68°F)	2.32 to 2.59 kΩ
	80°C (176°F)	0.310 to 0.326 kΩ

NOTICE:

If you checking the engine coolant temperature sensor in water, be careful not to allow water to go into the terminals. After checking, dry the sensor.

HINT:

Alternate procedure: Connect an ohmmeter to the installed engine coolant temperature sensor and read the resistance. Use an infrared thermometer to measure the engine temperature in the immediate vicinity of the sensor. Compare these values to the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

19	SWITCH STEP BY NUMBER OF MISFIRE CYLINDER(REFER RESULT OF STEP 4)

HINT:

- If the result of step 4 is ”1 or 2 cylinders” proceed to A.
- If the result of step 4 is ”more than 3 cylinders” proceed to B.

B → AGAIN GO TO STEP 5

A

CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

DTC	P0325	KNOCK SENSOR 1 CIRCUIT (BANK 1 OR SINGLE SENSOR)

DTC	P0327	KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR)

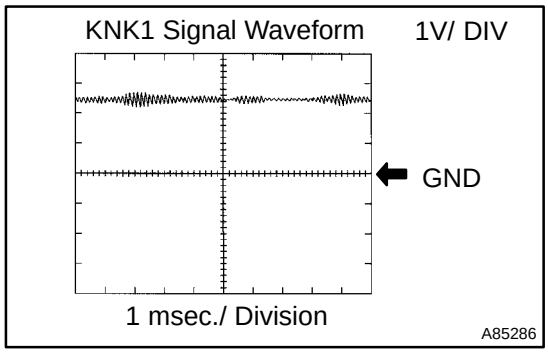
DTC	P0328	KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR)

CIRCUIT DESCRIPTION

A flat type knock sensor (non–resonant type) has the structure that can detect the vibration in a wider band of frequency from about 6 kHz to 15 kHz and has the following features.
Knock sensors are fitted on the cylinder block to detect the engine knocking.
The sensor contains a piezoelectric element which generates a voltage when it becomes deformed, which occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, the ignition timing is retarded to suppress it.

DTC No.	DTC Detecting Condition	Trouble Area
P0325	Knock sensor signal level remains at low for more than 10 seconds	• Open or short in knock sensor circuit • Knock sensor (under–torqued or loose) • ECM
P0327	Output voltage of the knock sensor is 0.5 V or less	• Short in knock sensor circuit • Knock sensor • ECM
P0328	Output voltage of the knock sensor is 4.5 V or more	• Open in knock sensor circuit • Knock sensor • ECM

HINT:
If the ECM detects the DTC P0325, it enters the fail–safe mode in which the corrective retarded angle value is set to the maximum value.



Reference: Inspection using the oscilloscope.

(1) After warming up run the engine at 4,000 rpm, check the waveform between terminal KNK1 and EKNK of the ECM connector.

MONITOR DESCRIPTION

The knock sensor, located on the cylinder block, detects spark knock. When spark knock occurs, the sensor picks–up vibrates in a specific frequency range. When the ECM detects the voltage in this frequency range, it retards the ignition timing to suppress the spark knock.
The ECM also senses background engine noise with the knock sensor and uses this noise to check for faults in the sensor. If the knock sensor signal level is too low for more than 10 seconds, and if the knock sensor output voltage is out of normal range, the ECM interprets this as a fault in the knock sensor and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0325	Knock sensor (bank 1) range check or rationality
	P0327	Knock sensor (bank 1) range check (low voltage)
	P0328	Knock sensor (bank 1) range check (high voltage)
Required sensors/components	Main sensors	Knock sensor
	Related sensors	Crankshaft position sensor, camshaft position sensor, engine coolant temperature sensor, mass air flow sensor
Frequency of operation	Continuous	
Duration	10 seconds	
MIL operation	Immediately	
Sequence of operation	None	

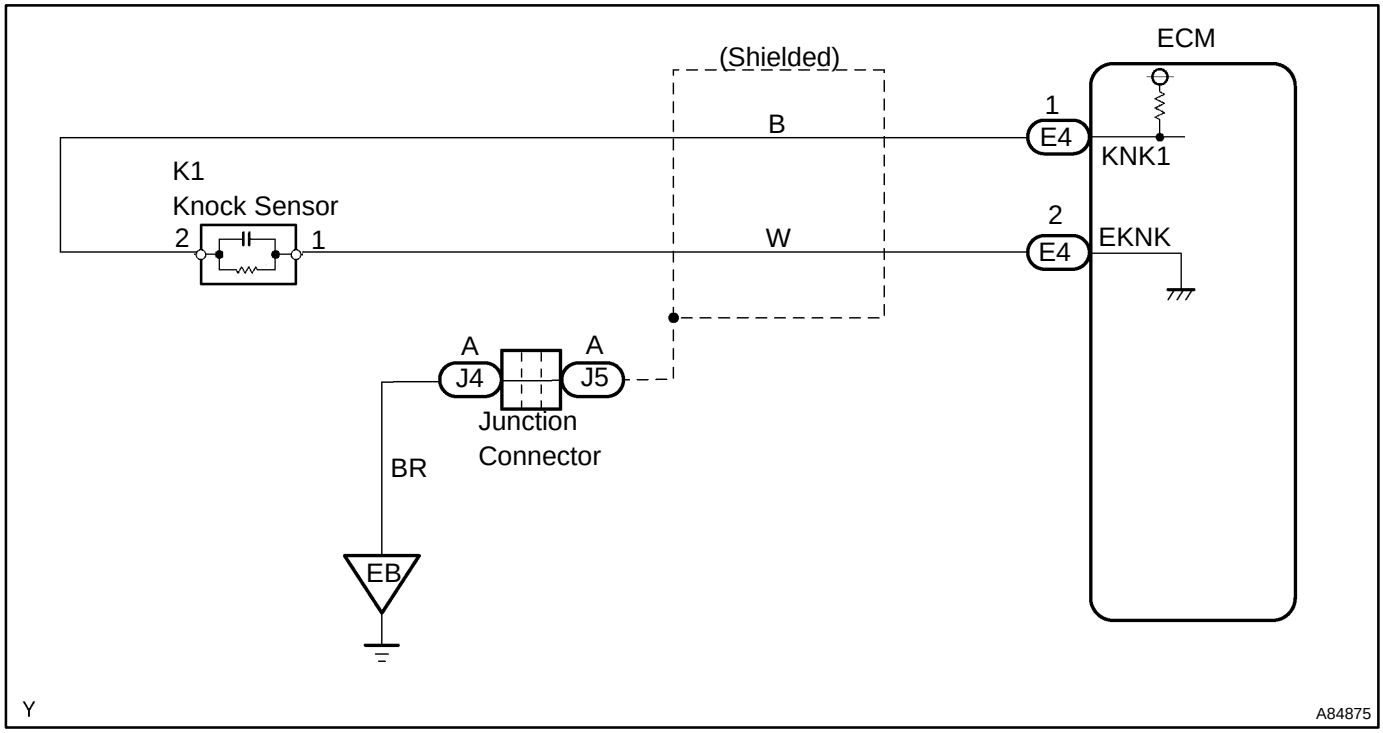
TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Battery voltage	10 V	–
Idle	OFF	
Time after engine start	5 seconds	–
Engine coolant temperature	60°C (140°F)	–
Intake air amount per revolution	0.3 g/rev	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0325 (Range check/Rationality):	
Time while the voltage output of the knock sensor is below the specific threshold	10 seconds
P0325 (Fluttering):	
Knock sensor voltage	Less than 0.5 V and More than 4.5 V
P0327:	
Knock sensor voltage	Less than 0.5 V
P0328:	
Knock sensor voltage	More than 4.5 V

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.

1	READ OUTPUT DTC

(a) Clear the DTC.
(b) Warm up the engine.
(c) Run the engine at 3,000 rpm for 10 seconds or more.
(d) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(e) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(f) Select the item ”DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES”.
(g) Read the DTCs.

Result :

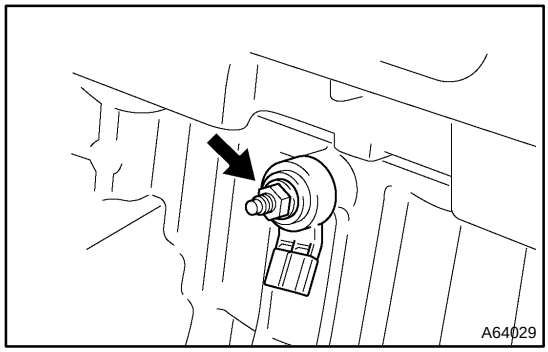
Display (DTC output)	Proceed to
P0325	A
”P0325, P0327 and/or P0328”	B
No output	C

B → **Go to step 3**

C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

A

2 INSPECT KNOCK SENSOR

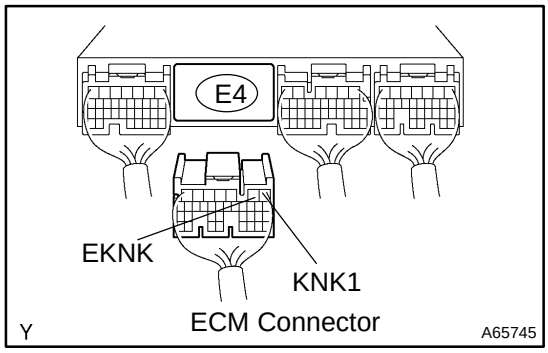


(a) Check the knock sensor installation.
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)

NG → **TIGHTEN SENSOR**

OK

3 CHECK HARNESS AND CONNECTOR(ECM – KNOCK SENSOR)



(a) Disconnect the E4 ECM connector.
(b) Measure the resistance between terminals of the E4 ECM connector.
Standard:

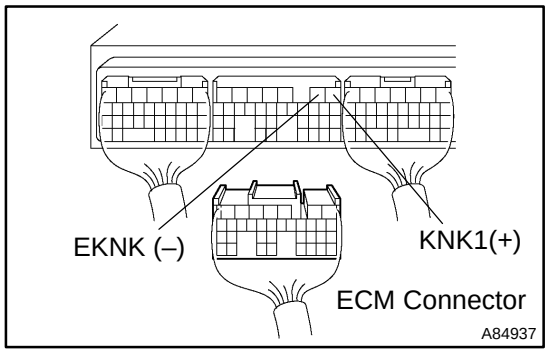
Tester Connection	Specified Condition
KNK1 (E4–1) – EKNK (E4–2)	120 to 280 KΩ at 20 °C (68 °F)

(c) Reconnect the ECM connector.

NG → **Go to step 5**

OK

4 INSPECT ECM(KNK1 VOLTAGE)



(a) Disconnect the E4 ECM connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between terminals of the E4 ECM terminals.
Standard:

Tester Connection	Specified Condition
KNK1 (E4–1) – EKNK (E4–2)	4.5 to 5.5 V

(d) Reconnect the ECM connector.

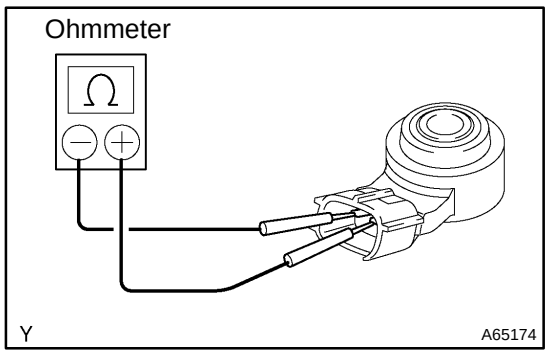
NG → **REPLACE ECM (See page 10–11)**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

NOTICE:
Fault may be intermittent. Check harness and connectors carefully.

5 INSPECT KNOCK SENSOR



(a) Remove the K1 knock sensor.
(b) Measure the resistance between the terminals.
Standard:

Tester Connection	Specified Condition
KNK1 (K1–1) – EKNK (K1–2)	120 to 280 KΩ aKt 20 °C (68 °F)

(c) Reinstall the knock sensor.

NG → **REPLACE KNOCK SENSOR**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

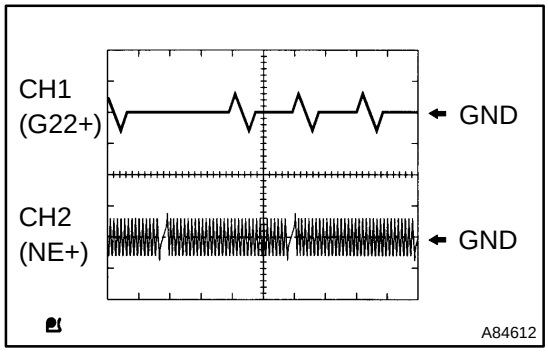
DTC	P0335	CRANKSHAFT POSITION SENSOR ”A” CIRCUIT

DTC	P0339	CRANKSHAFT POSITION SENSOR ”A” CIRCUIT INTERMITTENT

CIRCUIT DESCRIPTION

The crankshaft position sensor (NE signal) consists of a magnet, iron core and pickup coil.
The NE signal plate (crankshaft position sensor plate) has 34 teeth and is installed on the crankshaft. The NE signal sensor generates 34 signals for each engine revolution. This sensor monitors a plate (timing rotor) located on the crankshaft timing pulley and is used by the ECM to detect crankshaft angle and engine speed (RPM/NE). As the crankshaft timing pulley rotates through an engine revolution, this sensor communicates the rotation of the NE signal plate as a pulse signal to the ECM. Based on the signal, the ECM controls fuel injection time and ignition timing.

DTC No.	DTC Detection Condition	Trouble Area
P0335	No crankshaft position sensor signal to ECM during cranking (2 trip detection logic)	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Signal plate (crankshaft) • ECM
	No crankshaft position sensor signal to ECM with engine speed 600 rpm or more (2 trip detection logic)	
P0339	In condition (a), (b) and (c), when no crankshaft position sensor (NE+) signal is input for 0.05 seconds or more. (a) Engine revolution 1,000 rpm or more (b) STA signal is OFF (c) 3 seconds or more has lapsed after STA signal is switched from ON to OFF.	



Reference: Inspection using the oscilloscope.
HINT:
The correct waveform is as shown on the left.

Item	Contents
Terminal	CH1: G22+ – NE– CH2: NE+ – NE–
Equipment Set	5V/Division, 20ms/Division
Condition	During cranking or idling

MONITOR DESCRIPTION

If there is no signal from the crankshaft sensor despite the engine revolving, the ECM interprets this as a malfunction of the sensor.

MONITOR STRATEGY

Related DTCs	P0335	Crankshaft position sensor range check or rationality
Required sensors/components	Main sensors	Crankshaft position sensor
	Related sensors	Engine speed sensor
Frequency of operation	Continuous	
Duration	Case 1: 4.7 seconds, Case 2: 0.5 second	
MIL operation	2 driving cycles	
Sequence of operation	None	

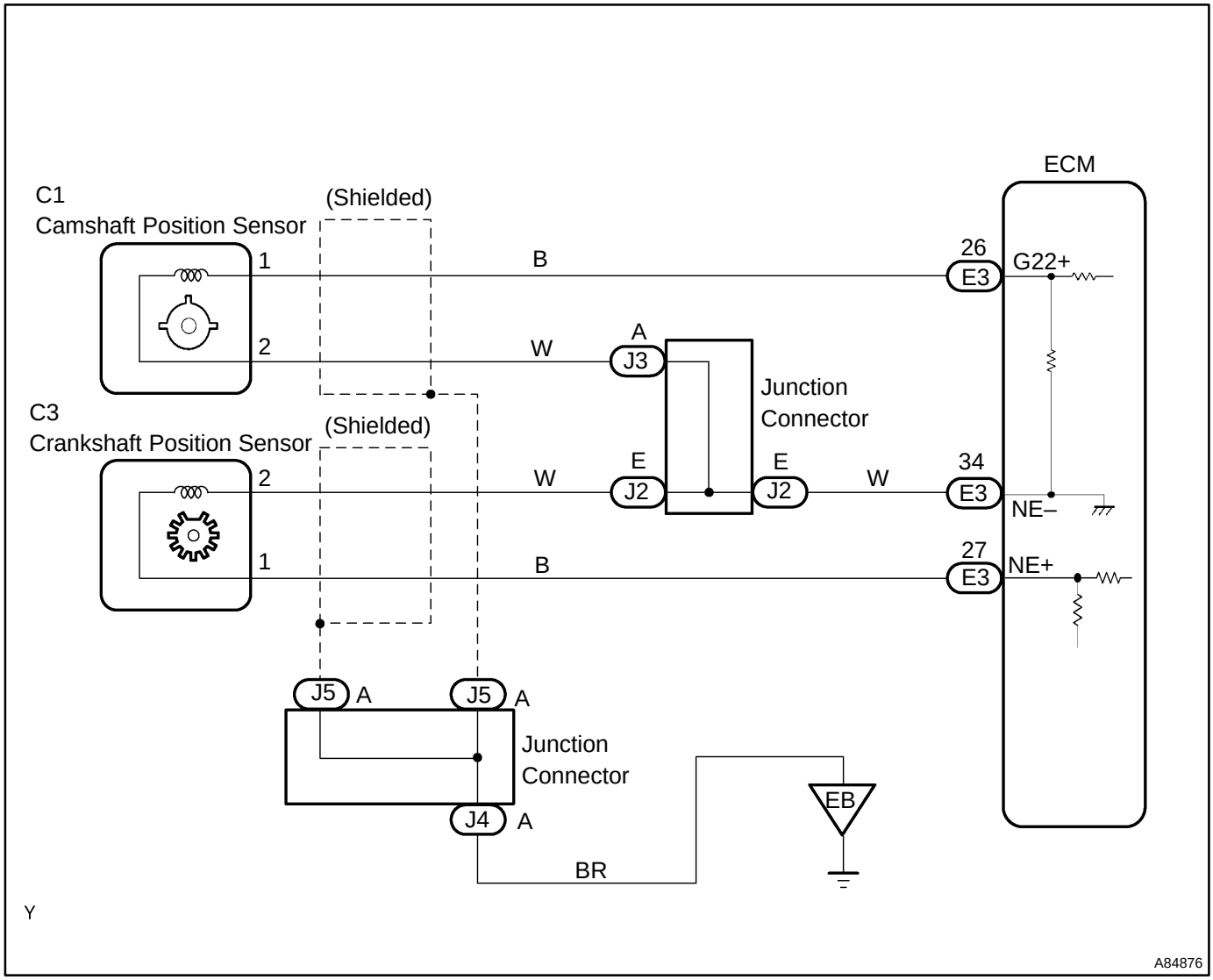
TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Case 1:		
Starter	ON	
Minimum battery voltage while starter ON	–	11 V
Case 2:		
Engine speed	600 rpm	–
Starter	OFF	
Time after starter ON to OFF	3 seconds	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Case 1:	
Engine speed signal	No signal for 4.7 seconds
Case 2:	
Engine speed signal	No signal for 0.5 second

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Perform the troubleshooting of DTC P0335 first. If no trouble is found, troubleshoot the engine mechanical systems.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

- READ VALUE OF HAND–HELD TESTER OR OBD II SCAN TOOL
  (a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
  (b) Start the engine and push the hand–held tester or the OBD II scan tool main switch ON.
  (c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / ENGINE SPD”.
- The engine speed can be confirmed in DATA LIST using the hand–held tester or OBD II scan tool. If there is no NE signals from the crankshaft position sensor despite the engine revolving, the engine speed will be indicated as zero. If voltage output of the crankshaft position sensor is insufficient, the engine speed will be indicated as lower PRM (than the actual RPM).

1 INSPECT CRANKSHAFT POSITION SENSOR(RESISTANCE)

Component Side:

C3 Crankshaft Position Sensor

Front View

Y A73303

(a) Disconnect the C43crankshaft position sensor connector.
(b) Measure the resistance between the terminals of the crankshaft position sensor connector.

Standaed:

Tester Connection	Specified Condition
1 – 2	985 to 1,600 Ω at cold
	1,265 to 1,890 Ω at hot

NOTICE:

"Cold" and "Hot" shown above mean the temperature of the coils themselves. "Cold" is from –10°C (14°F) to 50 °C (122 °F) and "Hot" is from 50 °C (122 °F) to 100 °C (212 °F).

(c) Reconnect the crankshaft position sensor connector.

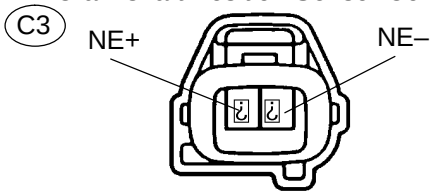
NG → **REPLACE CRANKSHAFT POSITION SENSOR (See page 18–2)**

OK

2 CHECK HARNESS AND CONNECTOR(CRANKSHAFT POSITION SENSOR – ECM)

Wire Harness Side:

Crankshaft Position Sensor Connector



Front View

A84567

(a) Disconnect the C3 crankshaft position sensor connector.
(b) Disconnect the E3 ECM connector.
(c) Check the resistance between the wire harness side connectors.

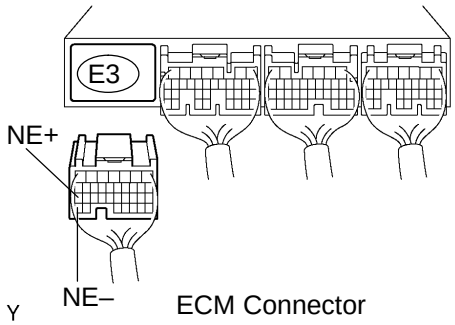
Standard (Check for open):

Tester connection	Specified Condition
NE+ (C3–1) – NE+ (E3–27)	Below 1 Ω
NE– (C3–2) – NE– (E3–34)	

Standard (Check for short):

Tester connection	Specified Condition
NE+ (C3–1) or NE+ (E3–27) – Body ground	10 kΩ or higher
NE– (C3–2) or NE– (E3–34) – Body ground	

(d) Reconnect the ECM connector.
(e) Reconnect the crankshaft position sensor connector.



Y ECM Connector A65743

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	CHECK SENSOR INSTALLATION(CRANKSHAFT POSITION SENSOR)

(a) Check the crankshaft position sensor installation .

NG → TIGHTEN SENSOR

OK

4	CHECK CRANKSHAFT POSITION SENSOR PLATE(TEETH OF SENSOR PLATE(CRANKSHAFT))

(a) Check the teeth of the sensor plate.

NG → REPLACE CRANKSHAFT POSITION SENSOR PLATE (CRANKSHAFT)

OK

REPLACE ECM (See page 10–11)

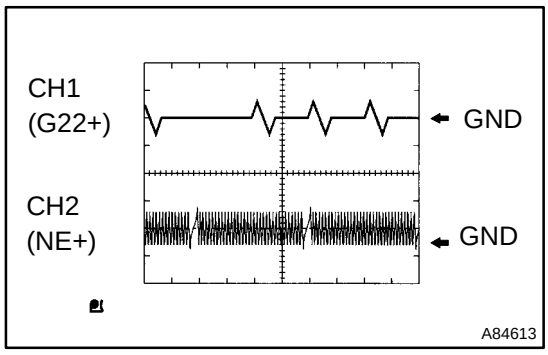
DTC	P0340	CAMSHAFT POSITION SENSOR ”A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

DTC	P0341	CAMSHAFT POSITION SENSOR ”A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

CIRCUIT DESCRIPTION

The camshaft position sensor (G22+ signal) consists of a magnet, iron core and pickup coil.
The G22+ signal plate has 3 teeth on its outer circumference and is installed on the camshaft timing pulley. When the camshafts rotate, the protrusion on the signal plate and the air gap on the pickup coil changes, causing fluctuations in the magnetic field and generating an electromotive force in the pickup coil.
The NE+ signal plate (crankshaft timing pulley) has 34 teeth and is installed to the crankshaft. The NE+ signal sensor generates 34 signals at every engine revolution. The ECM detects the crankshaft angle and the engine revolution based on the NE+ signals, and the cylinder and the angle of the VVT based on the combination of the G22+ and NE+ signals.

DTC No.	DTC Detection Condition	Trouble Area
P0340	• No camshaft position sensor signal to ECM during cranking (2 trip detection logic) • No camshaft position sensor signal to ECM with engine speed 600 rpm or more (1 trip detection logic)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft timing pulley • Timing chain has jumped a tooth • ECM
P0341	While crankshaft rotates twice, camshaft position sensor signal is input to ECM 12 times or more (1 trip detection logic) • Hint: Under normal condition, the camshaft position sensor is input into the ECM 3 times per 2 engine revolutions	



Reference: Inspection using the oscilloscope.
HINT:
The correct waveform is as shown on the left.

Item	Contents
Terminal	CH1: G22+ – NE– CH2: NE+ – NE–
Equipment Set	5V/DIV, 20ms/DIV
Condition	During cranking or idling

MONITOR DESCRIPTION

If there is no signal from the camshaft position sensor despite the engine revolving, or if the rotation of the camshaft and the crankshaft is not synchronized, the ECM interprets this as a malfunction of the sensor.

MONITOR STRATEGY

Related DTCs	P0340	Camshaft position sensor (bank 1) range check or rationality
	P0341	Camshaft position sensor (bank 1) range check or rationality
Required sensors/components	Main sensors	Camshaft position sensor
	Related sensors	Crankshaft position sensor, engine speed sensor
Frequency of operation	Continuous	
Duration	5 seconds	
MIL operation	P0340 case 2 (mis–aligned) and P0341: Immediately P0340 case 1 (no signal): 2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
P0340 Case 1 (No signal):		
Starter	ON	
Minimum battery voltage while starter ON	–	11 V
P0340 Case 2 (Mis–aligned):		
Engine speed	600 rpm	–
Starter	OFF	
P0341:		
Engine speed	600 rpm	–
Time after restart	180°CA	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0340 Case 1 (No signal):	
Camshaft position sensor signal	No signal
P0340 Case 2 (Mis–aligned):	
Crankshaft/camshaft alignment is mis–aligned (judged by comparing the crankshaft position to the camshaft position)	
Camshaft position sensor signal: No input in appropriate timing.	
P0341:	
Crankshaft/Camshaft alignment	Mis–aligned
Camshaft position sensor count	12 or more / 720°CA (= Engine 2 revolutions)

COMPONENT OPERATING RANGE

Parameter	Standard Value
Camshaft position sensor signal input during every 720°CA	3

WIRING DIAGRAM

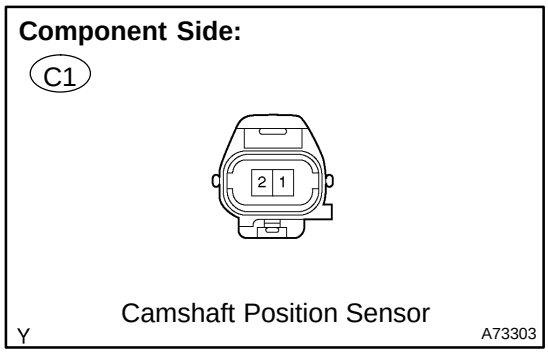
Refer to DTC P0335 on page 05–168.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.

1 INSPECT CAMSHAFT POSITION SENSOR(RESISTANCE)



(a) Measure the resistance between the terminals of camshaft position sensor connector.

Standard:

Tester Connection	Specified Condition
1 – 2	1,630 to 2,740 Ω at cold
	2,065 to 3,225 Ω at hot

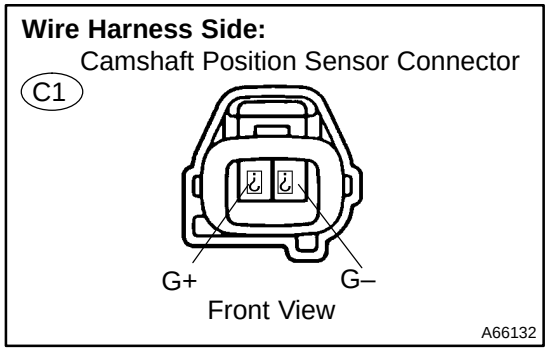
NOTICE:

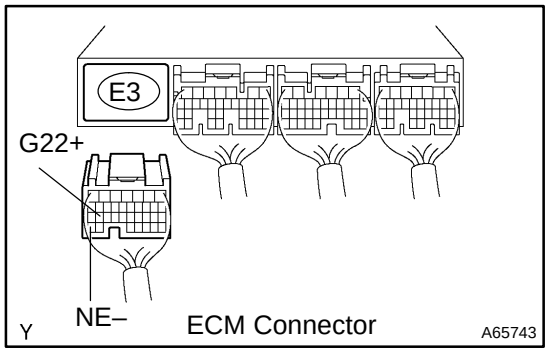
"Cold" and "Hot" shown above mean the temperature of the coils themselves. "Cold" is from –10°C (14°F) to 50 °C (122 °F) and "Hot" is from 50 °C (122 °F) to 100 °C (212 °F).

NG → **REPLACE CAMSHAFT POSITION SENSOR**

OK

2 CHECK HARNESS AND CONNECTOR(CAMSHAFT POSITION SENSOR – ECM)





(a) Disconnect the C1 camshaft position sensor connector.

(b) Disconnect the E3 ECM connector.

(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
G+ (C1–1) – G22+ (E3–26)	Below 1 Ω
G– (C1–2) – NE– (E3–34)	

Standard (Check for short):

Tester Connection	Specified Condition
G+ (C1–1) or G22+ (E3–26) – Body ground	10 kΩ or higher
G– (C1–2) or NE– (E3–34) – Body ground	

(d) Reconnect the ECM connector.

(e) Reconnect the camshaft position sensor connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	CHECK SENSOR INSTALLATION(CAMSHAFT POSITION SENSOR)

(a) Check the camshaft position sensor installation.

NG → TIGHTEN SENSOR

OK

4	CHECK CAMSHAFT TIMING GEAR ASSY(TEETH OF PLATE)

(a) Check the teeth of the signal plate.

NG → REPLACE CAMSHAFT TIMING GEAR ASSY

OK

REPLACE ECM (See page 10–11)

DTC	P0351	IGNITION COIL ”A” PRIMARY/SECONDARY CIRCUIT

DTC	P0352	IGNITION COIL ”B” PRIMARY/SECONDARY CIRCUIT

DTC	P0353	IGNITION COIL ”C” PRIMARY/SECONDARY CIRCUIT

DTC	P0354	IGNITION COIL ”D” PRIMARY/SECONDARY CIRCUIT

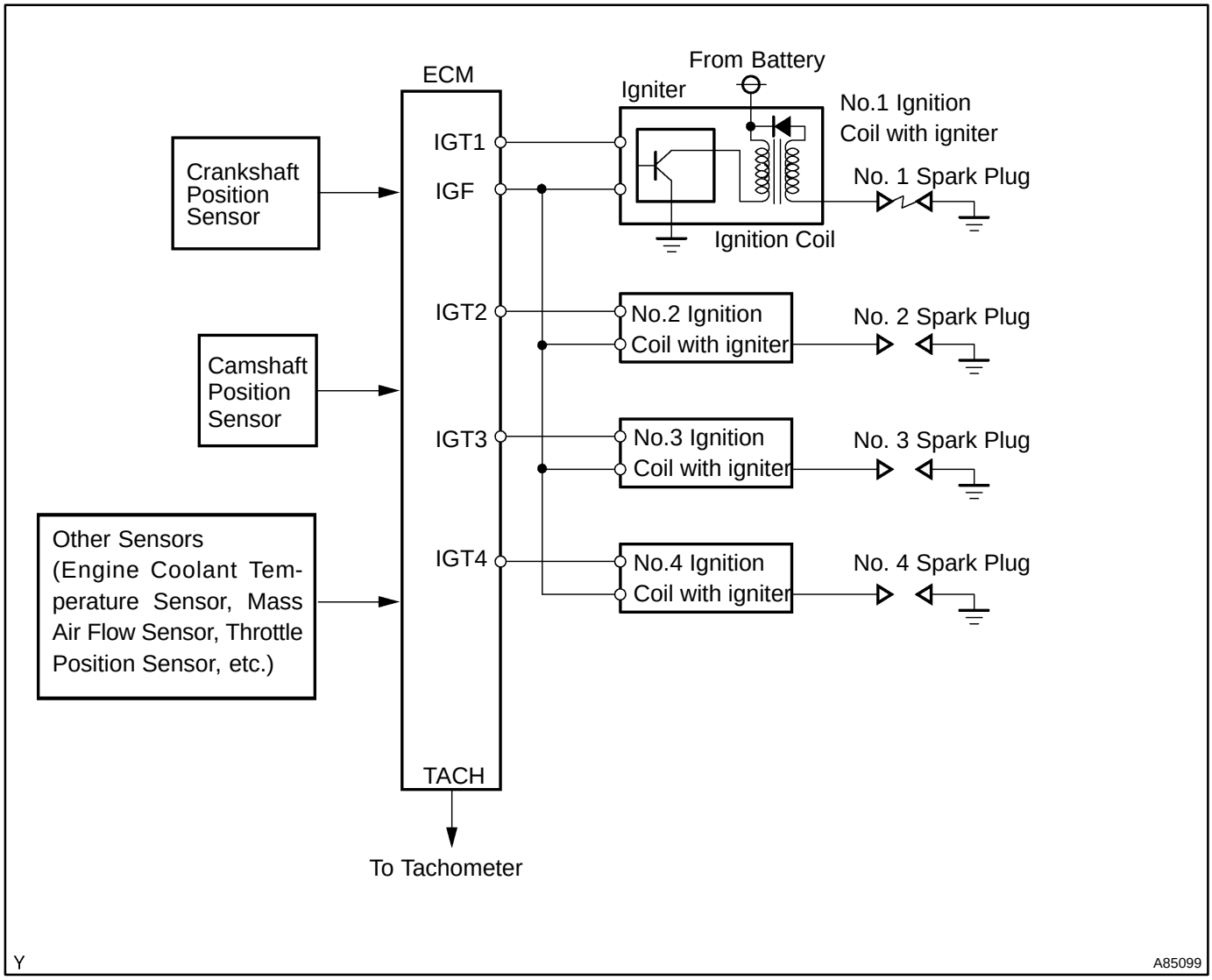
CIRCUIT DESCRIPTION

HINT:

- These DTCs indicate a malfunction related to the primary circuit.
- If DTC P0351 is displayed, check the No.1 ignition coil with igniter circuit.
- If DTC P0352 is displayed, check the No.2 ignition coil with igniter circuit.
- If DTC P0353 is displayed, check the No.3 ignition coil with igniter circuit.
- If DTC P0354 is displayed, check the No.4 ignition coil with igniter circuit.

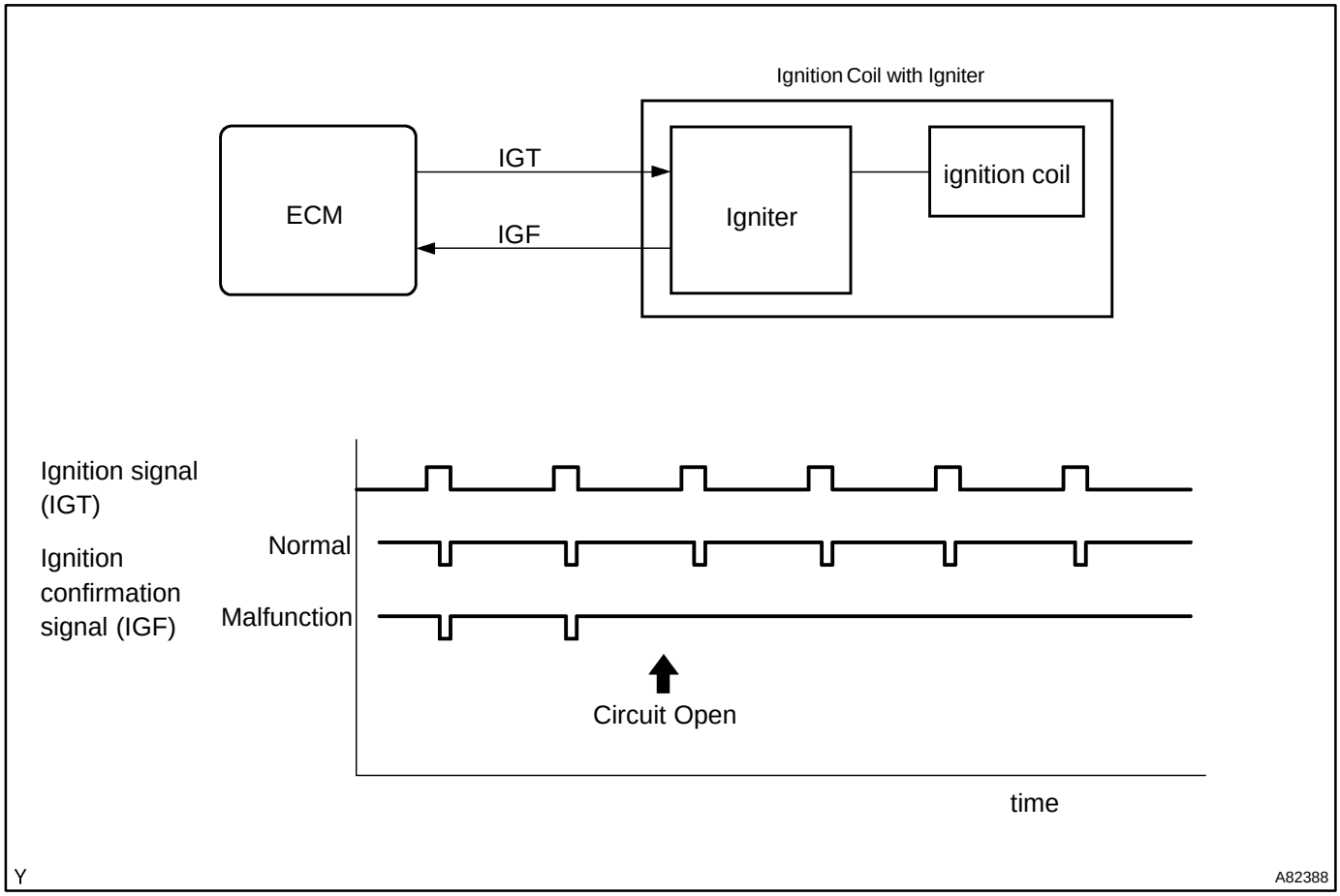
A Direct Ignition System (DIS) is used on this vehicle. The DIS improves the ignition timing accuracy, reduces high–voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor. The DIS is a 1–cylinder ignition system which ignites one cylinder with one ignition coil. In the 1–cylinder ignition system, the one spark plug is connected to the end of the secondary winding. High voltage generated in the secondary winding is applied directly to the spark plug. The spark of the spark plug passes from the center electrode to the ground electrode.

The ECM determines the ignition timing and outputs the ignition signals (IGT) for each cylinder. Using the ignition (IGT) signal, the ECM turns on and off the power transistor inside the igniter and this switches on and off the current to the primary coil. When the current flow to the primary coil is cut off, high–voltage is generated in the secondary coil and this voltage is applied to the spark plugs to spark inside the cylinders. As the ECM cuts the current to the primary coil, the igniter sends back the ignition confirmation (IGF) signal for each cylinder ignition to the ECM.



DTC No.	DTC Detection Condition	Trouble Area
P0351 P0352 P0353 P0354	No IGF signal to ECM while engine is running	• Ignition system • Open or short in IGF or IGT circuit from ignition coil with igniter to ECM (ignition coil circuit 1 through 4) • Ignition coil with igniter (ignition coil circuit 1 through 4) • ECM

MONITOR DESCRIPTION



If the ECM does not receive the ignition confirmation signal (IGF) after sending the ignition signal (IGT), it interprets this as a fault in the igniter and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0351	No. 1 ignition coil with igniter circuit malfunction
	P0352	No. 2 ignition coil with igniter circuit malfunction
	P0353	No. 3 ignition coil with igniter circuit malfunction
	P0354	No. 4 ignition coil with igniter circuit malfunction
Required sensors/components	Igniter	
Frequency of operation	Continuous	
Duration	0.256 seconds	
MIL operation	Immediately	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
Engine speed	–	1,500 rpm
Following condition is met:	(a) or (b)	
(a) Following conditions are met:	1 and 2	
1. Engine speed	–	500 rpm
2. Battery voltage	6 V	–
(b) Following conditions are met:	1 and 2	
1. Engine speed	500 rpm	–
2. Battery voltage	10 V	–

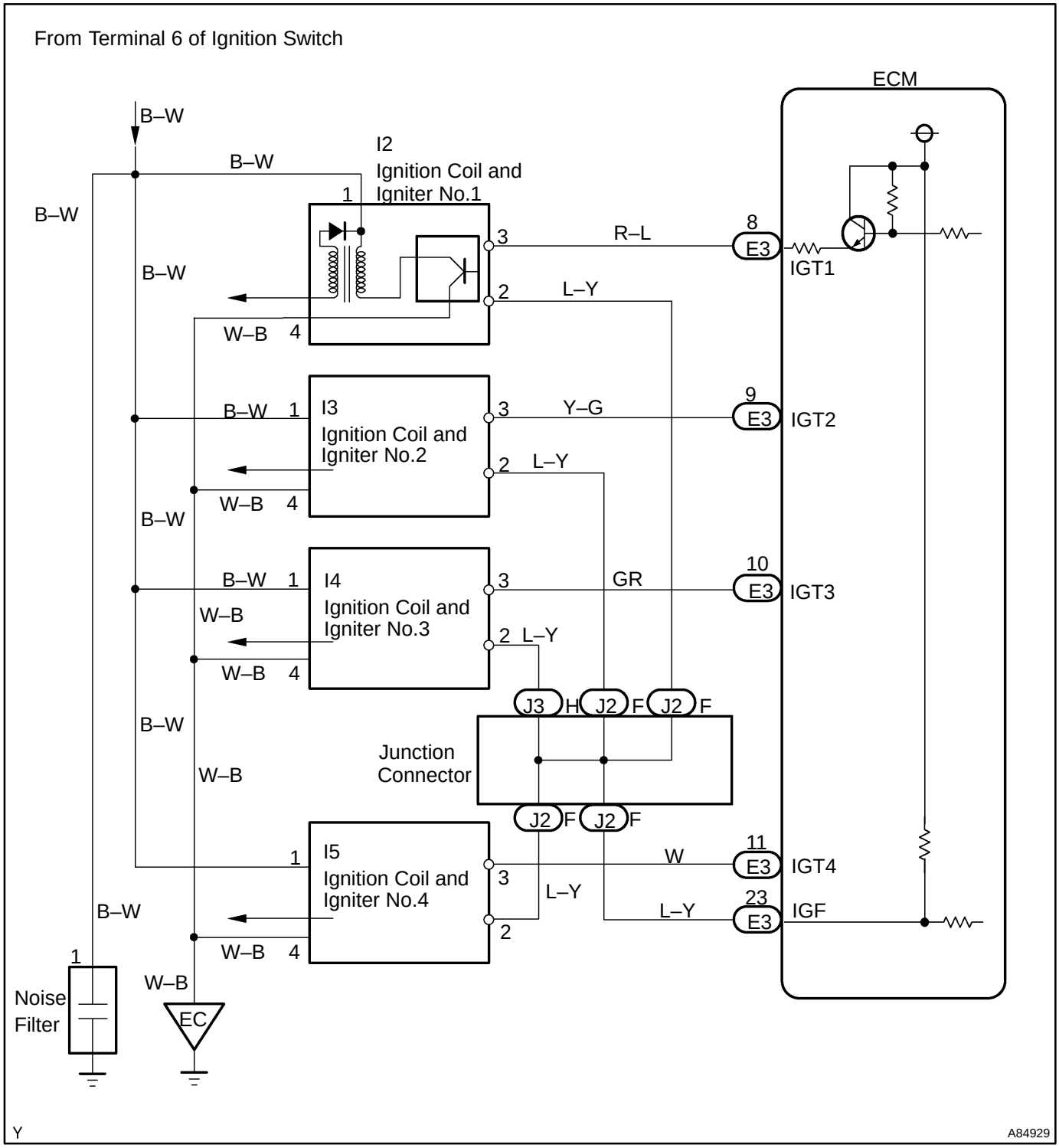
TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Ignition signal fail count	More than 2 times
"Ignition signal fail count" works as follows:	When IGF should have returned despite sending IGT

COMPONENT OPERATING RANGE

Standard Value
Confirmed signal number equals ignition signal number

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1 PERFORM SIMULATION TEST

(a) Clear the DTC (See page 05–9)

(b) Shuffle arrangement of the ignition coil and igniters.

NOTICE:

Do not shuffle the connectors.

(c) Perform the simulation test.

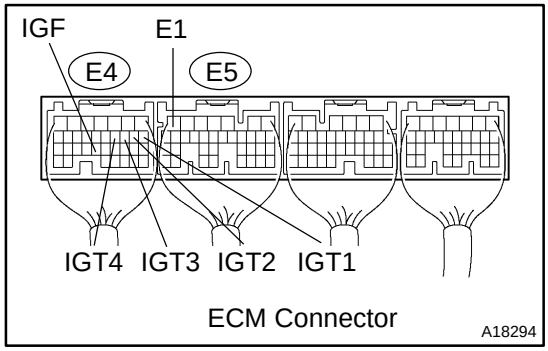
Result:

Display (DTC output)	Proceed to
The same DTC is output again	A
The other DTC is output	B

B → **REPLACE IGNITION COIL ASSY (See page 18–2)**

A

2 INSPECT ECM(IGT1, IGT2, IGT3, IGT4 AND IGF SIGNAL)



(a) Inspection using the oscilloscope.

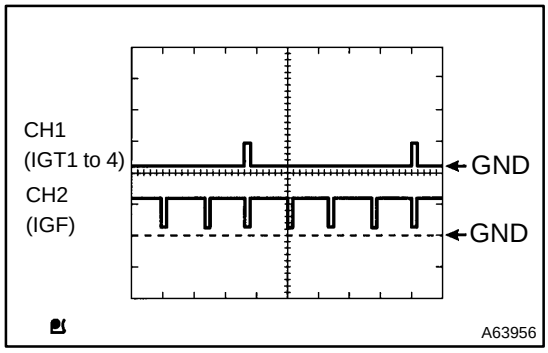
(b) During cranking or idling, check the waveform between terminals IGT1 to IGT4 and E1, IGF and E1 of the ECM connector.

Standard:

Item	Contents
Terminal	CH1: IGT1, IGT2, IGT3, IGT4 – E1 CH2: IGF – E1
Equipment Setting	2V/Division, 20ms/Division
Condition	While the engine is cranking or idling

HINT:

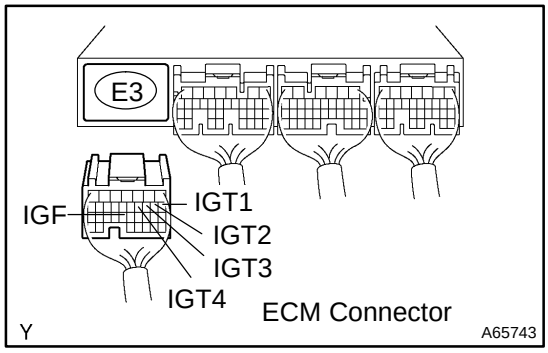
Correct waveform is as shown in the diagram on the left.

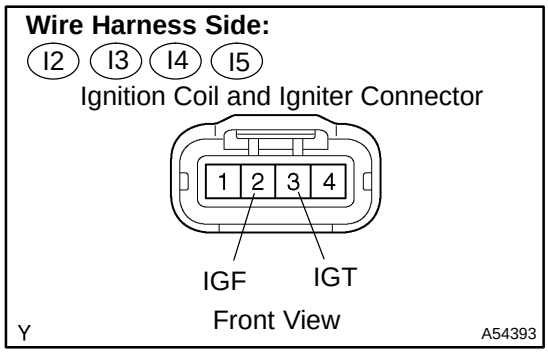


NG → **REPLACE ECM (See page 10–11)**

OK

3 CHECK HARNESS AND CONNECTOR(IGNITION COIL ASSY – ECM)





(a) Disconnect the I2, I3, I4 or I5 ignition coil and igniter connector.

(b) Disconnect the E3 ECM connector.

(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
IGF (I2–2) – IGF (E3–23)	Below 1 Ω
IGF (I3–2) – IGF (E3–23)	
IGF (I4–2) – IGF (E3–23)	
IGF (I5–2) – IGF (E3–23)	

Standard (Check for open):

Tester Connection	Specified Condition
IGT (I2–3) – IGT1 (E3–8)	Below 1 Ω
IGT (I3–3) – IGT2 (E3–9)	
IGT (I4–3) – IGT3 (E3–10)	
IGT (I5–3) – IGT4 (E3–11)	

Standard (Check for short):

Tester Connection	Specified Condition
IGF (I2–2) or IGF (E3–23) – Body ground	10 kΩ or higher
IGF (I3–2) or IGF (E3–23) – Body ground	
IGF (I4–2) or IGF (E3–23) – Body ground	
IGF (I5–2) or IGF (E3–23) – Body ground	

Standard (Check for short):

Tester Connection	Specified Condition
IGT (I2–3) or IGT1 (E3–8) – Body ground	10 kΩ or higher
IGT (I3–3) or IGT2 (E3–9) – Body ground	
IGT (I4–3) or IGT3 (E3–10) – Body ground	
IGT (I5–3) or IGT4 (E3–11) – Body ground	

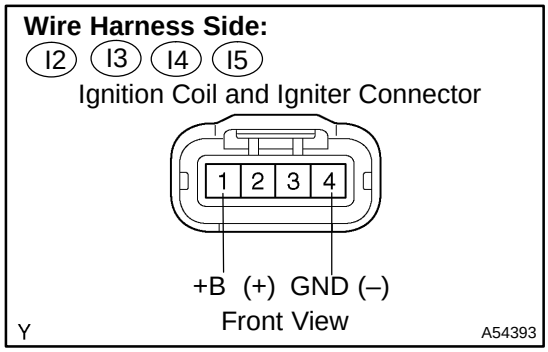
(d) Reconnect the ECM connector.

(e) Reconnect the ignition coil and igniter connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4 INSPECT IGNITION COIL ASSY(POWER SOURCE)



(a) Disconnect the I2, I3, I4 or I5 ignition coil and igniter connector.

(b) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
GND (I1–4) – Body ground	Below 1 Ω
GND (I2–4) – Body ground	
GND (I3–4) – Body ground	
GND (I4–4) – Body ground	

(c) Turn the ignition switch ON position.

(d) Measure the voltage between the terminal of the wire harness side connector and body ground.

Standard:

Tester Connection	Specified Condition
+B (I2–1) – GND (I2–4)	9 to 14 V
+B (I3–1) – GND (I3–4)	
+B (I4–1) – GND (I4–4)	
+B (I5–1) – GND (I5–4)	

(e) Reconnect the ignition coil and igniter connector.

OK → **REPLACE IGNITION COIL ASSY (See page 18–2)**

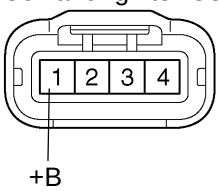
NG

5 CHECK HARNESS AND CONNECTOR(IGNITION COIL ASSY – IGNITION SWITCH)

Wire Harness Side:

(I2) (I3) (I4) (I5)

Ignition Coil and Igniter Connector



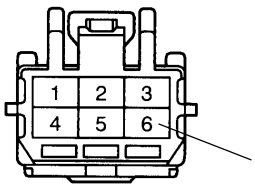
Front View

Y

A54393

Wire Harness Side:

(I10) Ignition Switch Connector



Front View

A66267

(a) Disconnect the I2, I3, I4 or I5 ignition coil and igniter connector.

(b) Disconnect the I10 ignition switch connector.

(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
+B (I2–1) – IG2 (I10–6)	Below 1 Ω
+B (I3–1) – IG2 (I10–6)	
+B (I4–1) – IG2 (I10–6)	
+B (I5–1) – IG2 (I10–6)	

Standard (Check for short):

Tester Connection	Specified Condition
+B (I2–1) or IG2 (I10–6) – Body ground	10 kΩ or higher
+B (I3–1) or IG2 (I10–6) – Body ground	
+B (I4–1) or IG2 (I10–6) – Body ground	
+B (I5–1) or IG2 (I10–6) – Body ground	

(d) Reconnect the ignition coil and igniter connector.

(e) Reconnect the ignition switch connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE IGNITION COIL ASSY (See page 18–2)

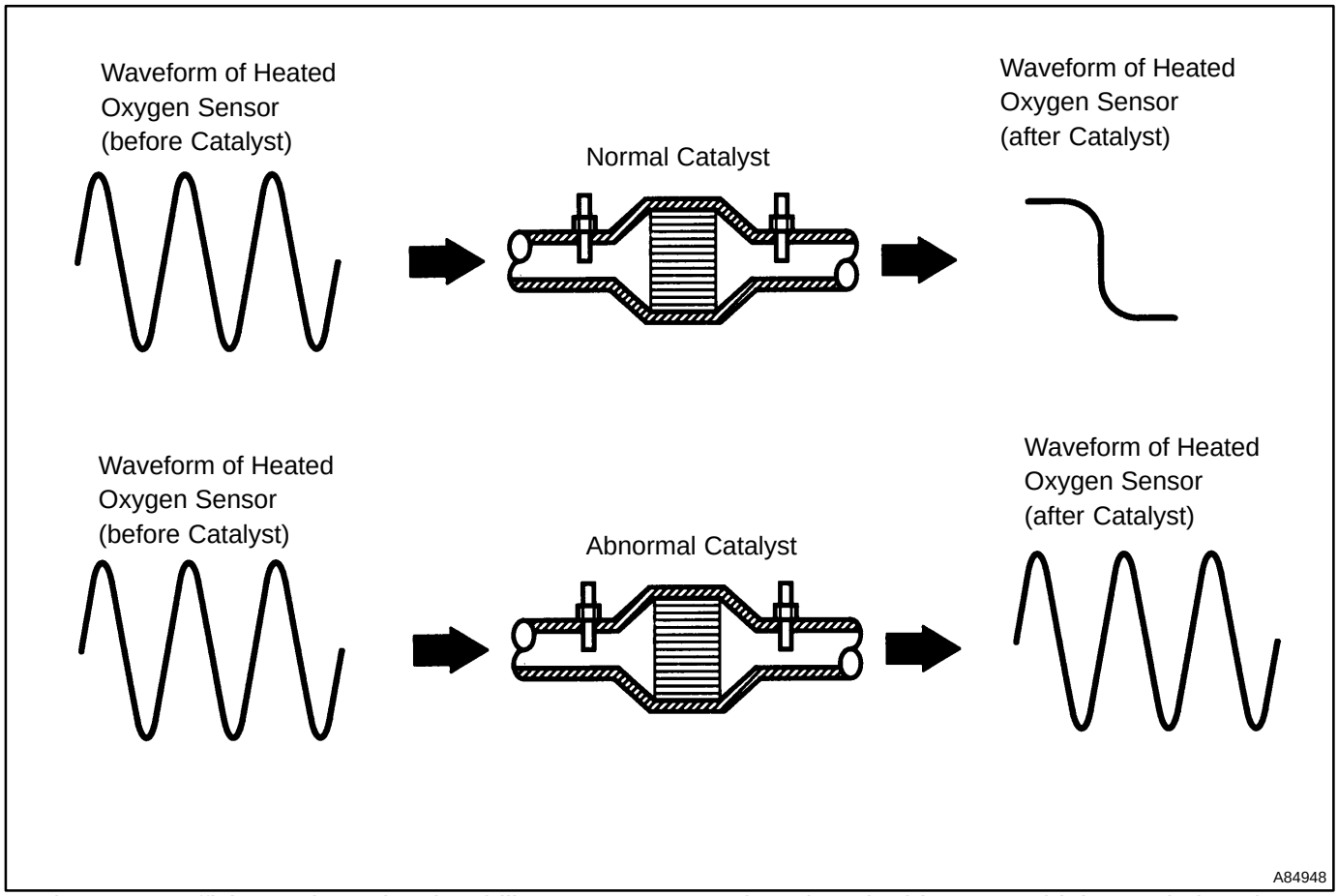
DTC	P0420	CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

CIRCUIT DESCRIPTION

The ECM compares the two waveforms of the heated oxygen sensors located before and after the catalyst to determine whether or not the catalyst performance has deteriorated.
Air–fuel ratio feedback compensation keeps the waveform of the heated oxygen sensor in front of the catalyst alternates between back and forth, from rich to lean.
If the catalyst is functioning normally, the waveform of the heated oxygen sensor behind the catalyst switches back and forth between rich and lean much more slowly than the waveform of the heated oxygen sensor in front of the catalyst.
When both waveforms change at a similar rate, it indicates that the catalyst performance has deteriorated.

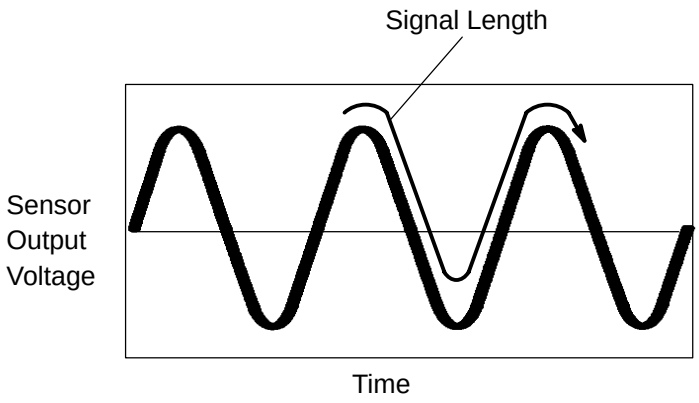
MONITOR DESCRIPTION

The vehicle is equipped with the two oxygen sensors (O2S). One is mounted upstream from the three–way catalytic (TWC) converter (front heated oxygen sensor ”sensor 1”), the second is mounted downstream (heated oxygen sensor ”sensor 2”). The catalyst efficiency monitor compares the sensor 1 and 2 signals in order to calculate TWC ability to store oxygen.
During normal operation, the TWC stores and releases oxygen as needed. This results in low oxygen variations in the post TWC exhaust stream as shown.



As the TWC’s efficiency degrades, its ability to store oxygen is reduced. This causes higher variations in post TWC exhaust stream oxygen content and results in increased sensor 2 signal activity as shown.
When running the monitor, the ECM compares sensor1 and sensor 2 signals over a specific time to determine the TWC efficiency. The ECM begins by calculating the signal length for both sensors.

Heated Oxygen Sensor Signal Length:



DTC No.	DTC Detection Condition	Trouble Area
P0420	After engine and catalyst are warmed up, and while vehicle is driven within set vehicle and engine speed range, waveforms of heated oxygen sensors have same amplitude (2 trip detection logic)	• Gas leakage in exhaust system • Heated oxygen sensor (bank 1 sensor 1, 2) • Three–way catalytic converter

MONITOR STRATEGY

Related DTCs	P0420	Bank 1 catalyst is deterioration
Required sensors/components	Main sensors	Front and rear heated oxygen sensor
	Related sensors	Mass air flow sensor, engine coolant temperature sensor, engine speed sensor, intake air temperature sensor
Frequency of operation	Once per driving cycle	
Duration	90 seconds	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Battery voltage	11 V	–
Intake air temperature	–10°C (14°F)	–
Idle	OFF	
Intake air amount	8.5 g/sec	25 g/sec
Engine speed	–	4,000 rpm
Engine coolant temperature	75°C (167°F)	–
Estimated catalyst temperature conditions are met:	1 and 2	
1. Upstream catalyst	500°C (932°F)	900°C (1,472°F)
2. Downstream catalyst	350°C (932°F)	900°C (1,472°F)
Fuel system status	Closed loop	

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Catalyst deterioration level	0.6 or more
Number of times detection	3 times

COMPONENT OPERATING RANGE

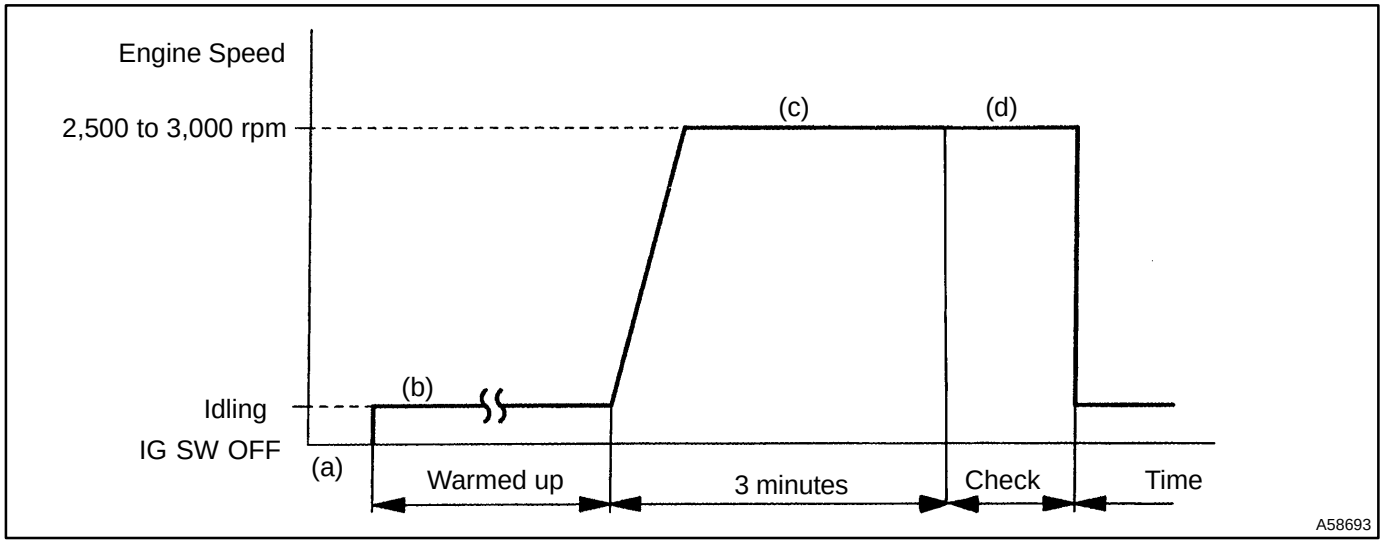
Parameter	Standard Value
Catalyst deterioration level (heated oxygen sensor signal length)	0 to 0.1

MONITOR RESULT (MODE 06 DATA)

Test ID	Comp ID	Description of Test Data	Description of Test Limit	Unit	Conversion Factor
$01	$01	Catalyst deterioration (bank 1) level determined by waveforms of the heated oxygen sensor.	Malfunction criteria for catalyst deterioration	–	Multiply by 0.007812 (no dimension)

Refer to page 05–27 for detailed information on Checking Monitor Status.

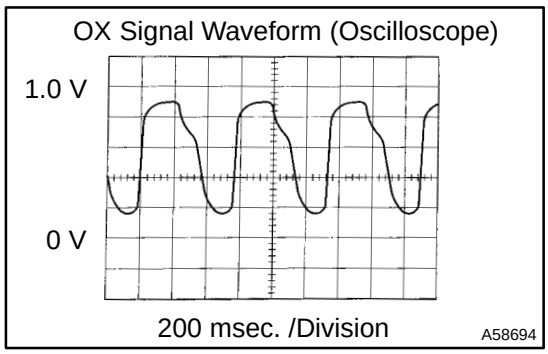
CONFIRMATION DRIVING PATTERN



(a) Connect the hand–held tester to the DLC3, or connect the probe of the oscilloscope between terminals OX1A, OX1B and E1 of the ECM connector.
(b) Start the engine and warm it up with all the accessories switched OFF until the engine coolant temperature becomes stable.
(c) Run the engine at 2,500 to 3,000 rpm for about 3 minutes.
(d) After confirming that the waveform of the bank 1 sensor 1 (OX) which oscillates between 0 V and 1 V under a feedback to the ECM, check the waveform of the bank 1 sensor 2 (OX).

HINT:

If there is malfunction in the system, the waveform of ”sensor 2” (OXL2) may become a similar to the one of ”sensor1” (OXL1) shown in the diagram on the left.



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0420)

(a) Connect the hand–held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Select the item "DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES".
(d) Read the DTCs.

Result:

Display (DTC output)	Proceed to
P0420	A
P0420 and other DTCs	B

HINT:

If any other codes besides P0420 are output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–35)**

A

2	CHECK FOR EXHAUST GAS LEAKAGE

NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT (See page 15–2)**

OK

3	INSPECT HEATED OXYGEN SENSOR(BANK 1 SENSOR 1) (See page 05–101)

Refer to the hint below.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

4	INSPECT HEATED OXYGEN SENSOR(BANK 1 SENSOR 2) (See page 05–128)

Refer to the hint below.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

REPLACE THREE–WAY CATALYTIC CONVERTER(EXHAUST MANIFOLD)

HINT:

Hand–held tester only:

- The following procedure enables the technician to identify a trouble area if malfunction in both front and rear heated oxygen sensors other than the catalyst converter, or the malfunction that indicates the actual air–fuel ratio extremely RICH or LEAN.
- Narrowing down the trouble area is possible by performing ”A/F CONTROL” ACTIVE TEST (heated oxygen sensor or other trouble areas can be distinguished).

(a) Perform ACTIVE TEST using hand–held tester (A/F CONTROL).

HINT:

”A/F CONTROL” is ACTIVE TEST which changes the injection volume –12.5 % or +25 %.

(1) Connect the hand–held tester to the DLC3 on the vehicle.
(2) Turn the ignition switch ON.
(3) Warm up the engine by running the engine speed at 2,500 rpm for approximately 90 seconds.
(4) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL”.
(5) Perform ”A/F CONTROL” with the engine in an idle condition (press the right or left button).

Result:

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume
+25 % → rich output: More than 0.5 V,
–12.5 % → lean output: Less than 0.4 V

NOTICE:

There is a delay of few seconds in the sensor 1 (front sensor) output, and there is about 20 seconds delay at maximum in the sensor 2 (rear sensor).

	Output voltage of heated oxygen sensor (sensor 1: front sensor)	Output voltage of heated oxygen sensor (sensor 2: rear sensor)	Mainly suspect trouble area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4 V **OK**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4 V **OK**	—
Case 2	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4 V **OK**	Sensor 1: front sensor (sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4 V **OK**	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Sensor 2: rear sensor (sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Injection volume +25 % –12.5 % Output voltage No reaction **NG**	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following of A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the heated oxygen sensors.
For displaying the graph indication, enter ”ACTIVE TEST / A/F CONTROL / USER DATA”, then select ”O2S B1S1 and O2S B1S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.

DTC	P0441	EVAPORATIVE EMISSION CONTROL SYSTEM INCORRECT PURGE FLOW

DTC	P0446	EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT

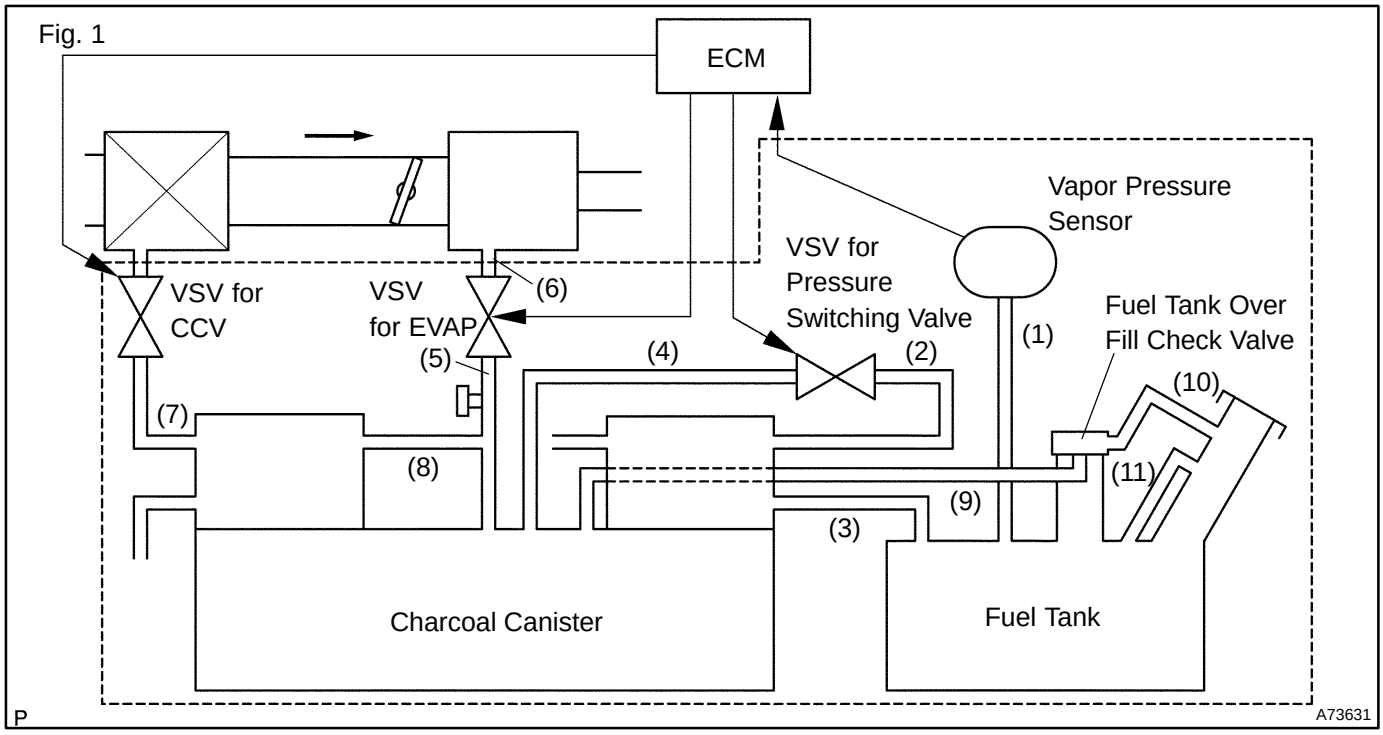
CIRCUIT DESCRIPTION

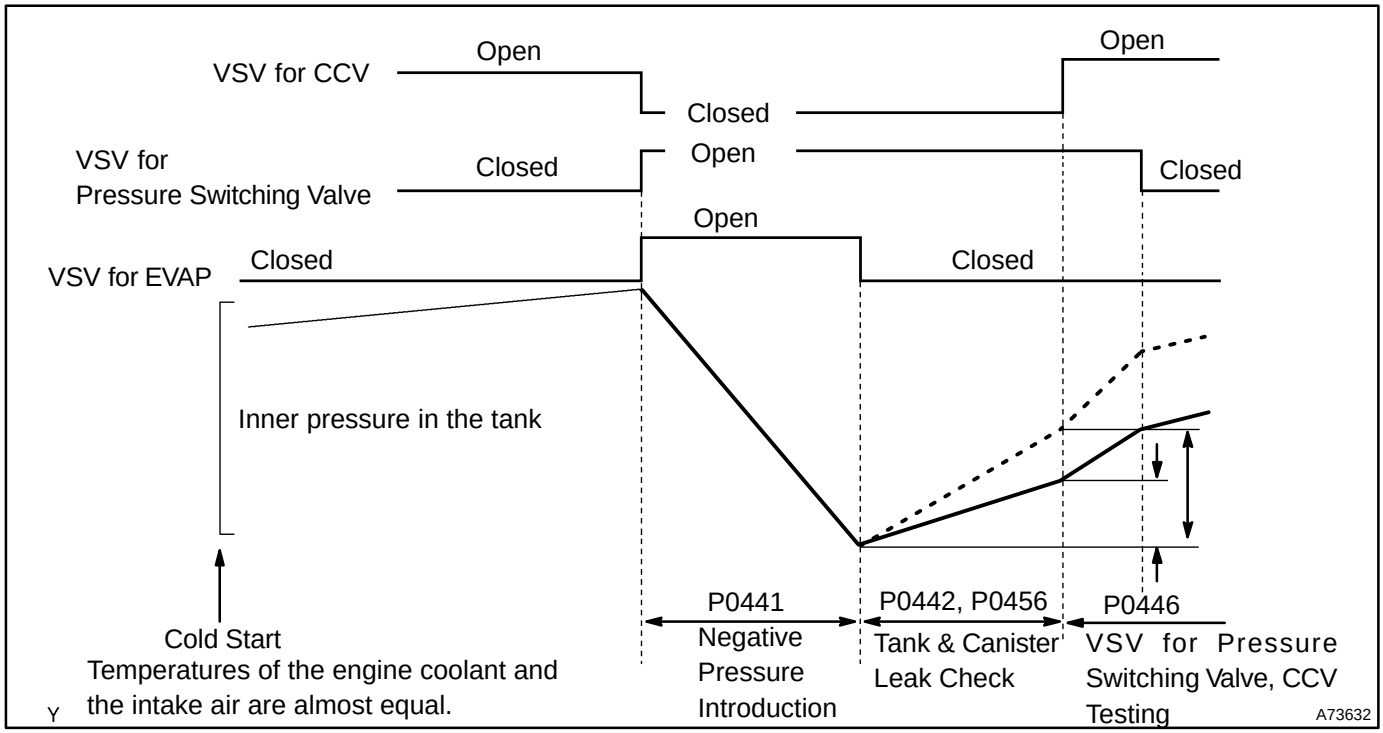
The vapor pressure sensor, VSV for canister closed valve (CCV), VSV for pressure switching valve are used to detect abnormalities in the evaporative emission control system.

The ECM decides whether there is an abnormality in the evaporative emission control system based on the vapor pressure sensor signal.

DTCs P0441 and P0446 are recorded by the ECM when evaporative emissions leak from the components within the dotted line in Fig. 1 below, or when there is malfunction in both VSV for EVAP and VSV for pressure switching valve, or in the vapor pressure sensor itself.

Fig. 1





DTC No.	DTC Detecting Condition	Trouble Area
P0441	Pressure in charcoal canister and fuel tank does not drop during purge control (2 trip detection logic)	• Fuel tank cap incorrectly installed • Fuel tank cap is cracked or damaged • Vacuum hose is cracked, holed, blocked, damaged or disconnected ((1), (2), (3), (4), (5), (6), (7), (8), (9), (10) and (11) in Fig. 1) • Open or short in vapor pressure sensor circuit • Vapor pressure sensor • Open or short in VSV circuit for EVAP • VSV for EVAP • Open or short in VSV circuit for CCV • VSV for CCV • Open or short in VSV circuit for pressure switching valve • VSV for pressure switching valve • Fuel tank is cracked, holed or damaged • Charcoal canister is cracked, holed or damaged • Fuel tank over fill check valve is cracked or damaged • ECM
	During purge cut–off, pressure is very low compared with atmospheric pressure (2 trip detection logic)	
P0446	No rising the fuel tank pressure when commanding the CCV open after an EVAP leak test	
	No changing the fuel tank pressure when commanding the pressure switching valve for the check after the EVAP leak test	
	A high negative pressure (vacuum) does not occurs in the system when commanding the VSV for EVAP open with the CCV closed	

HINT:

Typical DTC output of each trouble part.

Trouble part		Typical DTC output (*1)
Small Leak		P0442 and/or P0456 (*2)
Medium Leak (ex: Vacuum hose loose)		P0442
Large Leak (ex: Fuel tank cap loose)		P0441 and P0442 and P0446
VSV for EVAP	Open Malfunction	P0441
	Close Malfunction	P0441 and P0442 and P0446
VSV for CCV	Open Malfunction	P0441 and P0442 and P0446
	Close Malfunction	P0446
VSV for Pressure Switching	Open Malfunction	P0446
	Close Malfunction	P0441 and P0442 and P0446

*1: ECM may output some other DTCs combination.

*2: Refer to P0442 and P0456 on page 05–218.

MONITOR DESCRIPTION

P0441

The ECM checks for a stuck closed malfunction in the VSV for EVAP by commanding it to open with the CCV closed. If a high negative pressure does not develop inthe fuel tank, the ECM determines that the VSV for EVAP remains closed. The ECM turns on the MIL and a DTC is set.
The ECM checks for VSV for EVAP ”stuck open” fault by commanding both valves (VSV for EVAP and CCV) to close at a time when the fuel tank is at atmospheric pressure. If the fuel tank develops a high negative pressure at this early stage of the test, the ECM determines that the VSV for EVAP is stuck OPEN.
The ECM will turn on the MIL and a DTC is set.

P0446

If there is a malfunction detected in the VSV for evaporative emission (EVAP), the canister closed valve (CCV) and the VSV for bypass valve; the ECM will illuminate the MIL and set a DTC.
This portion of the EVAP diagnosis checks the following EVAP system functions:

(a) CCV stuck closed.
The ECM checks for a CCV ”stuck closed” malfunction by commanding the CCV to open after an EVAP leak test. If the fuel tank pressure does not rise (lose vacuum), the ECM determines that the CCV is stuck closed. The ECM will turn on the MIL and a DTC is set.

(b) VSV for pressure switching valve stuck closed.
The ECM checks for a VSV for pressure switching valve ”stuck closed” malfunction by commanding the VSV for pressure switching valve to close after an EVAP leak test. If the fuel tank pressure does not change, the ECM determines that the VSV for pressure switching valve is malfunctioning. The ECM will turn on the MIL and a DTC is set.

(c) VSV for EVAP (Purge line to intake manifold) stuck closed.
The ECM checks for a stuck closed malfunction in the VSV for EVAP by commanding it to open with the CCV closed. If a high negative pressure does not develop inthe fuel tank, the ECM determines that the VSV for EVAP remains closed. The ECM turns on the MIL and a DTC is set.

MONITOR STRATEGY

DTCs	P0441	VSV for EVAP malfunction
	P0446	Canister close valve stuck closed VSV for pressure switching valve malfunction VSV for EVAP malfunction
Required sensors/components	Main	Vapor pressure sensor
	Sub	Engine coolant temperature sensor, intake air temperature sensor, vehicle speed sensor
Frequency of operation	Once per drive cycle	
Duration	P0441 : 90 seconds P0446 : 10 seconds	
MIL operation	2 drive cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Criteria	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
The same as that for DTC P0442		

TYPICAL MALFUNCTION THRESHOLDS

P0441

Detection Criteria	Threshold
Following conditions (a) and (b) are met:	–
(a) Fuel tank pressure is –1.6 kPa (–12 mmhg) or more at the vacuum introduction start	–
(b) Difference between the fuel tank pressures at the vacuum introduction start and completion	Less than 0.9 kPa (7 mmHg)
Following conditions are met for 14 seconds	A and B
A. Difference between "minimum fuel tank pressure before leak check" and "fuel tank pressure when 14seconds after leak check"	0.5 kPa or more (3.5 mmHg)
B. Fuel tank pressure at 14 seconds after leak check	Less than – 3.7 kPa (–28 mmHg)

P0446

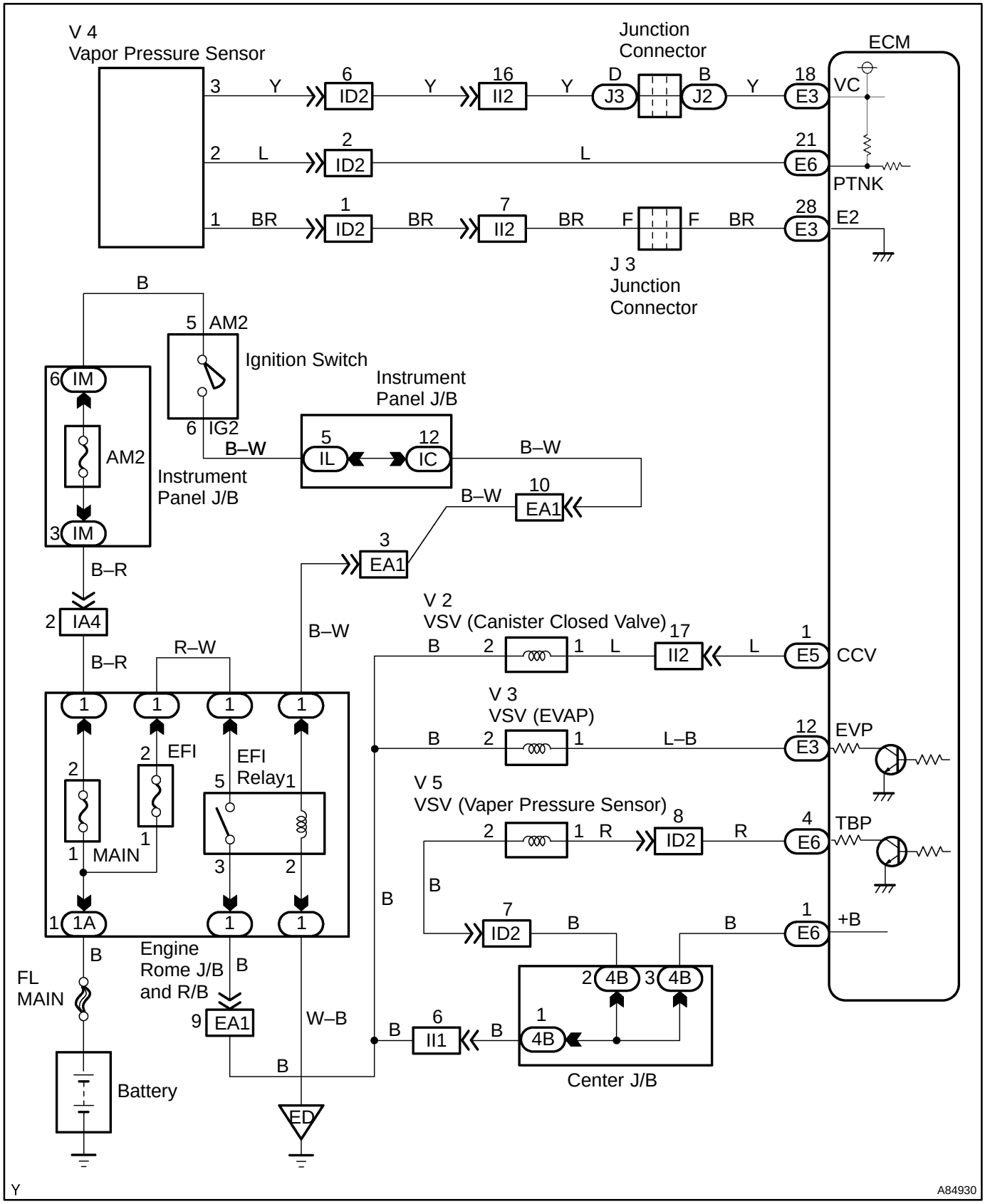
Detection Criteria	Threshold
Case 1: CCV stuck closed	
Fuel tank pressure when the CCV is opened after an EVAP leak check	Not changing
Case 2: VSV for pressure switching valve malfunction	
Fuel tank pressure when the VSV for bypass valve is closed after an EVAP leak check	Not changing
Case 3: VSV for EVAP stuck closed	
Fuel tank pressure after the VSV for EVAP is opened and manifold vacuum is introduced to the fuel tank	Not changing

MONITOR RESULT (MODE 06 DATA)

Test ID	Comp ID	Description of Test Data	Description of Test Limit	Unit	Conversion Factor
$02	$81	Tank pressure change value during vacuum introduction	Malfunction criteria for VSV for EVAP	mmHg	Multiply by 0.0916
	$82	Fuel tank pressure change value at switching over the canister close valve or VSV for pressure switching valve.	Malfunction criteria for canister close valve and VSV for pressure switching valve	mmHg	Multiply by 0.0458 minus 2.930
	$03	Fuel tank pressure change 5 seconds after the end the vacuum introduction cycle Conditions: • VSV for EVAP: Closed • CCV: Closed • VSV for bypass valve: Open	Malfunction criteria for 0.040 leak	mmHg	Multiply by 0.0458
	$04		Malfunction criteria for 0.020 leak	mmHg	Multiply by 0.0458

Refer to page 05–27 for the detailed information on Checking Monitor Status.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTC P0441 (Purge Flow), P0446 (VSV for CCV or VSV for Pressure switching valve), P0451, P0452 or P0453 (See page 05–242) is output with DTC P0442 or P0456 (See page 05–218), first troubleshoot DTC P0441, P0446, P0451, P0452 or P0453. If no malfunction is detected, troubleshoot DTC P0442 or P0456 next.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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 the ENGINE RUN TIME in the freeze frame data is less than 200 seconds, carefully check the vapor pressure sensor.

Hand–held Tester:

1	CHECK FUEL TANK CAP ASSY(CHECK THAT FUEL TANK CAP IS TOYOTA GENUINE PARTS)

NG → REPLACE TO TOYOTA GENUINE PARTS

OK

2	CHECK THAT FUEL TANK CAP IS CORRECTLY INSTALLED

NG → CORRECTLY INSTALL FUEL TANK CAP

OK

3	INSPECT FUEL TANK CAP ASSY (See page 12–1)

NG → REPLACE FUEL TANK CAP ASSY

OK

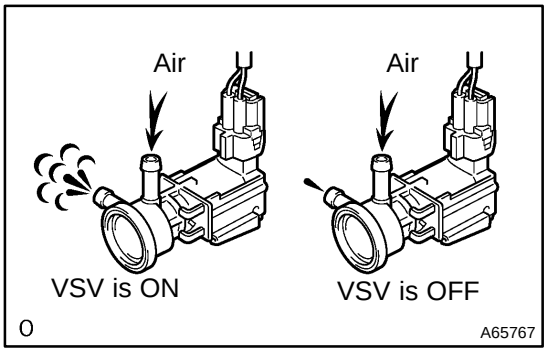
4	CHECK FILLER NECK FOR DAMAGE

(a) Remove the fuel tank cap.
(b) Visually check the fuel inlet pipe for damage.
(c) Reinstall the fuel tank cap.

NG → REPLACE FUEL TANK INLET PIPE SUB–ASSY

OK

5	PERFORM ACTIVE TEST BY HAND–HELD TESTER(CHECK FOR EVAP PURGE FLOW)



(a) Select the item ”DIAGNOSIS/ENHANCED OBD II/ACTIVE TEST” mode on the hand–held tester.
(b) Disconnect the vacuum hose of the VSV for EVAP from the charcoal canister.
(c) Start the engine.
(d) Select the item ”EVAP VSV (ALON)/ALL” in the ACTIVE TEST and operate EVAP VSV (Press the right or left button).
(e) When the VSV for the EVAP is operated by the hand–held tester, check whether the disconnected hose applies suction to your finger.
Result:
VSV is ON: Disconnected hose sucks.
VSV is OFF: Disconnected hose does not suck.
(f) Reconnect the vacuum hose.

OK	Go to step 9

NG

6	CHECK VACUUM HOSES(INTAKE MANIFOLD – VSV FOR EVAP, VSV FOR EVAP – CHARCOAL CANISTER)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole, damage and blockage.

NG	REPAIR OR REPLACE VACUUM HOSE

OK

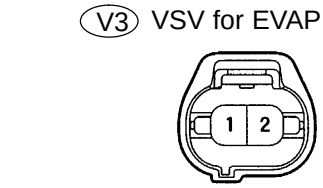
7	INSPECT VSV FOR EVAP(OPERATION) (See page 12–1)

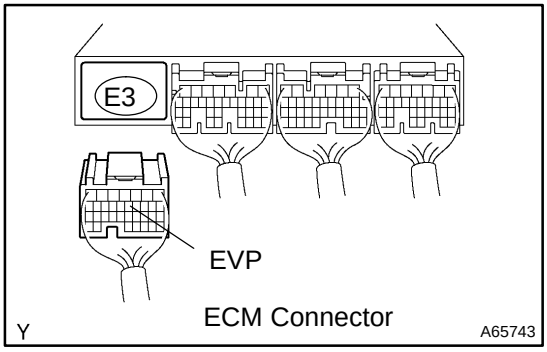
NG	REPLACE VSV FOR EVAP

OK

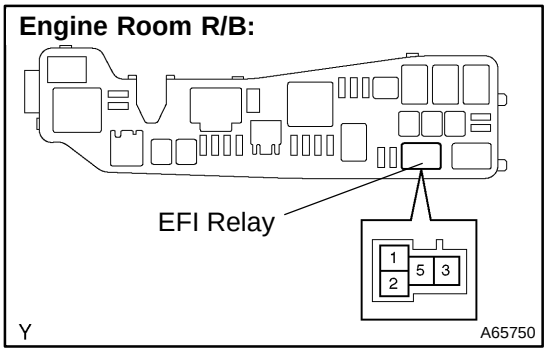
8	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR EVAP, VSV FOR EVAP – ECM)

Wire Harness Side:





Engine Room R/B:



(a) Check the harness and the connector between the VSV for EVAP and the ECM.
  (1) Disconnect the V3 VSV for EVAP connector.
  (2) Disconnect the E3 ECM connector.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for EVAP (V3–1) – EVP (E3–12)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for EVAP (V3–1) or EVP (E3–12) – Body ground	10 kΩ or higher

  (4) Reconnect the VSV for EVAP connector.
  (5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for EVAP and the EFI relay.
  (1) Disconnect the V3 VSV for EVAP connector.
  (2) Remove the EFI relay from the engine room R/B.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for EVAP (V3–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for EVAP (V3–2) or EFI relay (3) – Body ground	10 kΩ or higher

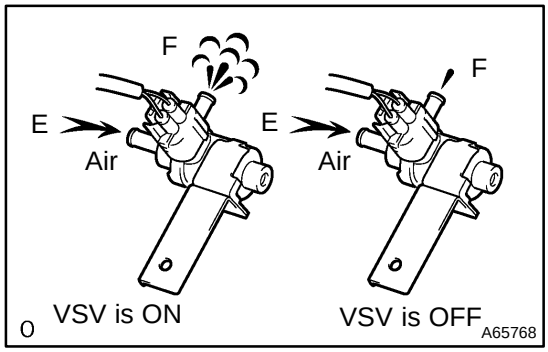
  (4) Reconnect the VSV for EVAP connector.
  (5) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

9	PERFORM ACTIVE TEST BY HAND–HELD TESTER(VSV FOR CCV)



(a) Disconnect the vacuum hose of the VSV for CCV from the charcoal canister.
(b) Start the engine.
(c) Select the item ”DIAGNOSIS/ENHANCED OBD II/ACTIVE TEST” mode on the hand–held tester.
(d) Select the item ”CAN CTRL VSV/ALL” in the ACTIVE TEST and operate CAN CTRL VSV (Press the right or left button).
(e) Check the VSV operation when it is operated by the hand–held tester.
Result:
VSV is ON: Air from port E flows out through port F.
VSV is OFF: Air does not flow from port E to port F.

OK	Go to step 13

NG

10	CHECK VACUUM HOSES(VSV FOR CCV – CHARCOAL CANISTER)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole, damage and blockage.

NG	REPAIR OR REPLACE VACUUM HOSES

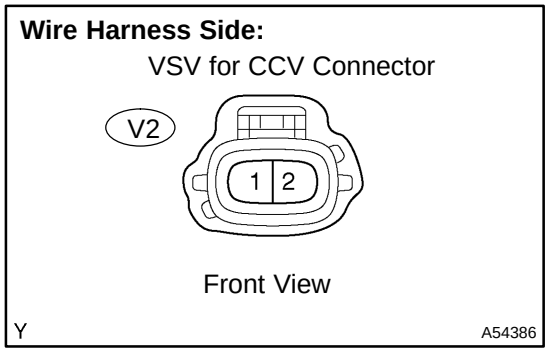
OK

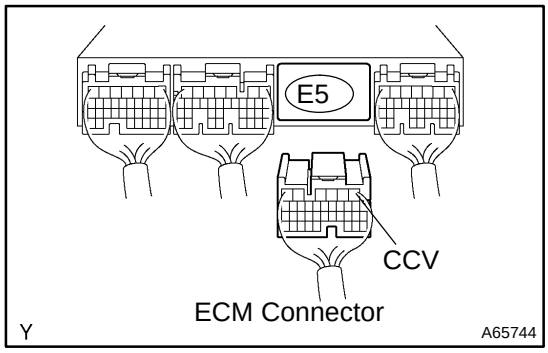
11	INSPECT VSV FOR CCV(OPERATION) (See page 12–6)

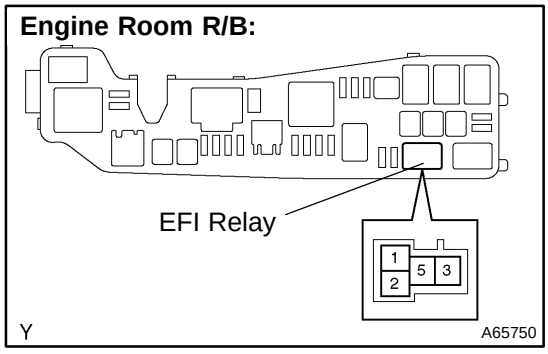
NG	REPLACE VSV FOR CCV

OK

12	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR CCV, VSV FOR CCV – ECM)







(a) Check the harness and connector between the VSV for CCV and ECM.
  (1) Disconnect the V2 VSV for CCV connector.
  (2) Disconnect the E5 ECM connector.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for CCV (V2–1) – CCV (E5–1)	Below 1 Ω

Tester Connection	Specified Condition
VSV for CCV (V2–1) or CCV (E5–1) – Body ground	10 kΩ or higher

  (4) Reconnect the VSV for CCV connector.
  (5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for CCV and the EFI relay.
  (1) Disconnect the V2 VSV for CCV connector.
  (2) Remove the EFI relay from the engine room R/B.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for CCV (V2–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for CCV (V2–2) or EFI relay (3) – Body ground	10 kΩ or higher

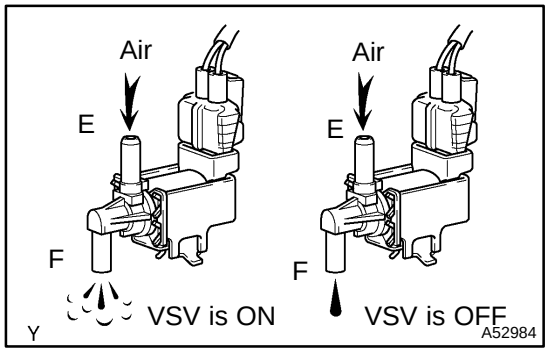
  (4) Reconnect the VSV for CCV connector.
  (5) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

13	PERFORM ACTIVE TEST BY HAND–HELD TESTER(VSV FOR PRESSURE SWITCHING VALVE)



(a) Select the item ”DIAGNOSIS/ENHANCED OBD II/ACTIVE TEST” mode on the hand–held tester.

(b) Select the item ”TANK BYPASS VSV/ALL” in the ACTIVE TEST and operate TANK BYPASS VSV (Press the right or left button).

(c) Check the VSV operation when it is operated by the hand–held tester.

Result:

VSV is ON: Air from port E flows out through port F.

VSV is OFF: Air does not flow from port E to port F.

OK	Go to step 16

NG

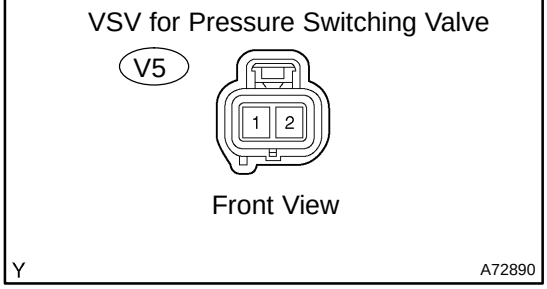
14	INSPECT VSV FOR PRESSURE SWITCHING VALVE(OPERATION)

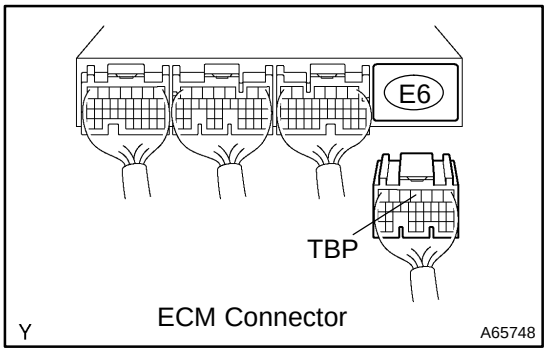
NG	REPLACE VSV FOR PRESSURE SWITCHING VALVE

OK

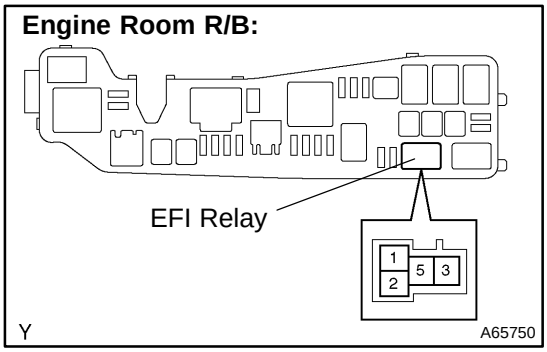
15	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR PRESSURE SWITCHING VALVE, VSV FOR PRESSURE SWITCHING VALVE – ECM)

Wire Harness Side:





Engine Room R/B:



(a) Check the harness and the connector between the VSV for pressure switching valve and the ECM.

(1) Disconnect the V5 VSV for pressure switching valve connector.

(2) Disconnect the E6 ECM connector.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–1) – TBP (E6–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–1) or TBP (E6–4) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for pressure switching valve connector.

(5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for pressure switching valve and the EFI relay.

(1) Disconnect the V5 VSV for pressure switching valve connector.

(2) Remove the EFI relay from the engine room R/B.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–2) or EFI relay (3) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for pressure switching valve connector.

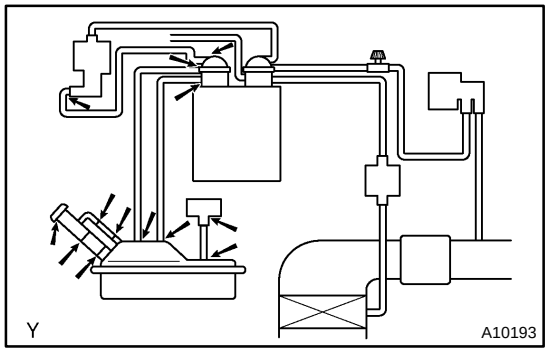
(5) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

16 CHECK FOR EVAPORATIVE EMISSIONS LEAK(NEAR FUEL TANK)



(a) Check whether hoses close to the fuel tank have been modified, and check if there are signs of any accident near the fuel tank.
  (1) Check the following parts for cracks, deformation or loose connection:
    - Fuel tank
    - Fuel tank filler pipe
    - Hoses and tubes around fuel tank

NG → **REPAIR OR REPLACE EVAPORATIVE EMISSIONS LEAK PART**

OK

17 CHECK VACUUM HOSES(VAPOR PRESSURE SENSOR – FUEL TANK, CHARCOAL CANISTER – VSV FOR PRESSURE SWITCHING VALVE)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole and damage.

NG → **REPAIR OR REPLACE VACUUM HOSE**

OK

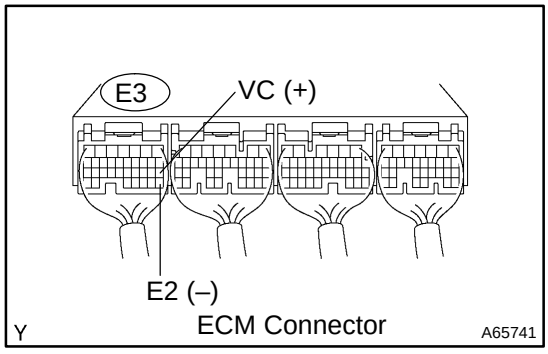
18 CHECK HOSE AND TUBE(FUEL TANK – CHARCOAL CANISTER)

(a) Check the connection between the fuel tank and fuel EVAP pipe, the fuel EVAP pipe and under–floor fuel tube, the under–floor fuel tube and charcoal canister.
(b) Check the hose and the tube for cracks, hole and damage.

NG → **REPAIR OR REPLACE HOSE AND TUBE**

OK

19 INSPECT ECM(VC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E3 ECM connector.

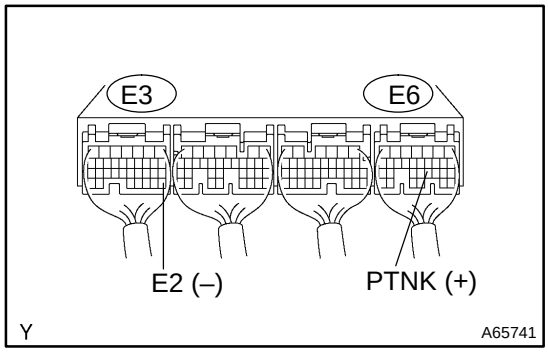
Standard:

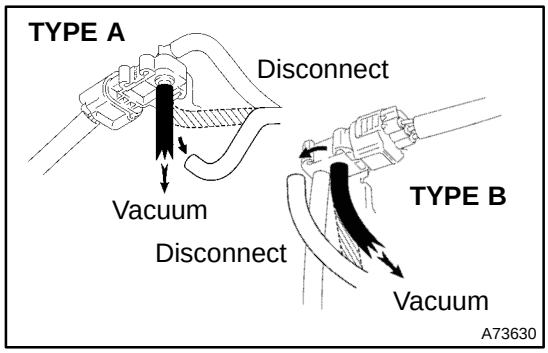
Tester Connection	Specified Condition
VC (E3–18) – E2 (E3–28)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–11)**

OK

20 INSPECT ECM(PTNK VOLTAGE)





(a) Turn the ignition switch ON.
(b) Measure the voltage between terminals of the E3 and E6 ECM connectors.
(1) Disconnect the vacuum hose from the vapor pressure sensor.

Standard (1):

Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	2.9 to 3.7 V

NOTICE:
The vacuum applied to the vapor pressure sensor must be less than 66.7 kPa (500 mmHg, 19.7 in.Hg).

(2) Using the MITYVAC (Hand–held Vacuum Pump), apply a vacuum of 4.0 kPa (30 mmHg, 1.18 in.Hg) to the vapor pressure sensor.

Standard (2):

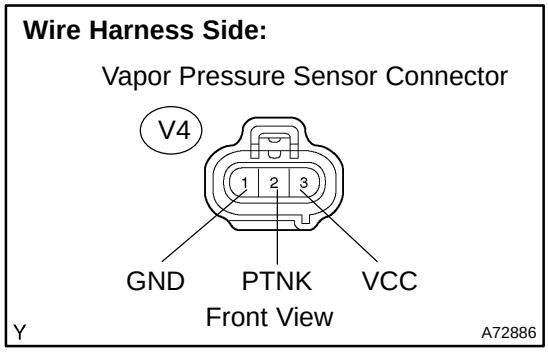
Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	0.5 V or less

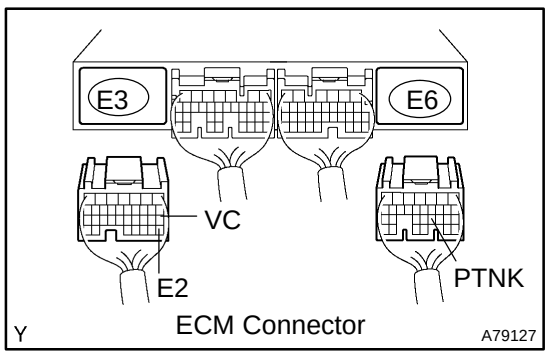
(3) Reconnect the vacuum hose.

OK → **Go to step 22**

NG

21 CHECK HARNESS AND CONNECTOR(VAPOR PRESSURE SENSOR – ECM)





(a) Disconnect the V4 vapor pressure sensor connector.
(b) Disconnect the E3 and E6 ECM connectors.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
PTNK (V4–2) – PTNK (E6–21)	Below 1 Ω
GND (V4–1) – E2 (E3–28)	
VCC (V4–3) – VC (E3–18)	

Standard (Check for short):

Tester Connection	Specified Condition
PTNK (V4–2) or PTNK (E6–21) – Body ground	10 kΩ or higher
VCC (V4–3) or VC (E3–18) – Body ground	

(d) Reconnect the vapor pressure sensor connector.
(e) Reconnect the ECM connectors.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

22	INSPECT FUEL TANK INLET VALVE ASSY

NG → REPLACE FUEL TANK INLET VALVE ASSY

OK

23	INSPECT FUEL TANK ASSY

NG → REPLACE FUEL TANK ASSY

OK

24	INSPECT CHARCOAL CANISTER ASSY(CRACKS, HOLE AND DAMAGE)

NG → REPAIR OR REPLACE CHARCOAL CANISTER ASSY

OK

REPLACE ECM (See page 10–11)

OBDII scan tool (excluding Hand–held Tester):

1	CHECK FUEL TANK CAP ASSY(CHECK THAT FUEL TANK CAP IS TOYOTA GEHUINE PARTS)

NG → REPLACE TO GENUINE PARTS

OK

2	CHECK THAT FUEL TANK CAP IS CORRECTLY INSTALLED

NG → CORRECTLY INSTALL FUEL TANK CAP

OK

3	INSPECT FUEL TANK CAP ASSY (See page 12–1)

NG → REPLACE FUEL TANK CAP ASSY

OK

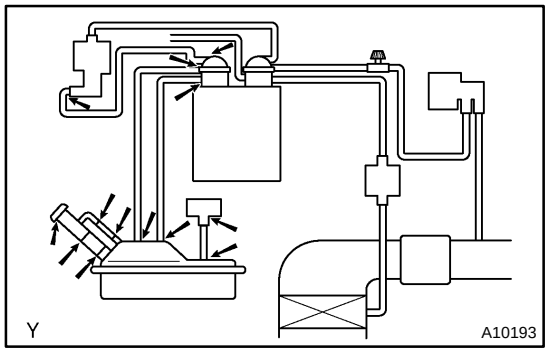
4	CHECK FILLER NECK FOR DAMAGE

(a) Remove the fuel tank cap.
(b) Visually check the fuel inlet pipe for damage.

NG → REPLACE FUEL TANK INLET PIPE SUB–ASSY

OK

5	CHECK FOR EVAPORATIVE EMISSIONS LEAK(NEAR FUEL TANK OR CHACOAL CANISTER)



(a) Check whether hoses close to the fuel tank have been modified, and check if there are signs of any accident near the fuel tank or the charcoal canister.
  (1) Check the following parts for cracks, deformation or loose connection:
    - Fuel tank
    - Charcoal canister
    - Fuel tank filler pipe
    - Hoses and tubes around fuel tank and charcoal canister

NG → REPAIR OR REPLACE EVAPORATIVE EMISSIONS LEAK PART

OK

6	CHECK VACUUM HOSES(VAPOR PRESSURE SENSOR – FUEL TANK, CHARCOAL CANISTER – VSV FOR PRESSURE SWITCHING VALVE)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole and damage.

NG → REPAIR OR REPLACE VACUUM HOSE

OK

7	CHECK HOSE AND TUBE(FUEL TANK – CHARCOAL CANISTER)

(a) Check the connection between the fuel tank and fuel EVAP pipe, the fuel EVAP pipe and under floor fuel tube , the under floor fuel tube and charcoal canister.
(b) Check the hose and the tube for cracks, hole and damage.

NG → REPAIR OR REPLACE HOSE AND TUBE

OK

8	CHECK VACUUM HOSES((5), (6), (7), (8) AND (9) IN FIG. 1 IN CIRCUIT DESCRIPTION)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole and damage.

NG → REPAIR OR REPLACE VACUUM HOSES

OK

9	CHECK EACH VSV CONNECTOR FOR LOOSENESS AND DISCONNECTION(VSV FOR EVAP, VSV FOR CCV, VSV FOR PRESSURE SWITCHING VALVE)

NG → REPAIR OR CONNECT VSV AND SENSOR CONNECTOR

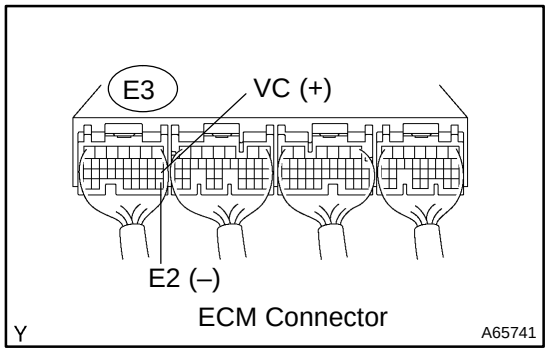
OK

10	INSPECT CHARCOAL CANISTER ASSY(CRACKS, HOLE AND DAMAGE)

NG → CHECK AND REPLACE CHARCOAL CANISTER ASSY

OK

11	INSPECT ECM(VC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure voltage between the terminals of the E3 ECM connector.

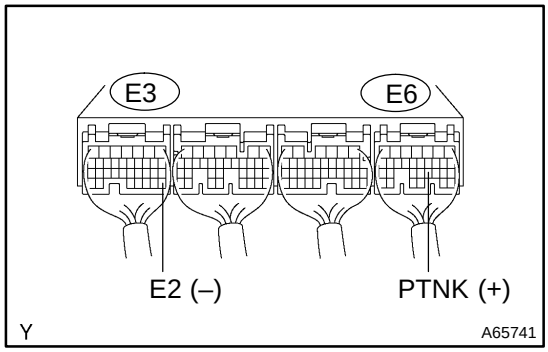
Standard:

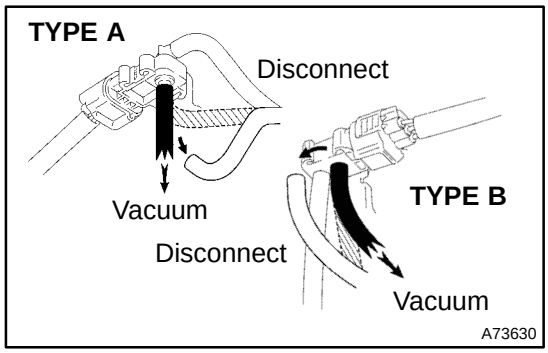
Tester Connection	Specified Condition
VC (E3–18) – E2 (E3–28)	4.5 to 5.5 V

NG → REPLACE ECM (See page 10–11)

OK

12	INSPECT ECM(PTNK VOLTAGE)





(a) Turn the ignition switch ON.

(b) Measure the voltage between terminals of the E3 and E6 ECM connectors.

(1) Disconnect the vacuum hose from the vapor pressure sensor.

Standard (1):

Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	2.9 to 3.7 V

NOTICE:

The vacuum applied to the vapor pressure sensor must be less than 66.7 kPa (500 mmHg, 19.7 in.Hg).

(2) Using the MITYVAC (Hand–held Vacuum Pump), apply a vacuum of 4.0 kPa (30 mmHg, 1.18 in.Hg) to the vapor pressure sensor.

Standard (2):

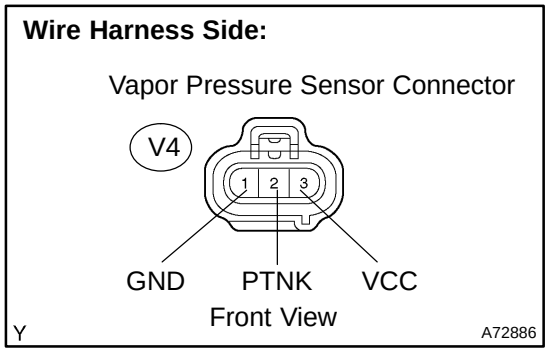
Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	0.5 V or less

(3) Reconnect the vacuum hose from the vapor pressure sensor.

OK → **Go to step 14**

NG

13 CHECK HARNESS AND CONNECTOR(VAPOR PRESSURE SENSOR – ECM)



(a) Disconnect the V4 vapor pressure sensor connector.
(b) Disconnect the E3 and E6 ECM connectors.
(c) Check the resistance between the wire harness side connectors.

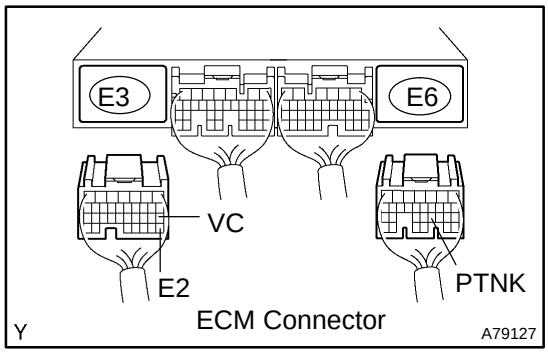
Standard (Check for open):

Tester Connection	Specified Condition
PTNK (V4–2) – PTNK (E6–21)	Below 1 Ω
GND (V4–1) – E2 (E3–28)	
VCC (V4–3) – VC (E3–18)	

Standard (Check for short):

Tester Connection	Specified Condition
PTNK (V4–2) or PTNK (E6–21) – Body ground	10 kΩ or higher
VCC (V4–3) or VC (E3–18) – Body ground	

(d) Reconnect the vapor pressure sensor connector.
(e) Reconnect the ECM connectors.

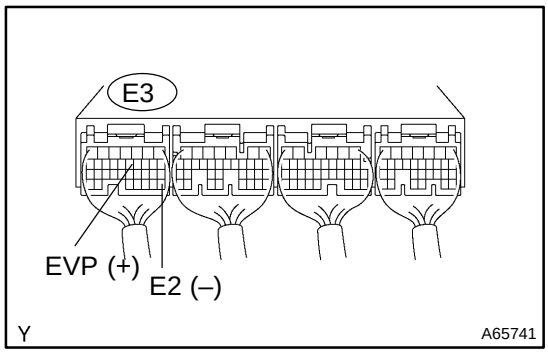


NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

14 INSPECT VSV FOR EVAP(FUNCTION)

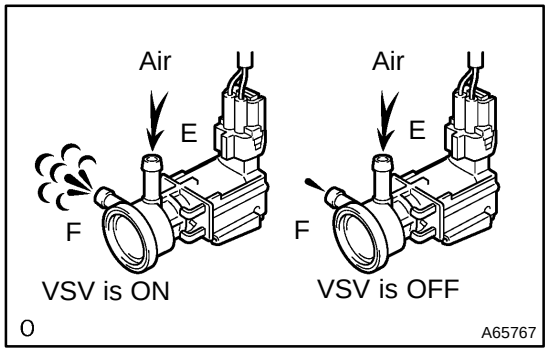


(a) Turn the ignition switch ON.
(b) Check the VSV function.
(1) Connect between terminals EVP and E2 of the ECM connector (VSV ON).

VSV is ON:
Air from port E flows out through port F

(2) Disconnect between terminals EVP and E2 of the ECM connector (VSV OFF).

VSV is OFF:
Air does not flow port E to port F



OK → **Go to step 17**

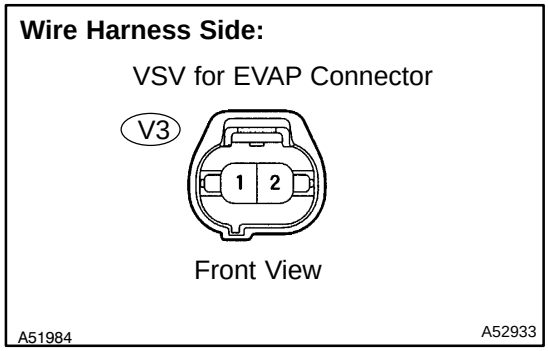
NG

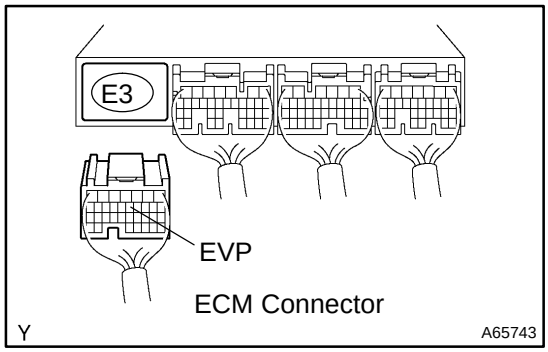
15	INSPECT VSV FOR EVAP(OPERATION) (See page 12–6)

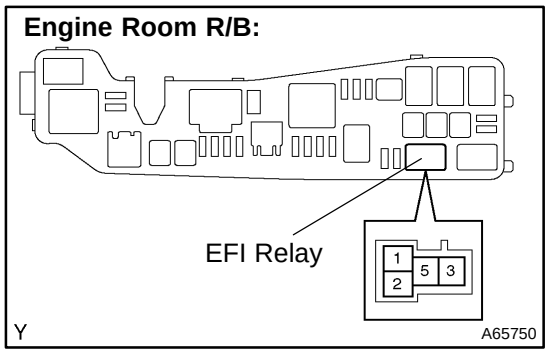
NG → REPLACE VSV FOR EVAP

OK

16	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR EVAP, VSV FOR EVAP – ECM)







(a) Check the harness and between the VSV for EVAP and the ECM connector.
(1) Disconnect the V3 VSV for EVAP connector.
(2) Disconnect the E3 ECM connector.
(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for EVAP (V3–1) – EVP (E3–12)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for EVAP (V3–1) or EVP (E3–12) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for EVAP connector.
(5) Reconnect the ECM connector.

(b) Check the harness and connector between the VSV for EVAP and the EFI relay.
(1) Disconnect the V3 VSV for EVAP connector.
(2) Remove the EFI relay from the engine room R/B.
(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for EVAP (V3–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for EVAP (V3–2) or EFI relay (3) – Body ground	10 kΩ or higher

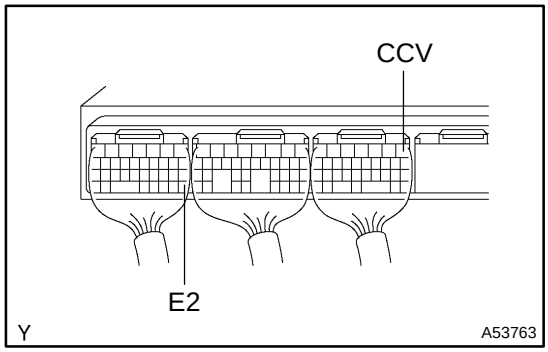
(4) Reconnect the VSV for EVAP connector.
(5) Reinstall the EFI relay.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

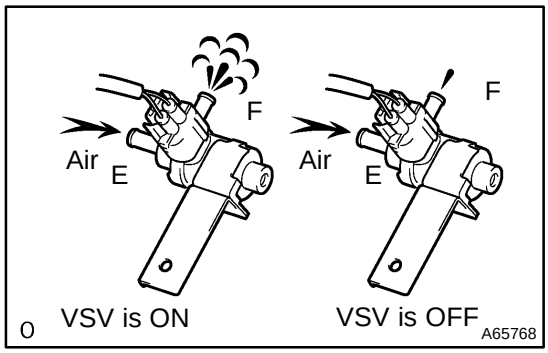
OK

REPLACE ECM (See page 10–11)

17	INSPECT VSV FOR CCV(FUNCTION)



(a) Turn the ignition switch ON.
(b) Check the VSV function.
(1) Connect between terminals CCV and E2 of the ECM connector (VSV ON).
VSV is ON:
Air from port E flows out through port F
(2) Disconnect between terminals CCV and E2 of the ECM connector (VSV OFF).
VSV is OFF:
Air does not flow from port E to port F



OK → **Go to step 20**

NG

18	INSPECT VSV FOR CCV(OPERATION) (See page 12–6)

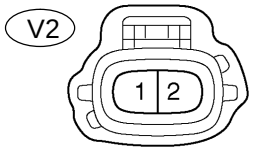
NG → **REPLACE VSV FOR CCV**

OK

19	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR CCV, VSV FOR CCV – ECM)

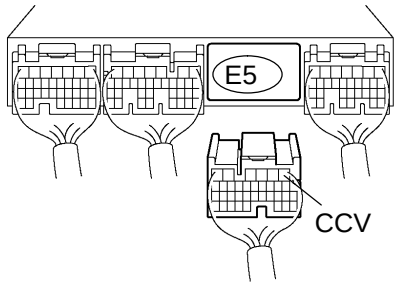
Wire Harness Side:

VSV for CCV Connector



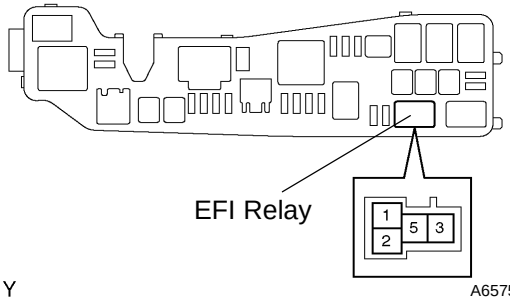
Front View

Y A54386



Y ECM Connector A65744

Engine Room R/B:



Y A65750

(a) Check the harness and the connector between the VSV for CCV and the ECM.
  (1) Disconnect the V2 VSV for CCV connector.
  (2) Disconnect the E5 ECM connector.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for CCV (V2–1) – CCV (E5–1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for CCV (V2–1) or CCV (E5–1) – Body ground	10 kΩ or higher

  (4) Reconnect the VSV for CCV connector.
  (5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for CCV and the EFI relay.
  (1) Disconnect the V2 VSV for CCV connector.
  (2) Remove the EFI relay from the engine room R/B.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for CCV (V2–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for CCV (V2–2) or EFI relay (3) – Body ground	10 kΩ or higher

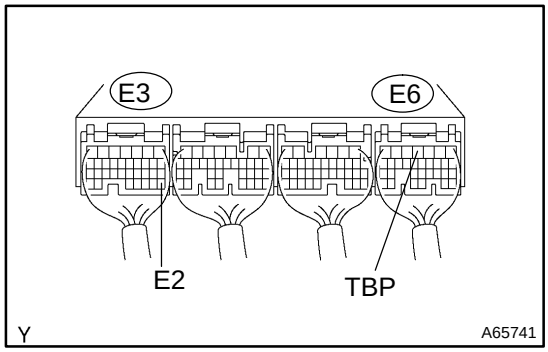
  (4) Reconnect the VSV for CCV connector.
  (5) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

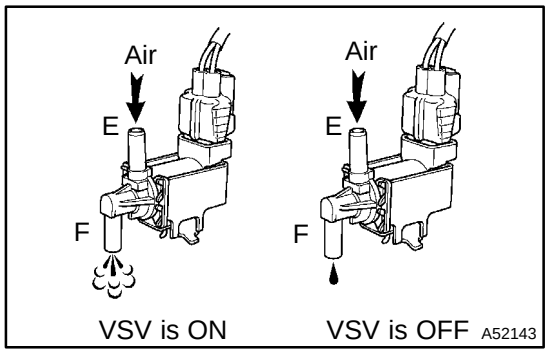
OK

REPLACE ECM (See page 10–11)

20	INSPECT VSV FOR PRESSURE SWITCHING VALVE(FUNCTION)



(a) Turn the ignition switch ON.
(b) Check the VSV function.
(1) Connect between terminals TBP and E2 of the ECM connector (VSV ON).
VSV is ON: Air from port E flows out through port F
(2) Disconnect between terminals TBP and E2 of the ECM connector (VSV OFF).
VSV is OFF: Air does not from flow port E to port F



OK → **Go to step 23**

NG

21	INSPECT VSV FOR PRESSURE SWITCHING VALVE(OPERATION) (See page 12–6)

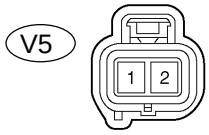
NG → **REPLACE VSV FOR PRESSURE SWITCHING VALVE**

OK

22	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR PRESSURE SWITCHING VALVE, VSV FOR PRESSURE SWITCHING VALVE – ECM)

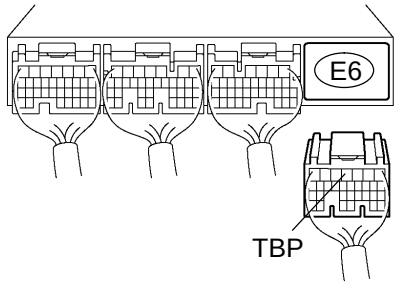
Wire Harness Side:

VSV for Pressure Switching Valve



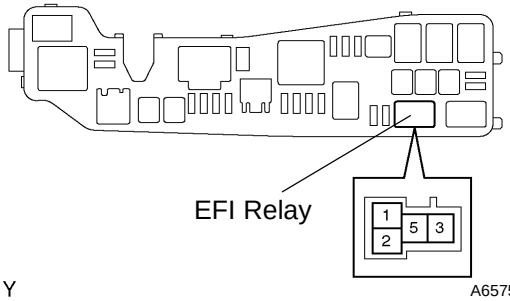
Front View

Y A72890



Y ECM Connector A65748

Engine Room R/B:



Y A65750

(a) Check the harness and the connector between the VSV for pressure switching valve and the ECM.

(1) Disconnect the V5 VSV for pressure switching valve connector.

(2) Disconnect the E6 ECM connector.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–1) – TBP (E6–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–1) or TBP (E6–4) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for pressure switching valve connector.

(5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for pressure switching valve and EFI relay.

(1) Disconnect the V5 VSV for pressure switching valve connector.

(2) Remove the EFI relay from the engine room R/B.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–2) or EFI relay (3) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for pressure switching valve connector.

(5) Reinstall the EFI relay from.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

23	INSPECT FUEL TANK INLET VALVE ASSY

NG → REPLACE FUEL TANK INLET VALVE ASSY

OK

24	INSPECT FUEL TANK ASSY

NG → REPLACE FUEL TANK ASSY

OK

IT IS LIKELY THAT VEHICLE USER DID NOT PROPERLY CLOSE FUEL TANK CAP

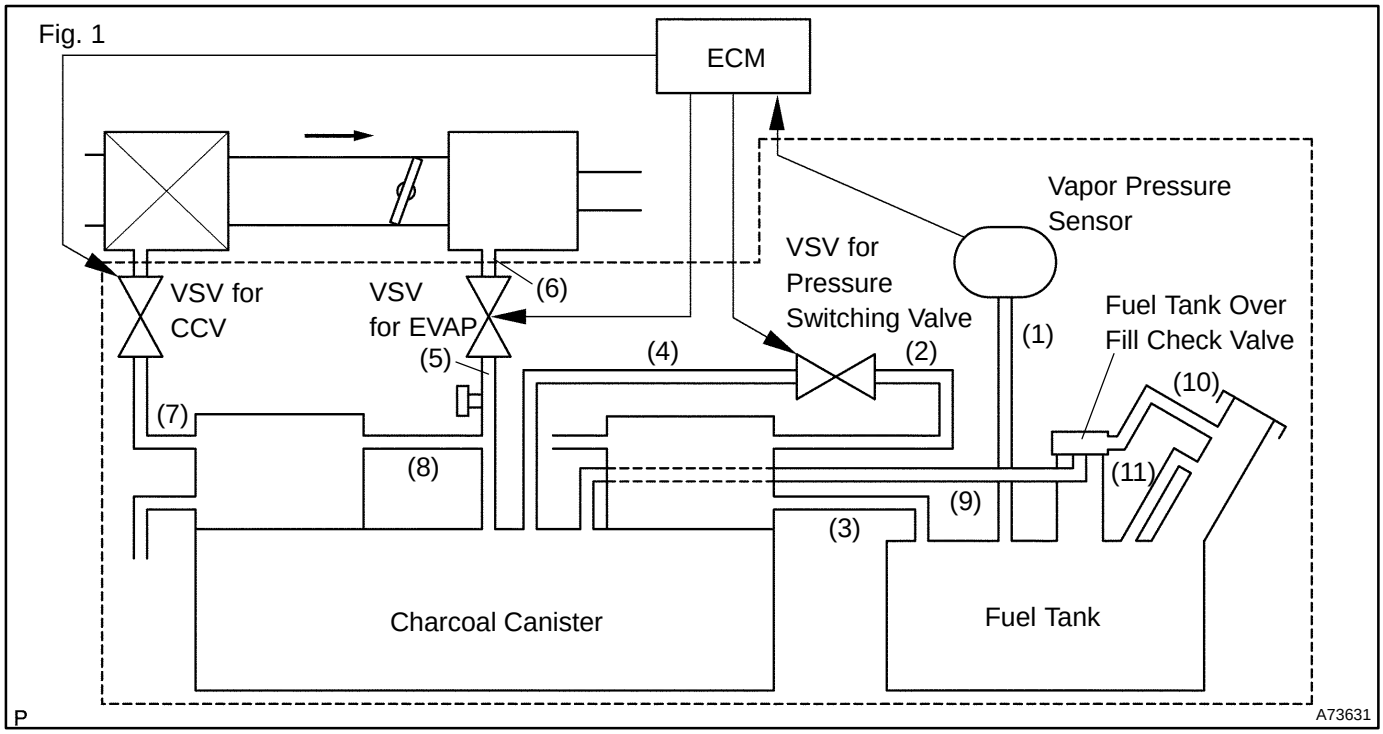
DTC	P0442	EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

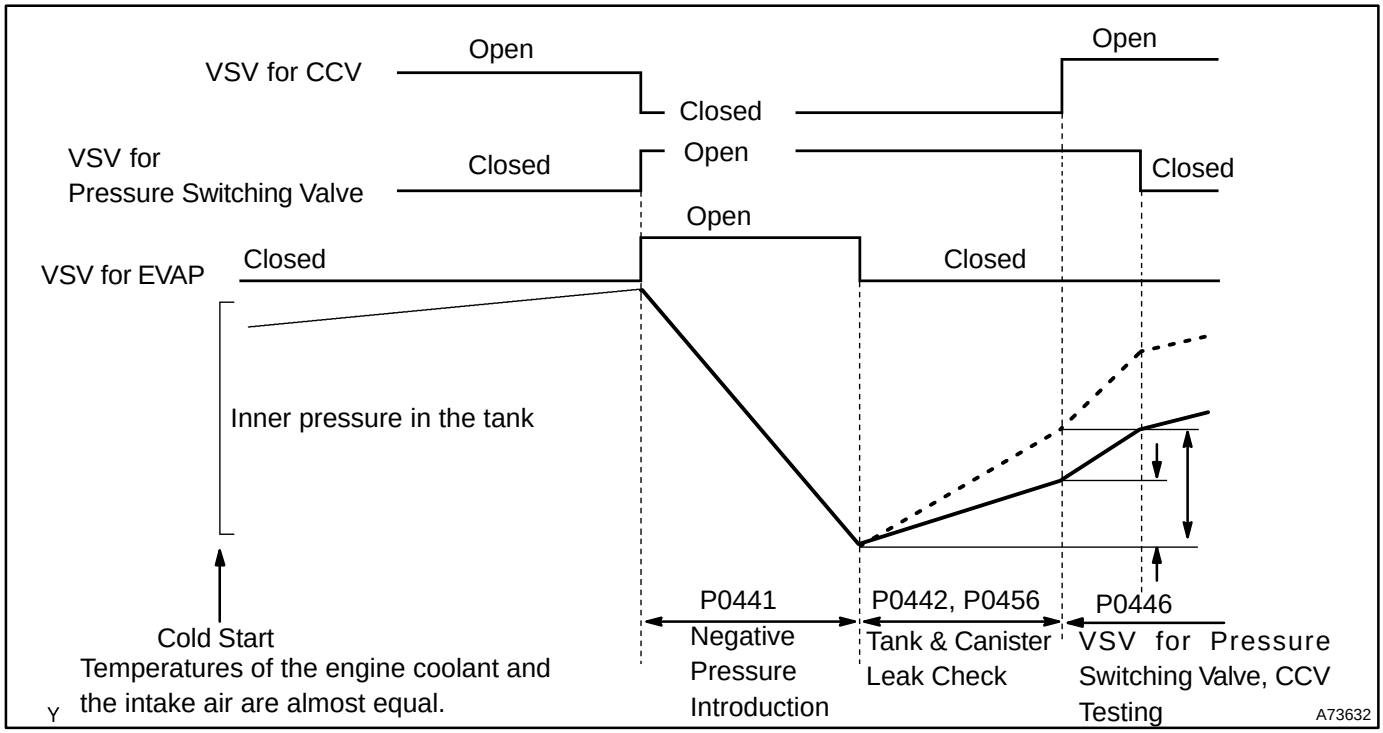
DTC	P0456	EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

CIRCUIT DESCRIPTION

The vapor pressure sensor and the VSV for the canister closed valve (CCV) are used to detect abnormalities in the evaporative emission control system. The ECM decides whether there is an abnormality in the evaporative emission control system based on the vapor pressure sensor signal.
DTC P0442 or P0456 is recorded by the ECM when evaporative emissions leak from the components within the dotted line in Fig. 1 below, or when the vapor pressure sensor malfunctions.

Fig. 1





DTC No.	DTC Detection Condition	Trouble Area
P0442	After negative pressure introduction is completed, if the pressure in the EVAP system sharply increases. (small leak) (2 trip detection logic)	• Vacuum hose has cracks, holes, or is blocked, damaged or disconnected • Fuel tank cap incorrectly installed • Fuel tank cap has cracks or is damaged • Open or short in vapor pressure sensor circuit • Vapor pressure sensor • Open or short in VSV circuit for EVAP • VSV for EVAP • Open or short in VSV circuit for CCV • VSV for CCV • Fuel tank has cracks, holes, or is damaged • Charcoal canister has cracks, holes, or is damaged • Fuel tank over fill check valve cracks, or is damaged • ECM
P0456	If the pressure in the EVAP system slightly increases while the ECM performs a leak check. (very small leak) (2 trip detection logic)	

HINT:

Typical DTC output of each trouble part.

Trouble part		Typical DTC output (*1)
Small Leak		P0442 and/or P0456 (*2)
Medium Leak (ex: Vacuum hose loose)		P0442
Large Leak (ex: Fuel tank cap loose)		P0441 and P0442 and P0446
VSV for EVAP	Open Malfunction	P0441
	Close Malfunction	P0441 and P0442 and P0446
VSV for CCV	Open Malfunction	P0441 and P0442 and P0446
	Close Malfunction	P0446
VSV for Pressure Switching	Open Malfunction	P0446
	Close Malfunction	P0441 and P0442 and P0446

*1: ECM may output some other DTCs combination.

*2: Refer to DTC P0441 and P0446 on page 05–193

MONITOR DESCRIPTION

The evaporative emission system consists of the vapor pressure sensor, the canister close valve (CCV), the VSV for pressure switching valve and the VSV for EVAP (Purge VSV), those are used to detect malfunction in the system by ECM.

This test will run once per driving cycle when the ECM detects stable vapor pressure in the fuel tank. While the vehicle is being driven on rough or winding roads, the movement of the fuel in the tank will cause unstable fuel tank vapor pressures and the diagnostic test will not executed.

The ECM performs the following steps:

(a) The CCV is closed. (shutting the system)

(b) The fuel tank pressure stability is checked. The diagnostic is disabled if the pressure change is more than specified value.

(c) The VSV for EVAP is opened. This introduces a negative pressure from the intake manifold to the fuel tank.

(d) The VSV for EVAP is closed and the negative pressure is sealed in the fuel tank.

(e) The ECM monitors the increase in fuel tank pressure for:

(1) Rapid increase in the internal pressure i.e. a large leak: 0.040 or more

(2) Pressure rise just above normal

If the ECM detects either of above conditions, it will interpret this as a leak in the EVAP system. The ECM will illuminate the MIL (2–trip detection logic) and set a DTC.

MONITOR STRATEGY

DTCs	P0442	Small leak (0.040 inch or more hole) detected
	P0456	Very small leak (0.020 inch hole) detected
Required sensors/components	Main	Vapor pressure sensor
	Sub	Mass air flow sensor, engine coolant temperature sensor, VSV for EVAP (purge VSV), VSV for CCV
Frequency of operation	Once per drive cycles	
Duration	60 seconds	
MIL operation	2 drive cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Criteria	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a monitor” (On page 05–25)	
Common pre–conditions for 0.020 and 0.040 inch:		
Altitude	–	2,400 m (7,872 ft.)
Throttle position learning	Completed	
Vapor pressure sensor	No malfunction	
Difference between intake air temperature and engine coolant temperature at engine start.	–7°C (–19.4°F)	11.1°C (52°F)
Vehicle speed condition	A or B	
A. Time after vehicle stopped (less than 6 mph (10 km/h))	90 seconds	–
B. Time after vehicle started (4 mph (7 km/h) or more)	20 seconds	
0.020 inch malfunction detection:		
Engine coolant temperature at engine start	10°C (50°F)	32°C (89.6°F)
Intake air temperature at engine start	10°C (50°F)	32°C (89.6°F)

Intake air temperature	10°C (50°F)	–
Fuel level condition in fuel tank during leak check	Fuel slosh is small (must not drive on road with bad conditions)	
Time after engine start	–	50 minutes
Fuel tank pressure condition before leak check (Fuel tank condition before closed negative pressure introduction)	Fuel tank internal pressure change is small before negative pressure introduction. (Reference: If fuel in the tank is high temperature, vapor volume increase and the internal pressure changes also increase)	
Vehicle speed and intake air amount condition before and after negative pressure introduction	Steady speed and not change greatly of intake air amount	
Fuel level	–	90%
0.020 inch leak detection	Not completed	
0.040 inch leak detection	Not detected	
VSV for CCV malfunction, bypass VSV malfunction	Not detected	
Vehicle speed	–	81 mph (130 km/h)
VSV for EVAP (Evap purge VSV) malfunction	Not detected	
0.040 inch malfunction:		
Engine coolant temperature at engine start	10°C (50°F)	35°C (95°F)
Intake air temperature at engine start	10°C (50°F)	35°C (95°F)
Intake air temperature	10°C (50°F)	–
Fuel level condition in fuel tank during leak check	Fuel slosh is small (must not drive on road with bad conditions)	
Time after engine start	–	50min
Fuel tank pressure condition before leak check (Fuel tank condition before closed negative pressure introduction)	Fuel tank internal pressure change is small before negative pressure introduction. (Reference: If fuel in the tank is high temperature, vapor volume increase and the internal pressure changes also increase)	
Vehicle speed and intake air amount condition before and after negative pressure introduction	Steady speed and not change greatly of intake air amount	
Fuel level	–	90%
0.040 inch leak detection	Not completed	
Fuel tank pressure at vacuum introduction completed	–2.4 kPa (–18 mmHg)	–
P0446 VSV check	No executed	

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
0.020 inch malfunction detection:	
Fuel tank pressure changing value, from –2.0 kPa (–15 mmHg), for 5 seconds	Increase more than 0.067 kPa (0.5 mmHg)
Fuel tank pressure changing value, from –2.7 kPa (–20 mmHg), for 5 seconds	Increase more than 0.067 kPa (0.5 mmHg)
0.040 inch malfunction detection:	
Fuel tank pressure changing value, from –2.0 kPa (–15 mmHg), for 5 seconds	Increase more than 0.24 kPa (1.8 mmHg)
Fuel tank pressure changing value, from –2.7 kPa (–20 mmHg), for 5 seconds	Increase more than 0.24 kPa (1.8 mmHg)

MONITOR RESULT (MODE 06 DATA)

Test ID	Comp ID	Description of Test Data	Description of Test Limit	Unit	Conversion Factor
$02	$81	Tank pressure change value during vacuum introduction	Malfunction criteria for VSV for EVAP	mmHg	Multiply by 0.0916
	$82	Fuel tank pressure change value at switching over the canister close valve or VSV for pressure switching valve.	Malfunction criteria for canister close valve and VSV for pressure switching valve	mmHg	Multiply by 0.0458 minus 2.930
	$03	Fuel tank pressure change 5 seconds after the end the vacuum introduction cycle Conditions: • VSV for EVAP: Closed • CCV: Closed • VSV for bypass valve: Open	Malfunction criteria for 0.040 leak	mmHg	Multiply by 0.0458
	$04		Malfunction criteria for 0.020 leak	mmHg	Multiply by 0.0458

Refer to page 05–27 for detailed information on Checking Monitor Status.

INSPECTION PROCEDURE

Hand–held Tester:

1 CHECK FUEL TANK CAP ASSY(CHECK THAT FUEL TANK CAP IS TOYOTA GENUINE PARTS)

NG → REPLACE TO TOYOTA GENUINE PARTS

OK

2 CHECK THAT FUEL TANK CAP IS CORRECTLY INSTALLED

NG → CORRECTLY INSTALL FUEL TANK CAP

OK

3 INSPECT FUEL TANK CAP ASSY (See page 12–1)

NG → REPLACE FUEL TANK CAP ASSY

OK

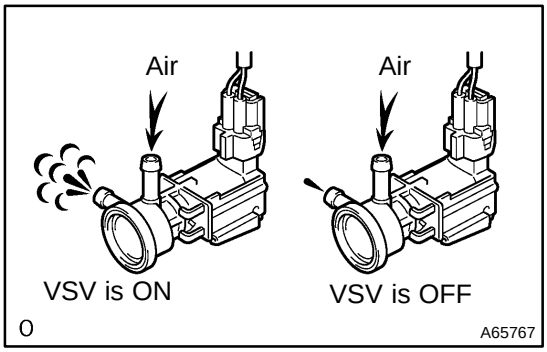
4 CHECK FILLER NECK FOR DAMAGE

(a) Remove the fuel tank cap.
(b) Visually check the fuel inlet pipe for damage.
(c) Reinstall the fuel tank cap.

NG → REPLACE FUEL TANK INLET PIPE SUB–ASSY

OK

5	PERFORM ACTIVE TEST BY HAND–HELD TESTER(CHECK FOR EVAP PURGE FLOW)



(a) Select the item ”DIAGNOSIS/ENHANCED OBD II/ACTIVE TEST” mode on the hand–held tester.
(b) Disconnect the vacuum hose of the VSV for EVAP from the charcoal canister.
(c) Start the engine.
(d) Select the item ”EVAP VSV (ALON)/ALL” in the ACTIVE TEST and operate EVAP VSV (Press the right or left button).
(e) When the VSV for the EVAP is operated by the hand–held tester, check whether the disconnected hose applies suction to your finger.
Result:
VSV is ON: Disconnected hose sucks.
VSV is OFF: Disconnected hose does not suck.
(f) Reconnect the vacuum hose.

OK	Go to step 9

NG

6	CHECK VACUUM HOSES(INTAKE MANIFOLD – VSV FOR EVAP, VSV FOR EVAP – CHARCOAL CANISTER)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole, damage and blockage.

NG	REPAIR OR REPLACE VACUUM HOSE

OK

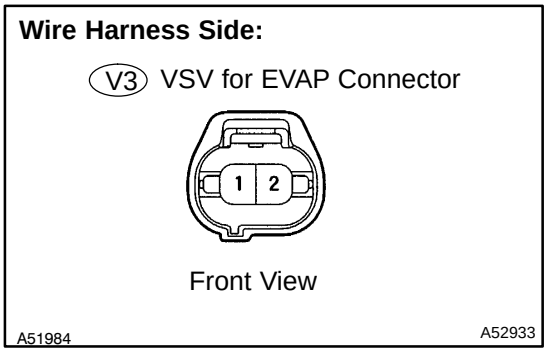
7	INSPECT VSV FOR EVAP(OPERATION) (See page 12–1)

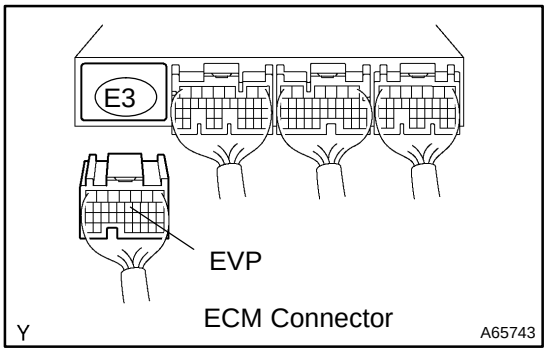
NG	REPLACE VSV FOR EVAP

OK

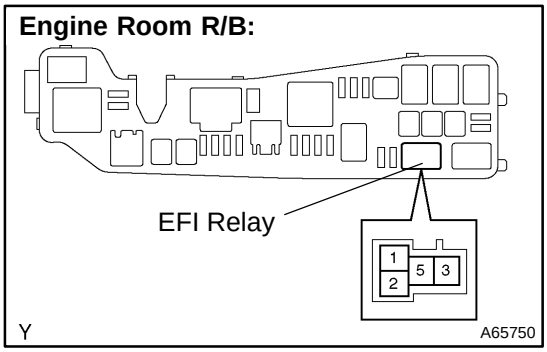
8	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR EVAP, VSV FOR EVAP – ECM)

Wire Harness Side:





Engine Room R/B:



(a) Check the harness and the connector between the VSV for EVAP and ECM.

(1) Disconnect the V3 VSV for EVAP connector.

(2) Disconnect the E3 ECM connector.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for EVAP (V3–1) – EVP (E3–12)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for EVAP (V3–1) or EVP (E3–12) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for EVAP connector.

(5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for EVAP and EFI relay.

(1) Disconnect the V3 VSV for EVAP connector.

(2) Remove the EFI relay from the engine room R/B.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for EVAP (V3–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for EVAP (V3–2) or EFI relay (3) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for EVAP connector.

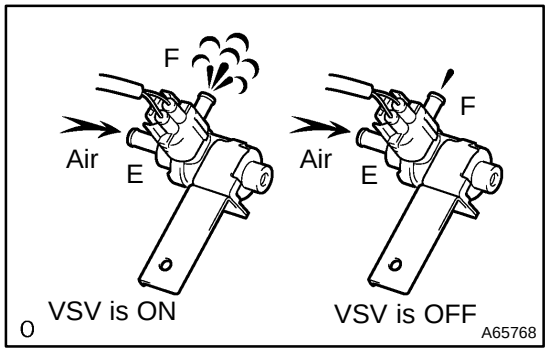
(5) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

9	PERFORM ACTIVE TEST BY HAND–HELD TESTER(VSV FOR CCV)



(a) Disconnect the vacuum hose of the VSV for CCV from the charcoal canister.
(b) Start the engine.
(c) Select the item ”DIAGNOSIS/ENHANCED OBD II/ACTIVE TEST” mode on the hand–held tester.
(d) Select the item ”CAN CTRL VSV/ALL” in the ACTIVE TEST and operate CAN CTRL VSV (Press the right or left button).
(e) Check the VSV operation when it is operated by the hand–held tester.

Result:
VSV is ON: Air from port E flows out through port F.
VSV is OFF: Air does not flow from port E to port F.

OK	Go to step 13

NG

10	CHECK VACUUM HOSES(VSV FOR CCV – CHARCOAL CANISTER)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole damage and blockage.

NG	REPAIR OR REPLACE VACUUM HOSES

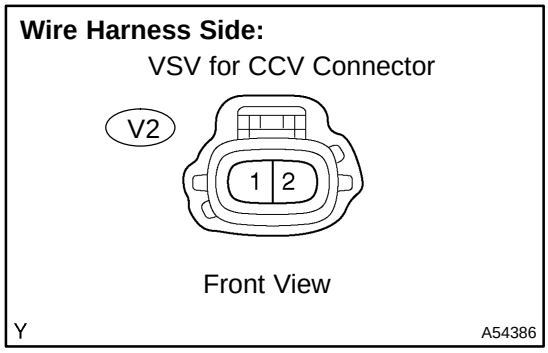
OK

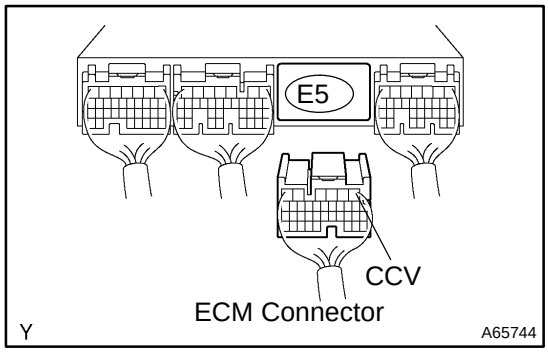
11	INSPECT VSV FOR CCV(OPERATION) (See page 12–6)

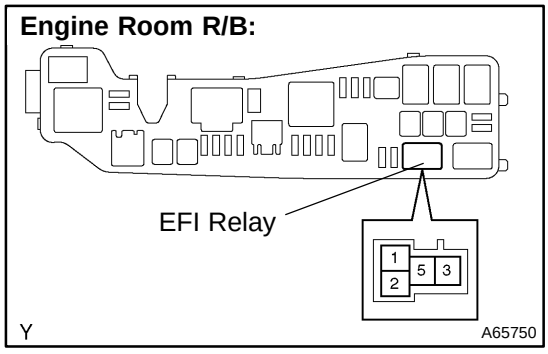
NG	REPLACE VSV FOR CCV

OK

12	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR CCV, VSV FOR CCV – ECM)







(a) Check the harness and connector between the VSV for CCV and ECM.
  (1) Disconnect the V2 VSV for CCV connector.
  (2) Disconnect the E5 ECM connector.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for CCV (V2–1) – CCV (E5–1)	Below 1 Ω

Tester Connection	Specified Condition
VSV for CCV (V2–1) or CCV (E5–1) – Body ground	10 kΩ or higher

  (4) Reconnect the VSV for CCV connector.
  (5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for CCV and EFI relay.
  (1) Disconnect the V2 VSV for CCV connector.
  (2) Remove the EFI relay from the engine room R/B.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for CCV (V2–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for CCV (V2–2) or EFI relay (3) – Body ground	10 kΩ or higher

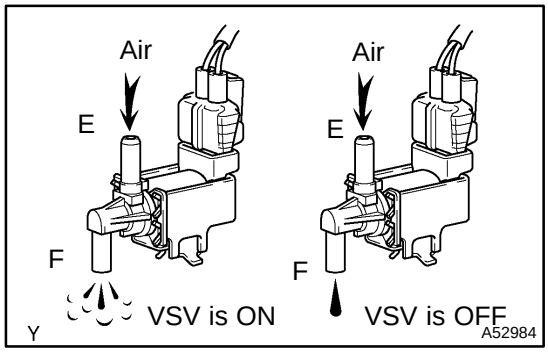
  (4) Reconnect the VSV for CCV connector.
  (5) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

13	PERFORM ACTIVE TEST BY HAND–HELD TESTER(VSV FOR PRESSURE SWITCHING VALVE)



(a) Select the item ”DIAGNOSIS/ENHANCED OBD II/ACTIVE TEST” mode on the hand–held tester.

(b) Select the item ”TANK BYPASS VSV/ALL” in the ACTIVE TEST and operate TANK BYPASS VSV (Press the right or left button).

(c) Check the VSV operation when it is operated by the hand–held tester.

Result:

VSV is ON: Air from port E flows out through port F.

VSV is OFF: Air does not flow from port E to port F.

OK	Go to step 16

NG

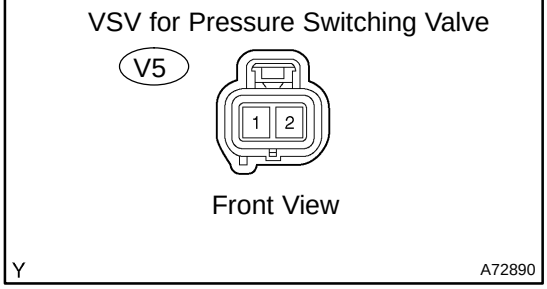
14	INSPECT VSV FOR PRESSURE SWITCHING VALVE(OPERATION)

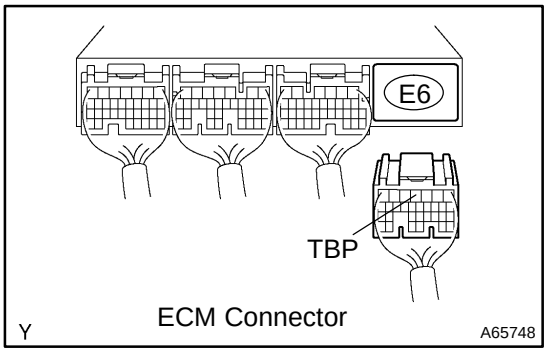
NG	REPLACE VSV FOR PRESSURE SWITCHING VALVE

OK

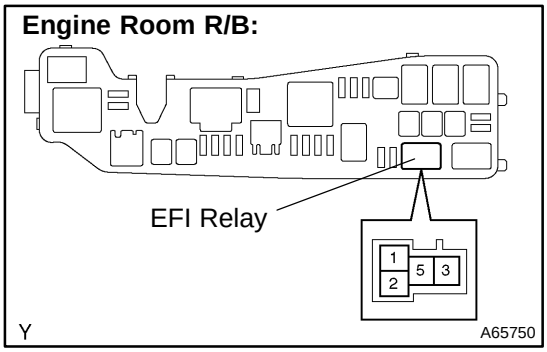
15	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR PRESSURE SWITCHING VALVE, VSV FOR PRESSURE SWITCHING VALVE – ECM)

Wire Harness Side:





Engine Room R/B:



(a) Check the harness and the connector between the VSV for pressure switching valve and the ECM.

(1) Disconnect the V5 VSV for pressure switching valve connector.

(2) Disconnect the E6 ECM connector.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–1) – TBP (E6–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–1) or TBP (E6–4) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for pressure switching valve connector.

(5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for pressure switching valve and EFI relay.

(1) Disconnect the V5 VSV for pressure switching valve connector.

(2) Remove the EFI relay from the engine room R/B.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–2) or EFI relay (3) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for pressure switching valve connector.

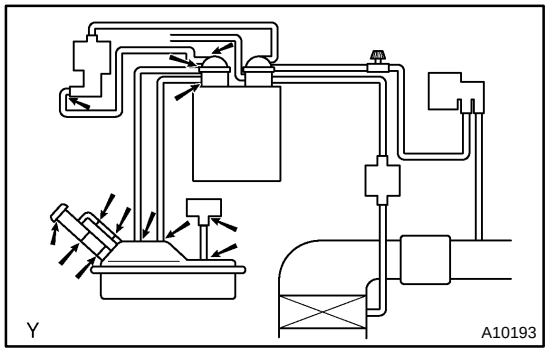
(5) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

16	CHECK FOR EVAPORATIVE EMISSIONS LEAK(NEAR FUEL TANK)



(a) Check whether hoses close to the fuel tank have been modified, and check if there are signs of any accident near the fuel tank.
  (1) Check the following parts for cracks, deformation or loose connection:
    - Fuel tank
    - Fuel tank filler pipe
    - Hoses and tubes around fuel tank

NG → **REPAIR OR REPLACE EVAPORATIVE EMISSIONS LEAK PART**

OK

17	CHECK VACUUM HOSES(VAPOR PRESSURE SENSOR – FUEL TANK, CHARCOAL CANISTER – VSV FOR PRESSURE SWITCHING VALVE)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole and damage.

NG → **REPAIR OR REPLACE VACUUM HOSE**

OK

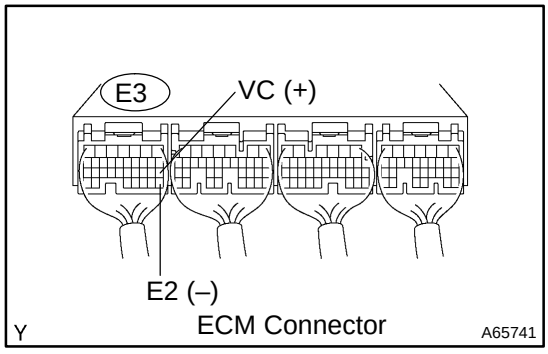
18	CHECK HOSE AND TUBE(FUEL TANK – CHARCOAL CANISTER)

(a) Check the connection between the fuel tank and fuel EVAP pipe, the fuel EVAP pipe and under floor fuel tube, the under floor fuel tube and charcoal canister.
(b) Check the hose and the tube for cracks, hole and damage.

NG → **REPAIR OR REPLACE HOSE AND TUBE**

OK

19	INSPECT ECM(VC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E3 ECM connector.

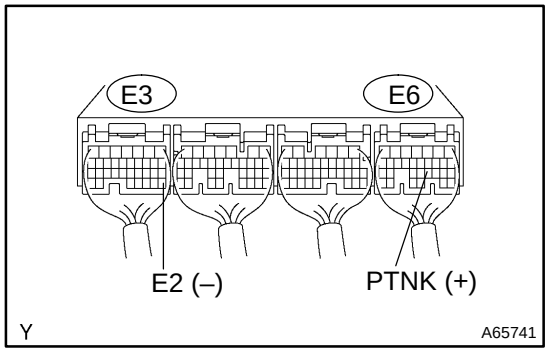
Standard:

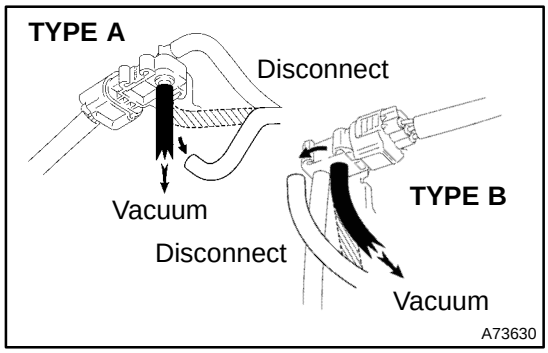
Tester Connection	Specified Condition
VC (E3–18) – E2 (E3–28)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–11)**

OK

20 INSPECT ECM(PTNK VOLTAGE)





(a) Turn the ignition switch ON.
(b) Measure the voltage between terminals of the E3 and E6 ECM connectors.
(1) Disconnect the vacuum hose from the vapor pressure sensor.

Standard (1):

Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	2.9 to 3.7 V

NOTICE:
The vacuum applied to the vapor pressure sensor must be less than 66.7 kPa (500 mmHg, 19.7 in.Hg).

(2) Using the MITYVAC (Hand–held Vacuum Pump), apply a vacuum of 4.0 kPa (30 mmHg, 1.18 in.Hg) to the vapor pressure sensor.

Standard (2):

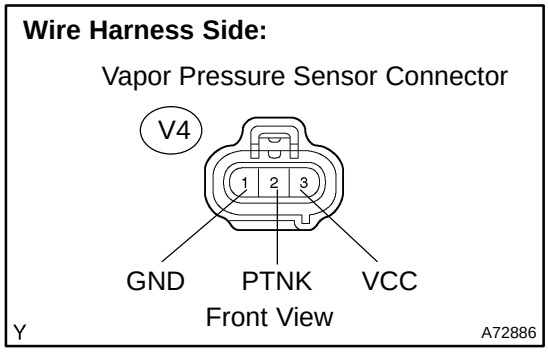
Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	0.5 V or less

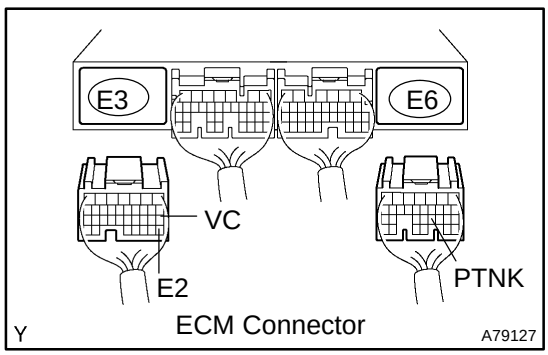
(3) Reconnect the vacuum hose.

OK → **Go to step 22**

NG

21 CHECK HARNESS AND CONNECTOR(VAPOR PRESSURE SENSOR – ECM)





(a) Disconnect the V4 vapor pressure sensor connector.
(b) Disconnect the E3 and E6 ECM connectors.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
PTNK (V4–2) – PTNK (E6–21)	Below 1 Ω
GND (V4–1) – E2 (E3–28)	
VCC (V4–3) – VC (E3–18)	

Standard (Check for short):

Tester Connection	Specified Condition
PTNK (V4–2) or PTNK (E6–21) – Body ground	10 kΩ or higher
VCC (V4–3) or VC (E3–18) – Body ground	

(d) Reconnect the vapor pressure sensor connector.
(e) Reconnect the ECM connectors.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

22	INSPECT FUEL TANK INLET VALVE ASSY

NG → REPLACE FUEL TANK INLET VALVE ASSY

OK

23	INSPECT FUEL TANK ASSY

NG → REPLACE FUEL TANK ASSY

OK

24	INSPECT CHARCOAL CANISTER ASSY(CRACKS, HOLE AND DAMAGE)

NG → REPAIR OR REPLACE CHARCOAL CANISTER ASSY

OK

REPLACE ECM (See page 10–11)

OBDII scan tool (excluding Hand–held Tester):

1	CHECK FUEL TANK CAP ASSY(CHECK THAT FUEL TANK CAP IS TOYOTA GEHUINE PARTS)

NG → REPLACE TO GENUINE PARTS

OK

2	CHECK THAT FUEL TANK CAP IS CORRECTLY INSTALLED

NG → CORRECTLY INSTALL FUEL TANK CAP

OK

3	INSPECT FUEL TANK CAP ASSY (See page 12–1)

NG → REPLACE FUEL TANK CAP ASSY

OK

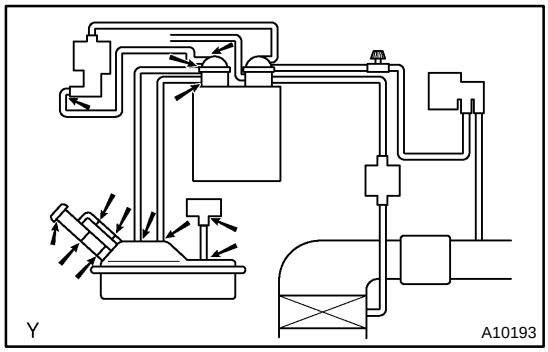
4	CHECK FILLER NECK FOR DAMAGE

(a) Remove the fuel tank cap.
(b) Visually check the fuel inlet pipe for damage.

NG → REPLACE FUEL TANK INLET PIPE SUB–ASSY

OK

5	CHECK FOR EVAPORATIVE EMISSIONS LEAK(NEAR FUEL TANK OR CHACOAL CANISTER)



(a) Check whether hoses close to the fuel tank have been modified, and check if there are signs of any accident near the fuel tank or the charcoal canister.
  (1) Check the following parts for cracks, deformation or loose connection:
    - Fuel tank
    - Charcoal canister
    - Fuel tank filler pipe
    - Hoses and tubes around fuel tank and charcoal canister

NG → REPAIR OR REPLACE EVAPORATIVE EMISSIONS LEAK PART

OK

6	CHECK VACUUM HOSES(VAPOR PRESSURE SENSOR – FUEL TANK, CHARCOAL CANISTER – VSV FOR PRESSURE SWITCHING VALVE)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole and damage.

NG → REPAIR OR REPLACE VACUUM HOSE

OK

7	CHECK HOSE AND TUBE(FUEL TANK – CHARCOAL CANISTER)

(a) Check the connection between the fuel tank and fuel EVAP pipe, the fuel EVAP pipe and under floor fuel tube, the under floor fuel tube and charcoal canister.
(b) Check the hose and the tube for cracks, hole and damage.

NG → REPAIR OR REPLACE HOSE AND TUBE

OK

8	CHECK VACUUM HOSES((5), (6), (7), (8) AND (9) IN FIG. 1 IN CIRCUIT DESCRIPTION)

(a) Check that the vacuum hose is connected correctly.
(b) Check the vacuum hose for looseness and disconnection.
(c) Check the vacuum hose for cracks, hole and damage.

NG → REPAIR OR REPLACE VACUUM HOSES

OK

9	CHECK EACH VSV CONNECTOR FOR LOOSENESS AND DISCONNECTION(VSV FOR EVAP, VSV FOR CCV, VSV FOR PRESSURE SWITCHING VALVE)

NG → REPAIR OR CONNECT VSV AND SENSOR CONNECTOR

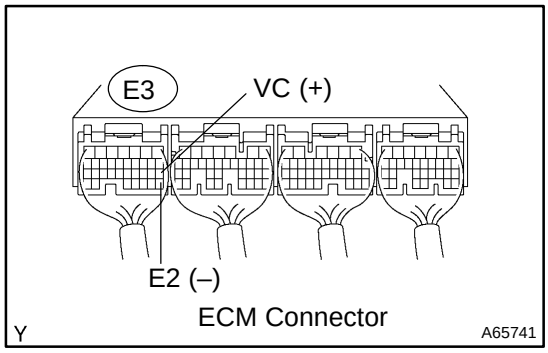
OK

10	INSPECT CHARCOAL CANISTER ASSY(CRACKS, HOLE AND DAMAGE)

NG → CHECK AND REPLACE CHARCOAL CANISTER ASSY

OK

11	INSPECT ECM(VC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure voltage between the terminals of the E3 ECM connector.

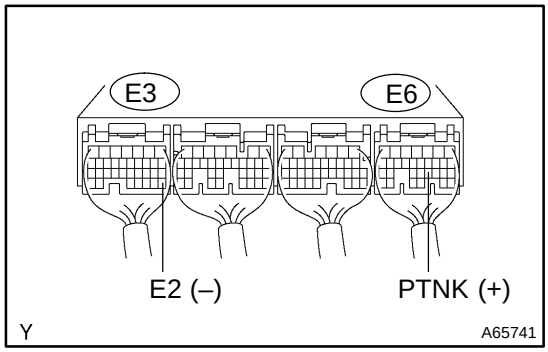
Standard:

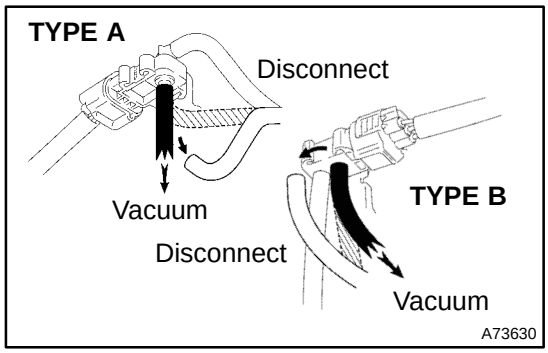
Tester Connection	Specified Condition
VC (E3–18) – E2 (E3–28)	4.5 to 5.5 V

NG → REPLACE ECM (See page 10–11)

OK

12	INSPECT ECM(PTNK VOLTAGE)





(a) Turn the ignition switch ON.

(b) Measure the voltage between terminals of the E3 and E6 ECM connectors.

(1) Disconnect the vacuum hose from the vapor pressure sensor.

Standard (1):

Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	2.9 to 3.7 V

NOTICE:

The vacuum applied to the vapor pressure sensor must be less than 66.7 kPa (500 mmHg, 19.7 in.Hg).

(2) Using the MITYVAC (Hand–held Vacuum Pump), apply a vacuum of 4.0 kPa (30 mmHg, 1.18 in.Hg) to the vapor pressure sensor.

Standard (2):

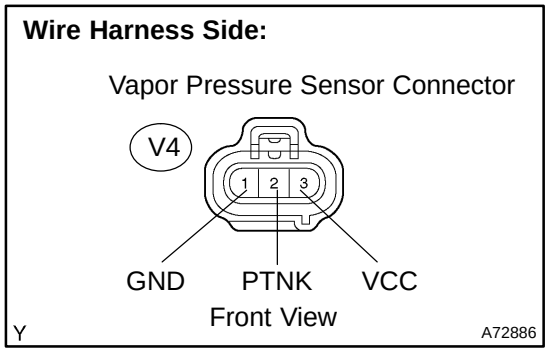
Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	0.5 V or less

(3) Reconnect the vacuum hose from the vapor pressure sensor.

OK → **Go to step 14**

NG

13 CHECK HARNESS AND CONNECTOR(VAPOR PRESSURE SENSOR – ECM)



(a) Disconnect the V4 vapor pressure sensor connector.
(b) Disconnect the E3 and E6 ECM connectors.
(c) Check the resistance between the wire harness side connectors.

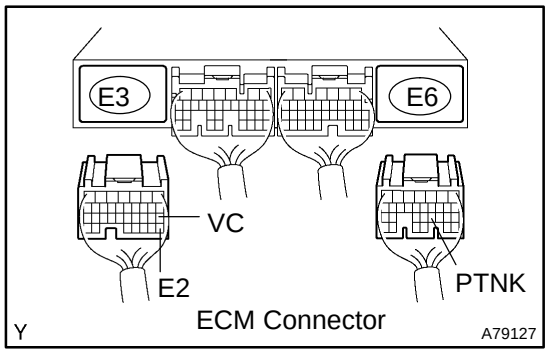
Standard (Check for open):

Tester Connection	Specified Condition
PTNK (V4–2) – PTNK (E6–21)	Below 1 Ω
GND (V4–1) – E2 (E3–28)	
VCC (V4–3) – VC (E3–18)	

Standard (Check for short):

Tester Connection	Specified Condition
PTNK (V4–2) or PTNK (E6–21) – Body ground	10 kΩ or higher
VCC (V4–3) or VC (E3–18) – Body ground	

(d) Reconnect the vapor pressure sensor connector.
(e) Reconnect the ECM connectors.

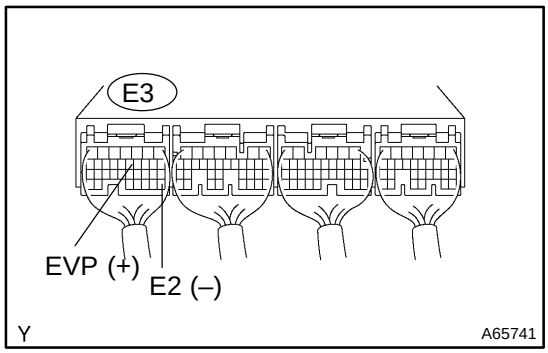


NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

14 INSPECT VSV FOR EVAP(FUNCTION)

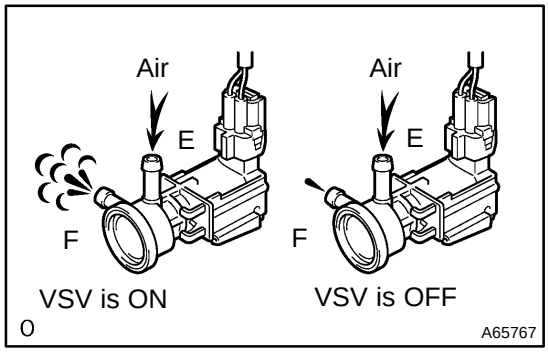


(a) Turn the ignition switch ON.
(b) Check the VSV function.
(1) Connect between terminals EVP and E2 of the ECM connector (VSV ON).

VSV is ON:
Air from port E flows out through port F

(2) Disconnect between terminals EVP and E2 of the ECM connector (VSV OFF).

VSV is OFF:
Air does not flow port E to port F



OK → **Go to step 17**

NG

15	INSPECT VSV FOR EVAP(OPERATION) (See page 12–6)

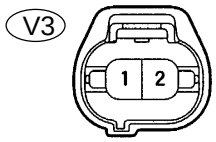
NG → REPLACE VSV FOR EVAP

OK

16	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR EVAP, VSV FOR EVAP – ECM)

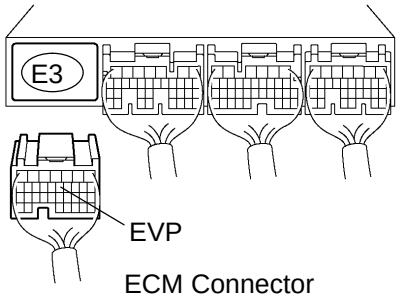
Wire Harness Side:

VSV for EVAP Connector



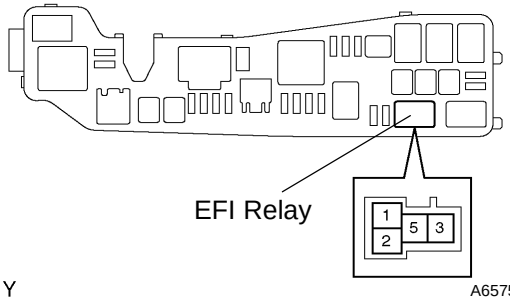
Front View

A51984 A52933



A65743

Engine Room R/B:



A65750

(a) Check the harness and connector between the VSV for EVAP and ECM.

(1) Disconnect the V3 VSV for EVAP connector.

(2) Disconnect the E3 ECM connector.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for EVAP (V3–1) – EVP (E3–12)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for EVAP (V3–1) or EVP (E3–12) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for EVAP connector.

(5) Reconnect the ECM connector.

(b) Check the harness and connector between the VSV for EVAP and EFI relay.

(1) Disconnect the V3 VSV for EVAP connector.

(2) Remove the EFI relay from the engine room R/B.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for EVAP (V3–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for EVAP (V3–2) or EFI relay (3) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for EVAP connector.

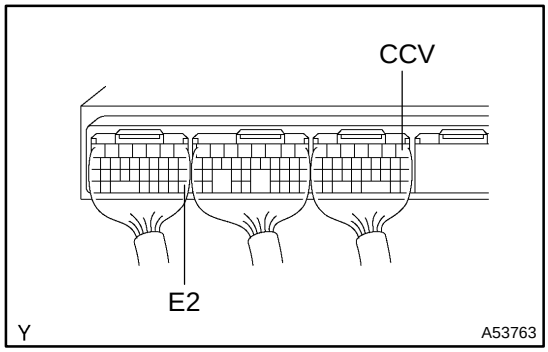
(5) Reinstall the EFI relay.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

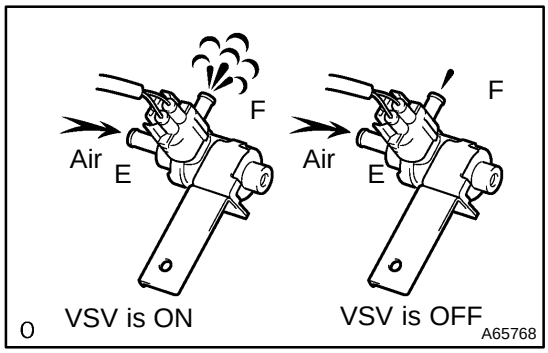
OK

REPLACE ECM (See page 10–11)

17	INSPECT VSV FOR CCV(FUNCTION)



(a) Turn the ignition switch ON.
(b) Check the VSV function.
(1) Connect between terminals CCV and E2 of the ECM connector (VSV ON).
VSV is ON:
Air from port E flows out through port F
(2) Disconnect between terminals CCV and E2 of the ECM connector (VSV OFF).
VSV is OFF:
Air does not flow from port E to port F



OK → **Go to step 20**

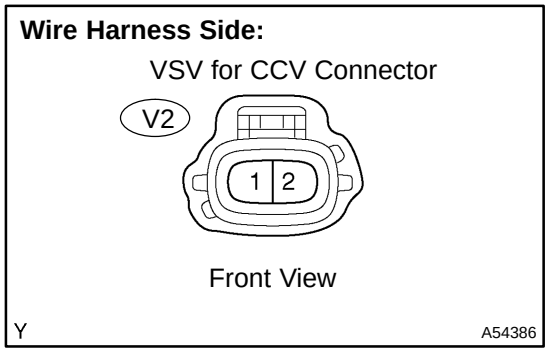
NG

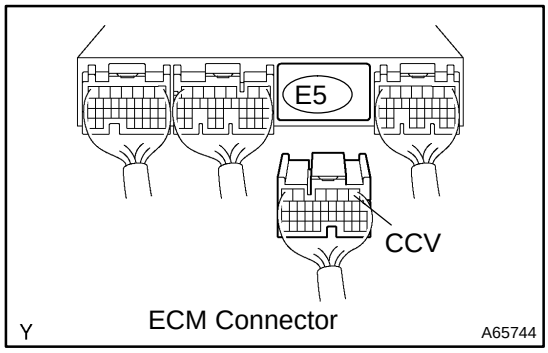
18	INSPECT VSV FOR CCV(OPERATION) (See page 12–6)

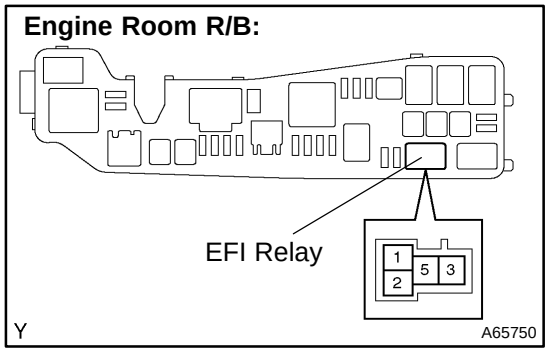
NG → **REPLACE VSV FOR CCV**

OK

19	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR CCV, VSV FOR CCV – ECM)







(a) Check the harness and the connector between the VSV for CCV and ECM.
  (1) Disconnect the V2 VSV for CCV connector.
  (2) Disconnect the E5 ECM connector.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for CCV (V2–1) – CCV (E5–1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for CCV (V2–1) or CCV (E5–1) – Body ground	10 kΩ or higher

  (4) Reconnect the VSV for CCV connector.
  (5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for CCV and EFI relay.
  (1) Disconnect the V2 VSV for CCV connector.
  (2) Remove the EFI relay from the engine room R/B.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for CCV (V2–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for CCV (V2–2) or EFI relay (3) – Body ground	10 kΩ or higher

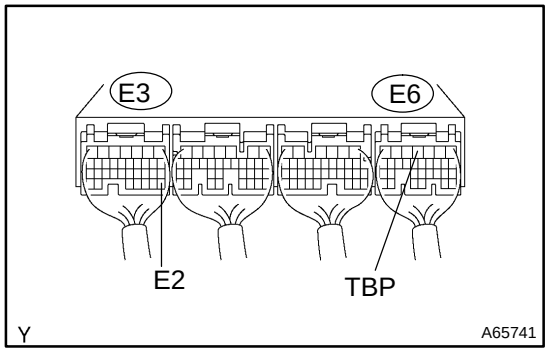
  (4) Reconnect the VSV for CCV connector.
  (5) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

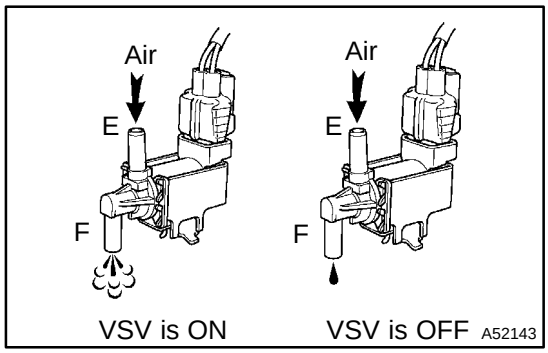
OK

REPLACE ECM (See page 10–11)

20	INSPECT VSV FOR PRESSURE SWITCHING VALVE(FUNCTION)



(a) Turn the ignition switch ON.
(b) Check the VSV function.
(1) Connect between terminals TBP and E2 of the ECM connector (VSV ON).
VSV is ON: Air from port E flows out through port F
(2) Disconnect between terminals TBP and E2 of the ECM connector (VSV OFF).
VSV is OFF: Air does not from flow port E to port F



OK → **Go to step 23**

NG

21	INSPECT VSV FOR PRESSURE SWITCHING VALVE(OPERATION) (See page 12–6)

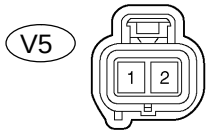
NG → **REPLACE VSV FOR PRESSURE SWITCHING VALVE**

OK

22	CHECK HARNESS AND CONNECTOR(EFI RELAY – VSV FOR PRESSURE SWITCHING VALVE, VSV FOR PRESSURE SWITCHING VALVE – ECM)

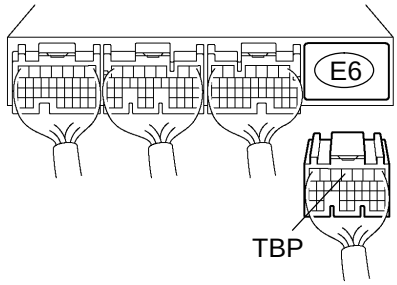
Wire Harness Side:

VSV for Pressure Switching Valve



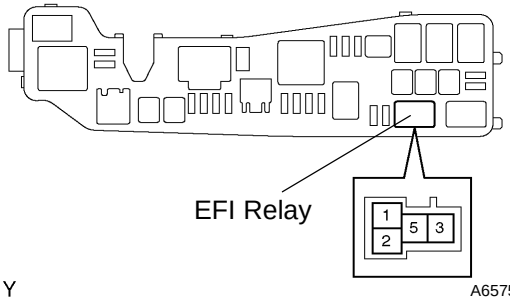
Front View

Y A72890



Y ECM Connector A65748

Engine Room R/B:



Y A65750

(a) Check the harness and the connector between the VSV for pressure switching valve and ECM.

(1) Disconnect the V5 VSV for pressure switching valve connector.

(2) Disconnect the E6 ECM connector.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–1) – TBP (E6–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–1) or TBP (E6–4) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for pressure switching valve connector.

(5) Reconnect the ECM connector.

(b) Check the harness and the connector between the VSV for pressure switching valve and EFI relay.

(1) Disconnect the V5 VSV for pressure switching valve connector.

(2) Remove the EFI relay from the engine room R/B.

(3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV for pressure switching valve (V5–2) or EFI relay (3) – Body ground	10 kΩ or higher

(4) Reconnect the VSV for pressure switching valve connector.

(5) Reinstall the EFI relay from.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

23	INSPECT FUEL TANK INLET VALVE ASSY

NG → REPLACE FUEL TANK INLET VALVE ASSY

OK

24	INSPECT FUEL TANK ASSY

NG → REPLACE FUEL TANK ASSY

OK

IT IS LIKELY THAT VEHICLE USER DID NOT PROPERLY CLOSE FUEL TANK CAP

DTC	P0451	EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE

DTC	P0452	EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR/SWITCH LOW INPUT

DTC	P0453	EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR/SWITCH HIGH INPUT

MONITOR DESCRIPTION

DTC P0451, P0452 or P0453 is recorded by the ECM when the vapor pressure sensor malfunctions.

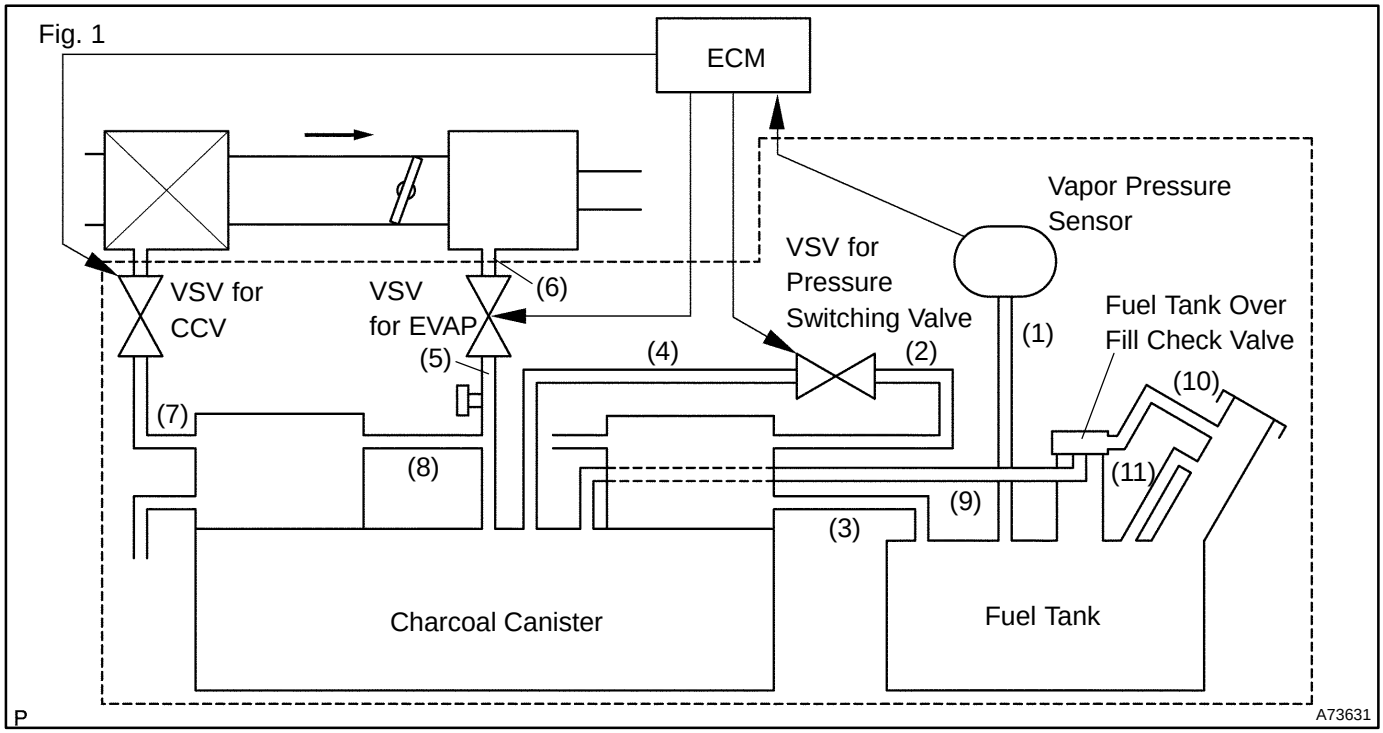
P0451

The ECM senses pressure in the fuel tank using the vapor pressure sensor. The ECM supplies the sensor with a regulated 5 V reference–voltage and the sensor returns a signal voltage between 0.5 V and 4.5 V according to the pressure level in the fuel tank.
When the pressure in the fuel tank is low, the output voltage of the vapor pressure sensor is low. When it is high, the output voltage is high.
For this DTC P0451, the ECM checks for a ”noisy” sensor or a ”stuck” sensor.
The ECM checks for the ”noisy” sensor by monitoring the fuel tank pressures when the vehicle is stationary and there should be little variation in the tank pressure. If the indicated pressure varies beyond specified limits, the ECM will illuminate the MIL and a DTC is set.
The ECM checks for the ”stuck” sensor by monitoring the fuel tank pressure for an extended time period. If the indicated pressure does not change over this period, the ECM will conclude that the fuel tank pressure sensor is malfunctioning. The ECM will illuminate the MIL and a DTC is set.

P0452 and P0453

The ECM senses pressure in the fuel tank using the vapor pressure sensor. The ECM supplies the sensor with a regulated 5 V reference–voltage and the sensor returns a signal voltage between 0.5 V and 4.5 V according to the pressure level in the fuel tank.
When the pressure in the fuel tank is low, the output voltage of the vapor pressure sensor is low. When it is high, the output voltage is high.
If the output voltage of the vapor pressure sensor is out of the normal range, the ECM will determine that there is a malfunction in the sensor or sensor circuit.
When pressure indicated by the vapor pressure sensor deviates below –3.999 kpa (–30 mmHg) or above 1.999 kpa (15 mmHg), the ECM interprets this as a malfunction in the vapor pressure sensor. The ECM will turn on the MIL and a DTC will be set.

Fig. 1



DTC No.	DTC Detection Condition	Trouble Area
P0451	• Vapor pressure sensor's voltage output extremely changes under the following conditions: (a) and (b) (2 trip detection logic): (a) Vehicle speed: 0 km/h (0mph), Engine speed: Idling, and VSV for pressure switching valve: OFF (b) Vapor pressure sensor value greater than opening pressure value of charcoal canister • Vapor pressure sensor's voltage output remains at fixed value	• Open or short in vapor pressure sensor circuit • Vapor pressure sensor • ECM
P0452	Open in vapor pressure sensor circuit	
P0453	Short in vapor pressure sensor circuit	

MONITOR STRATEGY

P0451

Related DTCs	P0451	Evaporative emission control system pressure sensor range/performance
Required sensors/components	Main sensors	Vapor pressure sensor
	Related sensors	Mass air flow sensor, engine coolant temperature sensor
Frequency of operation	Once per driving cycle	
Duration	Signal fluctuation (noise) monitoring: 10 seconds No signal change (stuck) monitoring: 20 minutes	
MIL operation	2 driving cycles	
Sequence of operation	None	

P0452 and P0453

Related DTCs	P0452	Evaporative emission control system pressure sensor/switch low input
	P0453	Evaporative emission control system pressure sensor/switch high input
Required sensors/components	Main sensors	Vapor pressure sensor
	Related sensors	Mass air flow sensor, engine coolant temperature sensor
Frequency of operation	Once per driving cycle	
Duration	7 seconds	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

P0451

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Signal fluctuation (noise) monitoring:		
Altitude	–	2,400 m (7,872 ft)
Difference between intake air temperature and engine coolant temperature at engine start	–7°C (–19.4°F)	11.1°C (52°F)
Engine coolant temperature at engine start	4.4°C (40°F)	35°C (95°F)
Intake coolant temperature at engine start	4.4°C (40°F)	35°C (95°F)
Vehicle stop and idling	5 seconds	15 seconds
Stuck monitoring:		
Altitude	–	2,400 m (7,872 ft)
Vapor pressure sensor	No malfunction	
Difference between intake air temperature and engine coolant temperature at engine start	–7°C (–19.4°F)	11.1°C (52°F)
Engine coolant temperature at engine start	4.4°C (40°F)	35°C (95°F)
Intake air coolant temperature at engine start	4.4°C (40°F)	35°C (95°F)
Time after engine start	6 seconds	–

P0452 and P0453

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Difference between intake air temperature and engine coolant temperature at engine start	–	12°C (22°F)
Engine coolant temperature at engine start	10°C (50°F)	35°C (95°F)
Intake air temperature at engine start	10°C (50°F)	35°C (95°F)
Engine	Running	

TYPICAL MALFUNCTION THRESHOLDS

P0451

Detection Criteria	Threshold
Signal fluctuation (noise) monitoring:	
The number of times the output changed ±0.667 kpa (5 mmhg) or more during 5 to 15 seconds after idling and vehicle stop	7 times or more
No signal change (stuck) monitoring:	
Fuel tank pressure "no change" time (less than 0.18 kpa (1.35 mmHg) after engine start)	20 minutes or more

P0452 and P0453

Detection Criteria	Threshold
P0452:	
Fuel tank pressure	Less than –3.999 kPa (–30 mmHg)
P0453:	
Fuel tank pressure	1.999 kPa (15 mmHg) or more

WIRING DIAGRAM

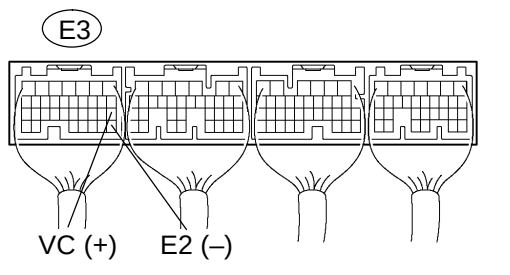
Refer to DTC No. P0441 on page 05–193.

INSPECTION PROCEDURE

HINT:

- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may be open.
- If DTC P0441 (Purge Flow), P0446 (VSV for CCV), P0451, P0452 or P0453 (Evaporative Pressure Sensor) is output with DTC P0442 or P0456, troubleshoot DTC P0441, P0446, P0451, P0452 or P0453 first. If no malfunction is detected, troubleshoot DTC P0442 or P0456 next.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.
- If the ENGINE RUN TIME in the freeze frame data is less than 200 seconds, carefully check the vapor pressure sensor.

1 INSPECT ECM(VC VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage between the terminals of the E3 ECM connector.

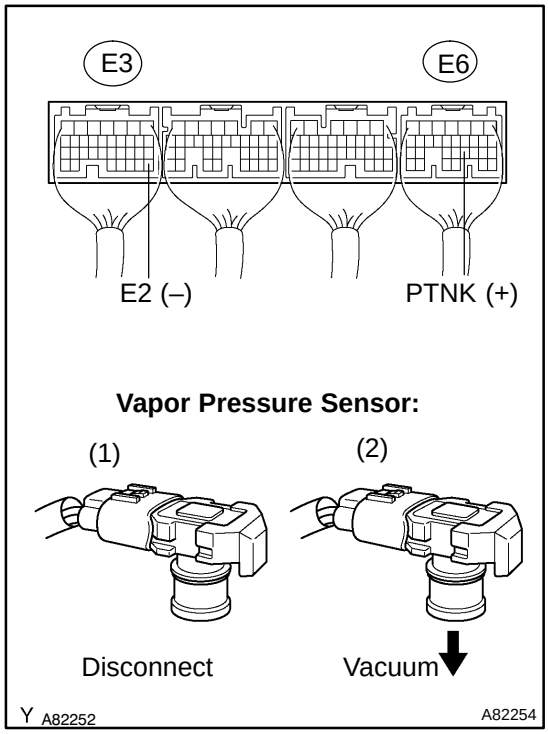
Standard:

Tester Connection	Specified Condition
VC (E3–18) – E2 (E3–28)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–11)**

OK

2 INSPECT ECM(PTNK VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E3 and E6 ECM connectors.
(1) Disconnect the vacuum hose from the vapor pressure sensor.

Standard (1):

Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	2.9 to 3.7 V

(2) Using the MITYVAC (Hand–Held Vacuum Pump), apply a vacuum of 4.0 kPa (30 mmHg, 1.18 in.Hg) to the vapor pressure sensor.

NOTICE:
The vacuum applied to the vapor pressure sensor must be less than 66.7 kPa (500 mmHg, 19.7 in.Hg).

Standard (2):

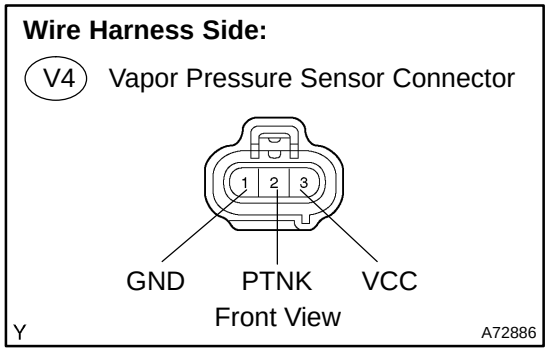
Tester Connection	Specified Condition
PTNK (E6–21) – E2 (E3–28)	0.5 V or less

(3) Reconnect the vacuum hose.

OK → **REPLACE ECM (See page 10–11)**

NG

3 CHECK HARNESS AND CONNECTOR(VAPOR PRESSURE SENSOR – ECM)



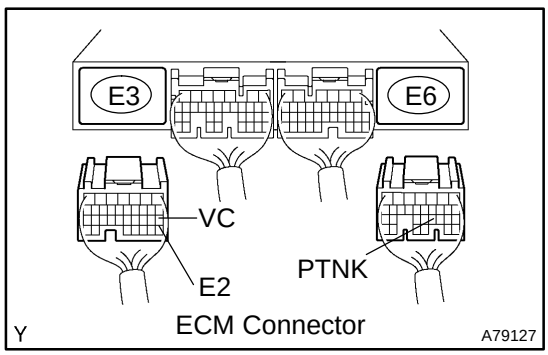
(a) Disconnect the V4 vapor pressure sensor connector.
(b) Disconnect the E3 and E6 ECM connectors.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
PTNK (V4–2) – PTNK (E6–21)	Below 1 Ω
GND (V4–1) – E2 (E3–28)	
VCC (V4–3) – VC (E3–18)	

Standard (Check for short):

Tester Connection	Specified Condition
PTNK (V4–2) or PTNK (E6–21) – Body ground	10 kΩ or higher
VCC (V4–3) or VC (E3–18) – Body ground	



(d) Reconnect the ECM connectors.
(e) Reconnect the vapor pressure sensor connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

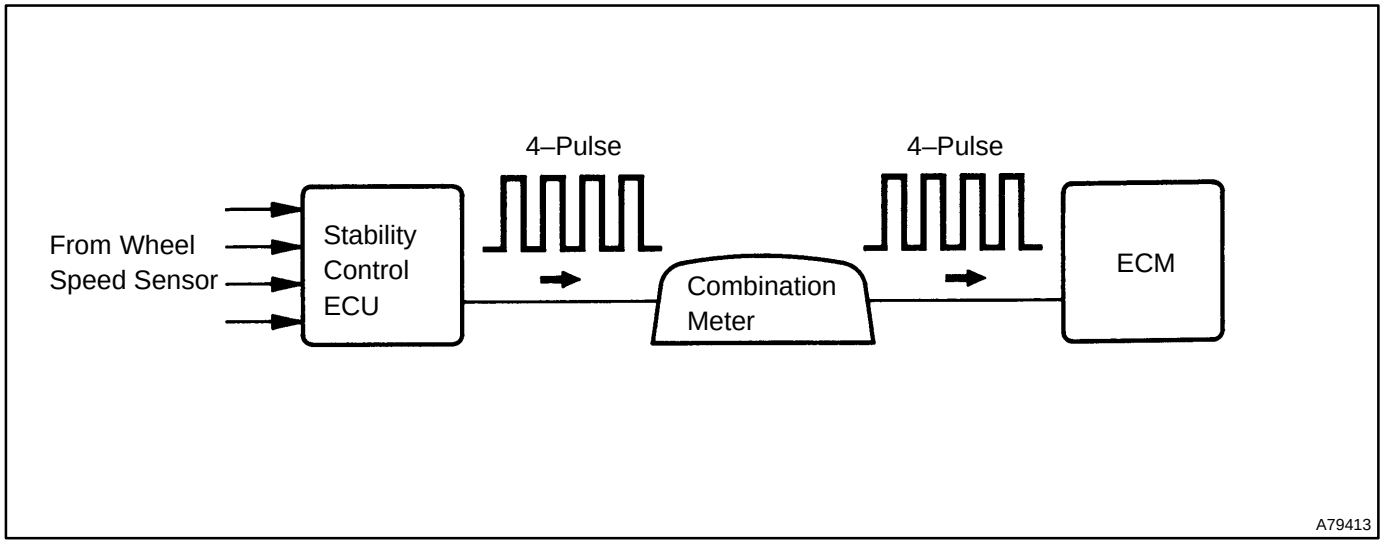
REPLACE VAPOR PRESSURE SENSOR ASSY

DTC	P0500	VEHICLE SPEED SENSOR ”A”

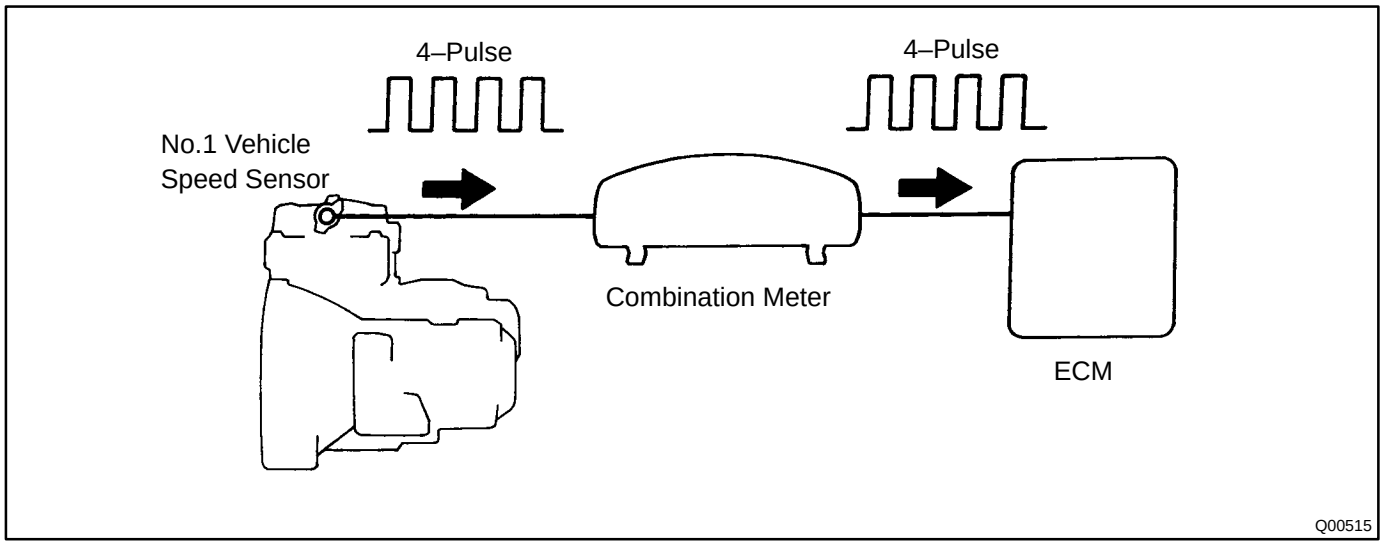
CIRCUIT DESCRIPTION

The vehicle equipped with ABS detects a vehicle speed using the stability control ECU and wheel speed sensor. This sensor monitors a wheel rotation speed and sends the signal to the ECU.
The stability control ECU converts these wheel speed signals into a 4–pulse signal and outputs it to the ECM via the combination meter.
The ECM determines the vehicle speed based on the frequency of these pulse signals.
In the vehicle without ABS, the No. 1 vehicle speed sensor outputs a 4–pulse signal for every revolution of the rotor shaft, which is rotated by the transmission output shaft via the driven gear. After this signal is converted into a more precise rectangular waveform by the waveform shaping circuit inside the combination meter, it is then transmitted to the ECM. The ECM determines the vehicle speed based on the frequency of these pulse signal.

w/ ABS:



w/o ABS:



DTC No.	DTC Detection Condition	Trouble Area
P0500	The ECM detects following conditions simultaneously 500 times (2 trip detection logic): • No SP1 (speed sensor) signal while ECM detects SP2 (No. 2 speed sensor) signal • Vehicle speed is 6 mph (9 km/h) or more for 4 seconds • Park/Neutral position switch is OFF (Shift lever is in other than P and N positions) • Transfer is in other than N position	• Open or short in speed sensor circuit • Speed sensor • Combination meter • ECM • Stability control ECU

MONITOR DESCRIPTION

Equipped with ABS:

The ECM assumes that the vehicle is driven when the RPM of the transmission counter gear indicates more than 300 rpm and it has been over 30 seconds since the park/neutral position switch was turned OFF. If there is no signal from the vehicle speed sensor with these conditions satisfied, the ECM concludes that there is a fault in the vehicle speed sensor. The ECM will turn on the MIL and a DTC is set.

Not equipped with ABS:

The ECM assumes that the vehicle is driven when the park/neutral position switch is OFF and it has been over 4 seconds since the actual vehicle speed was 9 km/h or more.

If there is no signal from the vehicle speed sensor with these conditions satisfied, the ECM concludes that there is a fault in the vehicle speed sensor. The ECM will turn on the MIL and a DTC is set.

MONITOR STRATEGY

Related DTCs	P0500	Vehicle speed sensor ”A” pulse input error
Required sensors/components	Main sensors	Vehicle speed sensor
	Related sensors	Park/Neutral position switch, engine coolant temperature sensor, combination meter
Frequency of operation	Continuous	
Duration	w/ ABS: 2 seconds w/o ABS: 8 seconds	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

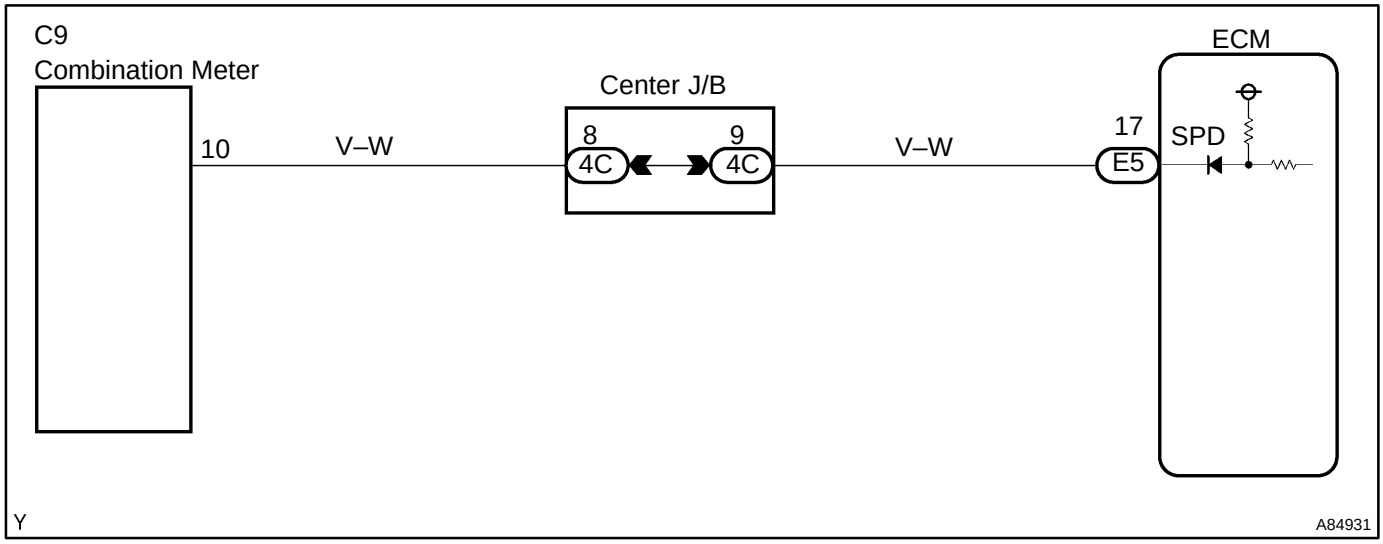
Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
w/o ABS:		
Engine coolant temperature	70 °C	–
Engine speed	2,000 rpm	5,000 rpm
Intake air amount per engine revolution	0.42 g/rev	–
Fuel cut at high engine speed	Not executing	
w/ ABS:		
Either of following condition is met	(a) or (b)	
(a) Following conditions are met	1 and 2	
1. Engine coolant temperature	20°C	–
2. Time after park/neutralposition switch ON to OFF	10 seconds	–
(b) Following conditions are met	1 and 2	
1. Engine coolant temperature	–	20°C
2. Time after park/neutral position switch ON to OFF	30 seconds	–

Engine speed	2650 rpm (vary with throttle opening angle)	–
Detection time on intake air temperature	2 seconds (Intake air temperature is –10°C or more) 8 seconds (Intake air temperature less than –10°C)	–
Time after IG SW ON	3 seconds	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Vehicle speed sensor signal	No pulse input

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

1	CHECK OPERATION OF SPEEDOMETER

(a) Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.

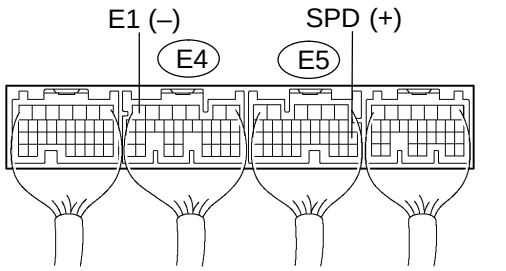
HINT:

The vehicle speed sensor is operating normally if the speedometer display is normal.

NG → **CHECK SPEEDOMETER CIRCUIT (See page 05–640)**

OK →

2 INSPECT ECM(SPD VOLTAGE)

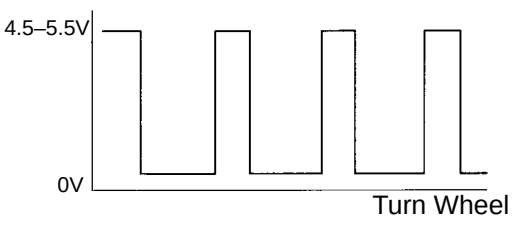


ECM Connector
A18294

(a) Shift the lever to the neutral position.
(b) Jack up the vehicle.
(c) Turn the ignition switch ON.
(d) Check the voltage between the terminals of the E4 and E5 ECM connectors as the wheel is turned slowly.

Standard:

Tester Connection	Specified Condition
SPD (E5–17) – E1 (E4–7)	Voltage is generated intermittently



A62954

HINT:
The output voltage should fluctuate up and down similarly to the diagram on the left when the wheel is turned slowly.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

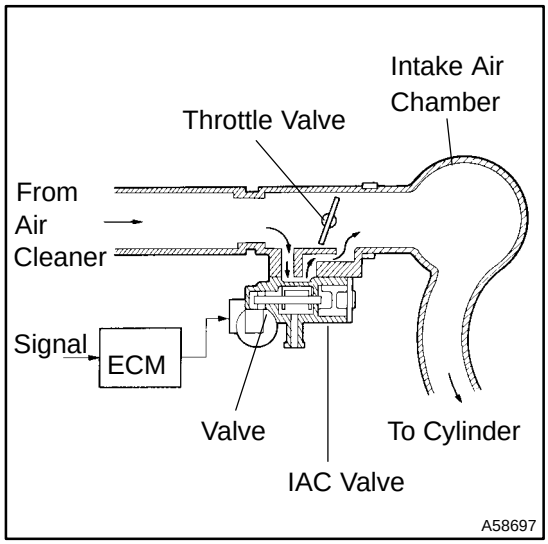
OK

REPLACE ECM (See page 10–11)

DTC	P0505	IDLE AIR CONTROL SYSTEM

DTC	P0511	IDLE AIR CONTROL CIRCUIT

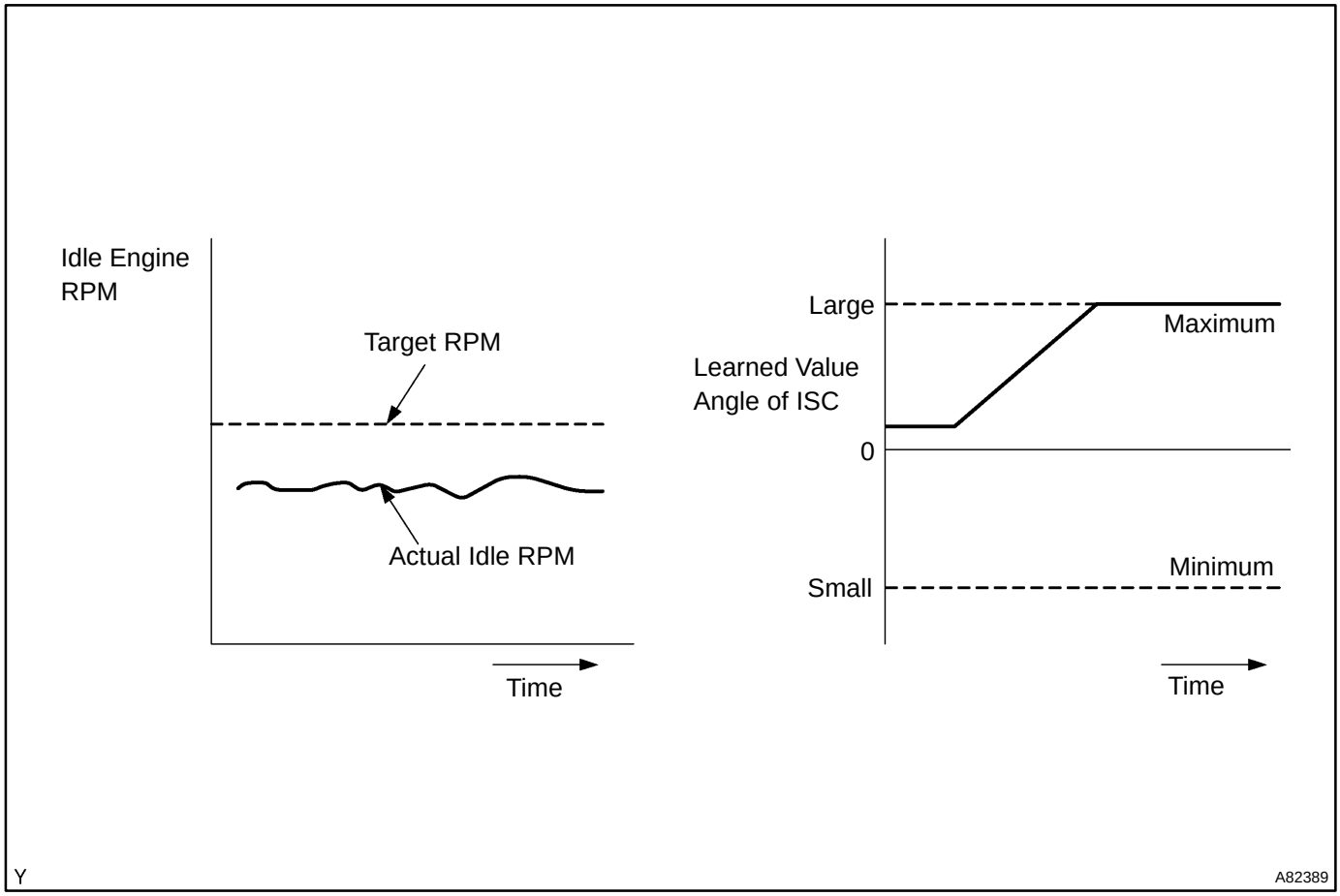
CIRCUIT DESCRIPTION



The rotary solenoid type idle air control (IAC) valve is located under the throttle body and intake air bypassing the throttle valve flows into the IAC valve through the passage.
In this way the intake air volume bypassing the throttle valve is regulated, controls the engine speed.
The ECM operates the IAC valve only to perform idle–up and provide feedback for the target idling speed.

DTC No.	DTC Detecting Condition	Trouble Area
P0505	Idle air continues to vary greatly from target speed (2 trip detection logic)	• Open or short in idle air control (IAC) valve circuit • Idle air control (IAC) valve is stuck or closed • A/C switch circuit • Air induction system • PCV valve and hose • ECM
P0511	Open or short ISC circuit	

MONITOR DESCRIPTION



The idle speeds are determined depending on the volume of air that passes through the IAC valve. When the volume is large, the idle speed becomes higher. When the volume is small, the idle speed becomes lower. The IAC valve controls the air volume that bypasses the throttle valve. The engine control module (ECM) sends duty signals to the IAC valve and drives the IAC valve stepper motor to determine the air volume that bypasses the throttle valve.

Although the ECM regulates the idle engine RPM with the feedback control in several vehicle stopped, actual idle RPM does not reach the targeted RPM and a learned valve angle of the idle air control (IAC) remains at the maximum or remains at the minimum, the ECM determines to detect malfunction in the IAC system.

Example:

If the RPM difference between the targeted and actual idle engine RPMs exceeds 200 rpm (*1) with the vehicle stopped in an idle, and this occurs 5 times, or if the learned value angle of the IAC remains at its maximum or minimum angle for 5 seconds, P505 is detected.

P0511 is detected as an open/short circuit in the IAC if the rate of duty signal input to the IAC valve has stuck at 0 or 100 %.

*1: Threshold RPM is varied by an engine load.

MONITOR STRATEGY

Related DTCs	P0505	Idle air control valve
	P0511	Idle air control valve
Required sensors/components	Main sensors	Crankshaft position sensor
	Related sensors	Vehicle speed sensor, engine coolant temperature sensor
Frequency of operation	P0505 Functional check: once per driving cycle P0505 Range check, P0511: continuous	
Duration	P0505 Functional check: 10 minutes P0505 Range check, P0511: 10 seconds	
MIL operation	P0505 Functional check: 2 driving cycles P0505 Range check, P0511: Immediately	
Sequence of operation	None	

TYPICAL ENABLING CONDITION

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of Disable a Monitor" (On page 05–25)	
P0505 Functional check:		
Battery voltage	11 V	–
Engine coolant temperature	75°C (167°F)	–
Idle	ON (more than 6 seconds)	
Vehicle speed	–	1.8 mph (3 km/h)
Engine speed	400 rpm	–
P0505 Range check:		
Output signal duty	10 %	90 %
Battery voltage	10 V	–
P0511:		
Output signal duty	10 %	90 %
Battery voltage	10 V	–
Time after first missing of voltage change	10 sec	–

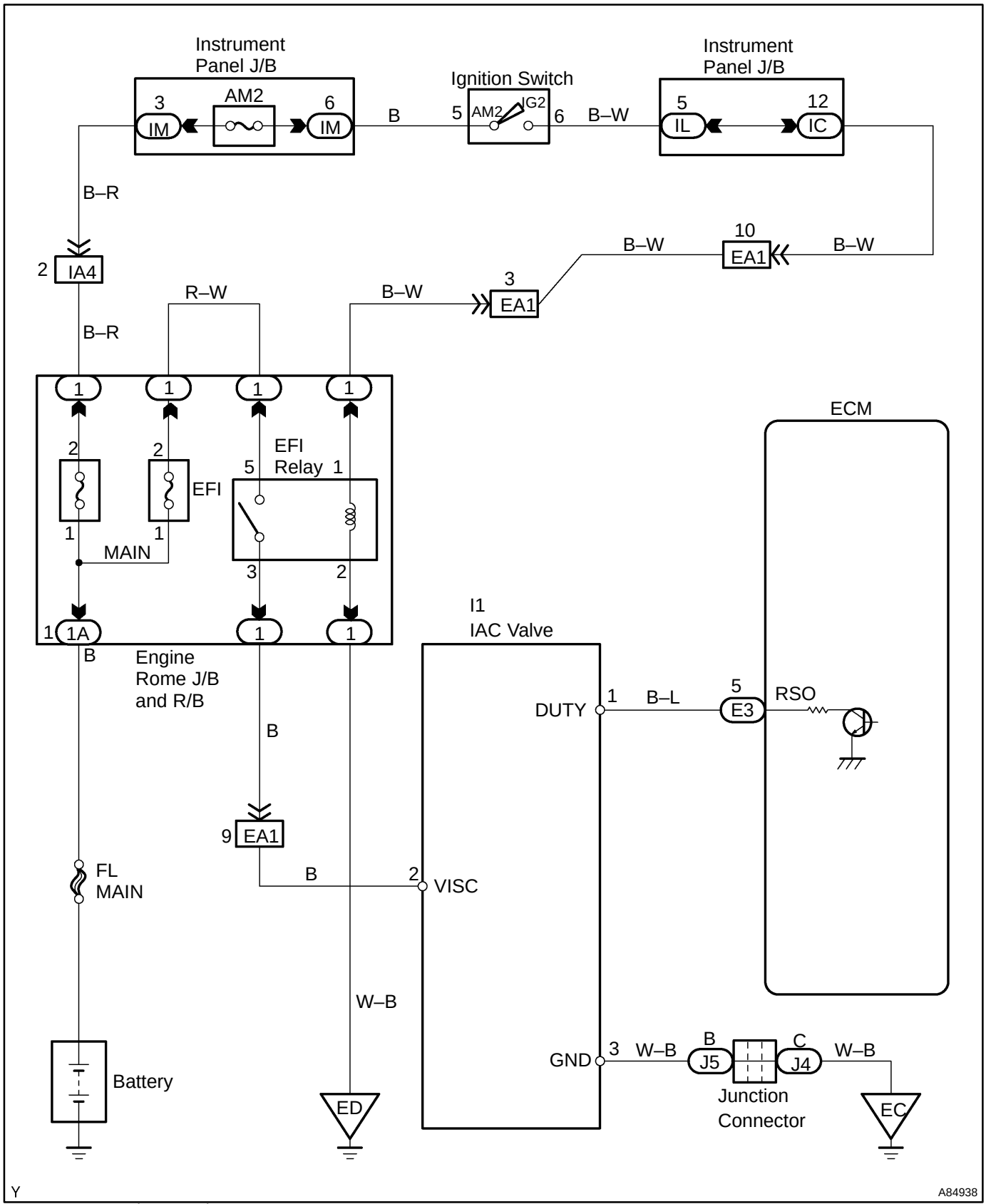
TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0505 Functional check:	
Following conditions are met (At idle (after running with more than 6.2 mph (10 km/h) per trip)	Case1: A and B (5 times) Case2: B (5 seconds)
A. Either of the following conditions is met:	1 or 2
1. Deviation of engine speed (When shift position N or A/C ON)	Less than – 100 rpm or more than 200 rpm
2. Deviation of engine speed (When shift position D or A/C OFF)	Less than – 100 rpm or more than 150 rpm
B. Either of the following condition is met:	1 or 2
1. IAC flow rate learning value (A/C OFF)	0.5 L/sec or less or 2.75 L/sec or more
2. IAC flow rate learning value (A/C ON)	0.22 L/sec or less or 0.98 L/sec or more
P0505 Range check:	
Number of missing output voltage change	2,000 times or more
P0511:	
Number of missing output voltage change	1,000 times or more

COMPONENT OPERATING RANGE

Parameter	Standard value
P0505, P0511:	
Time while no missing voltage change	0.5 seconds or more

WIRING DIAGRAM



2004 COROLLA (RM1037U)

INSPECTION PROCEDURE

HINT:

- When the throttle position is slightly opened (the accelerator pedal is slightly depressed) because a floor carpet is overlapped on the accelerator pedal, or if not fully releasing the accelerator pedal, etc., DTC P505 will possibly be detected.
- Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.

Hand–held tester:

1 CHECK OTHER DTC OUTPUT

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester main switch ON.
(c) Read the DTCs.

Result:

Display (DTC output)	Proceed to
P0505	A
P0511 and other DTCs	B

B → **Go to step 7**

A

2 CHECK CONNECTION OF PCV HOSE

NG → **REPAIR OR REPLACE PCV HOSE**

OK

3 CHECK AIR INDUCTION SYSTEM

NG → **REPAIR OR REPLACE**

OK

4	PERFORM ACTIVE TEST USING HAND–HELD TESTER(CHECK IAC VALVE OPERATION)

(a) Warm up the engine to the normal operating temperature.
(b) Switch off all the accessories.
(c) Switch off the A/C.
(d) Shift the lever into the neutral position.
(e) Connect the hand–held tester to the DLC3.
(f) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / ISC DUTY RATIO”.
(g) Check that the engine RPM varies when changing the ISC duty ratio.
Engine RPM:
Engine RPM fluctuates up and down in response to the ISC duty ratio variation.

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

NG

5	CHECK A/C SIGNAL CIRCUIT

NG → **REPAIR OR REPLACE**

OK

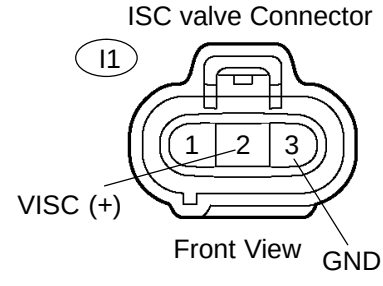
6	CHECK BLOCKAGE OF IAC VALVE AND PASSAGE TO BYPASS THROTTLE VALVE

NG → **REPLACE IDLE AIR CONTROL VALVE**

OK

7	CHECK HARNESS AND CONNECTOR

Wire Harness Side:



(a) Disconnect the I1 IAC valve connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals of the IAC valve wire harness side connector.
Standard:

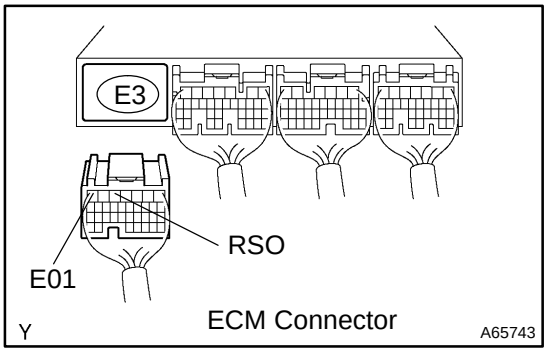
Tester Connection	Specified Condition
VISC (I1–2) – GND (I1–3)	9 to 14 V

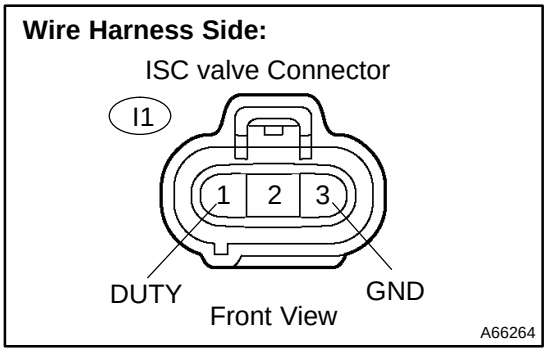
(d) Reconnect the IAC valve connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

8	CHECK HARNESS AND CONNECTOR(IAC VALVE – ECM)





(a) Disconnect the I1 IAC valve connector.
(b) Disconnect the E3 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
DUTY (I1–1) – RSO (E3–5)	Below 1 Ω
GND (I1–3) – E01 (E3–7)	

Standard (Check for short):

Tester Connection	Specified Condition
DUTY (I1–1) or RSO (E3–5) – Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the IAC valve connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

9	INSPECT IDLE AIR CONTROL VALVE (See page 10–1)

NG → **REPLACE IDLE AIR CONTROL VALVE**

OK

REPLACE ECM (See page 10–11)

OBD II scan tool (excluding hand–held tester):

1	CHECK OTHER DTC OUTPUT

(a) Connect the hand–held tester to the DLC3.
Result:

Display (DTC output)	Proceed to
P0505	A
"P0511" and other DTCs	B

B → **Go to step 6**

A

2	CHECK CONNECTION OF PCV HOSE

NG → REPAIR OR REPLACE PCV HOSE

OK

3	CHECK AIR INDUCTION SYSTEM

NG → REPAIR OR REPLACE

OK

4	CHECK A/C SIGNAL CIRCUIT

NG → REPAIR OR REPLACE

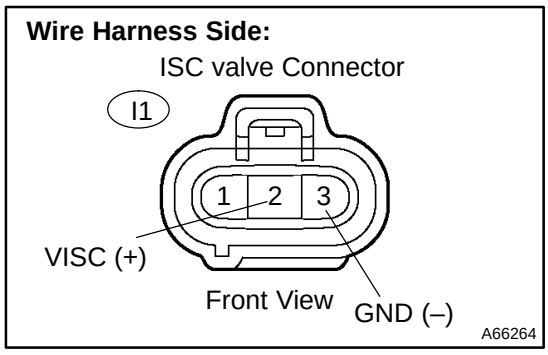
OK

5	CHECK BLOCKAGE OF IAC VALVE AND PASSAGE TO BYPASS THROTTLE VALVE

NG → REPAIR OR REPLACE IDLE AIR CONTROL VALVE

OK

6	CHECK HARNESS AND CONNECTOR



(a) Disconnect the I1 IAC valve connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals of the IAC valve wire harness side connector.

Standard:

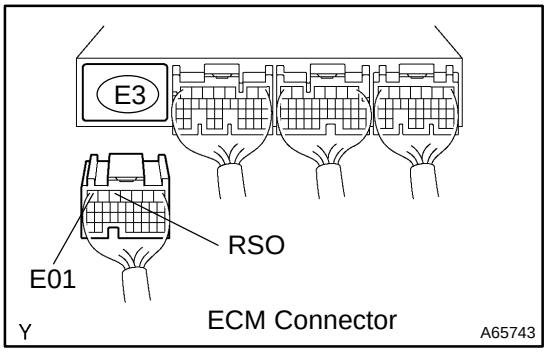
Tester Connection	Specified Condition
VISC (I1–2) – GND (I1–3)	9 to 14 V

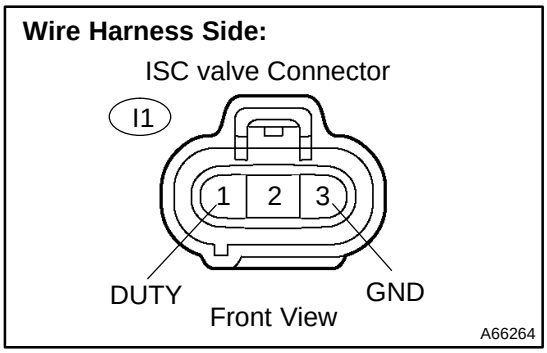
(d) Reconnect the IAC valve connector.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

7 CHECK HARNESS AND CONNECTOR(IAC VALVE – ECM)





(a) Disconnect the I1 IAC valve connector.
(b) Disconnect the E3 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
DUTY (I1–1) – RSO (E3–5)	Below 1 Ω
GND (I1–3) – E01 (E3–7)	

Standard (Check for short):

Tester Connection	Specified Condition
DUTY (I1–1) or RSO (E3–5) – Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the IAC valve connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

8 INSPECT IDLE AIR CONTROL VALVE (See page 10–1)

NG → **REPAIR OR REPLACE IDLE AIR CONTROL VALVE**

OK

REPLACE ECM(See page 10–11)

DTC P0560 SYSTEM VOLTAGE

MONITOR DESCRIPTION

The battery supplies electricity to the ECM even when the ignition switch is OFF. This electricity allows the ECM store data such as DTC history, freeze frame data, fuel trim values, and other data. If the battery voltage falls below a minimum level, the ECM will conclude that there is a fault in the power supply circuit. At the next engine start, the ECM will turn on the MIL and a DTC will be set.

DTC No.	DTC Detection Condition	Trouble Area
P0560	Open in back–up power source circuit	• Open in back–up power source circuit • ECM

MONITOR STRATEGY

Related DTCs	P0560	System voltage malfunction
Required sensors/components	ECM	
Frequency of operation	Continuous	
Duration	3 seconds	
MIL operation	Immediately (*1)	
Sequence of operation	None	

*1: The DTC is set immediately. The MIL will be illuminated after the next engine start.

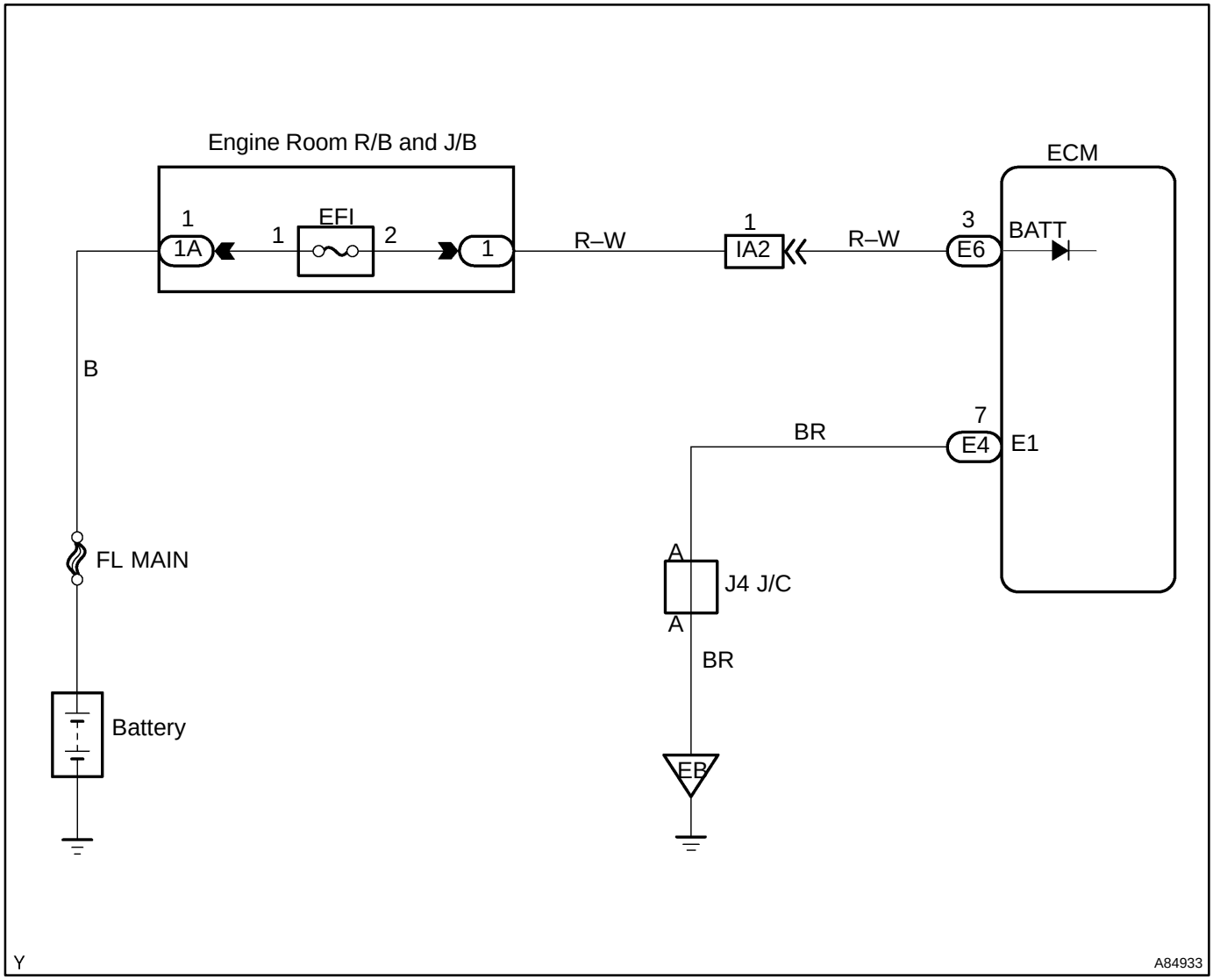
TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Stand–by RAM	Initialized	

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Battery voltage	Less than 3.5 V

WIRING DIAGRAM

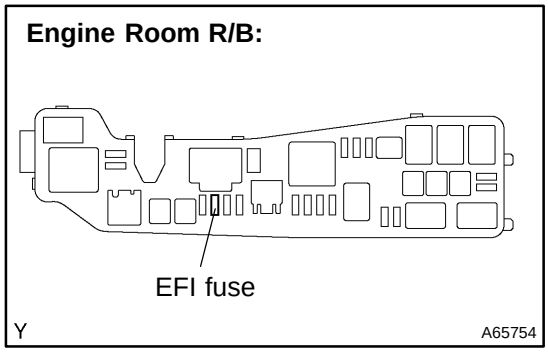


INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.

1 CHECK FUSE(EFI FUSE)

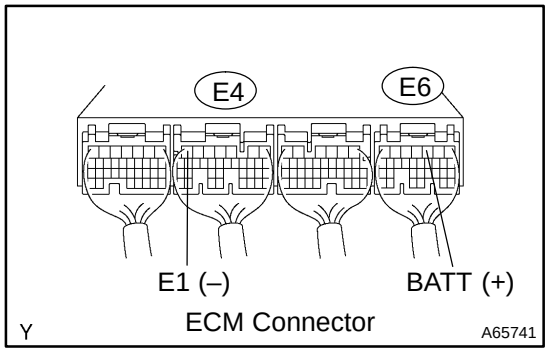


(a) Remove the EFI fuse from the engine room R/B.
(b) Check for continuity in the EFI fuse.
Standard: Continuity
(c) Reinstall the EFI fuse.

NG → **CHECK FOR SHORT IN ALL HARNESSES AND COMPONENTS CONNECTED FUSE**

OK

2 INSPECT ECM(BATT VOLTAGE)



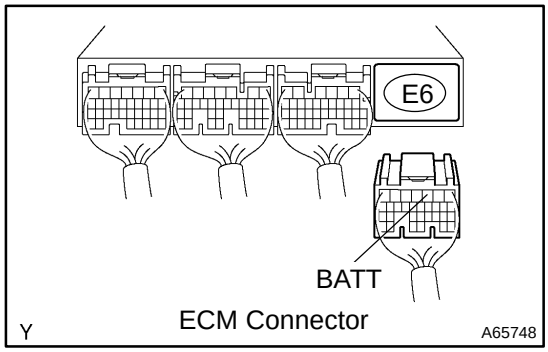
(a) Measure the voltage between the terminals of the E4 and E6 ECM connectors.
Standard:

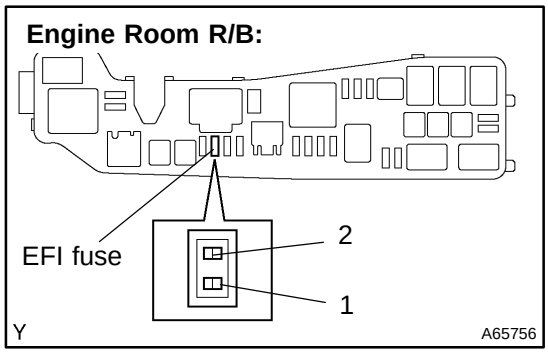
Tester Connection	Specified Condition
BATT (E6–3) – E1 (E4–7)	8 to 14 V

OK → **REPLACE ECM (See page 10–11)**

NG

3	CHECK HARNESS AND CONNECTOR(ECM – EFI FUSE, EFI FUSE – BATTERY)





(a) Check the harness and the connector between the EFI fuse and ECM.
  (1) Remove the EFI fuse from the engine room R/B.
  (2) Disconnect the E6 ECM connector.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
EFI fuse (2) – BATT (E6–3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
EFI fuse (2) or BATT (E6–3) – Body ground	10 kΩ or higher

  (4) Reconnect the ECM connector.
  (5) Reinstall the EFI fuse.

(b) Check the harness and the connector between the EFI fuse and battery.
  (1) Remove the EFI fuse from the engine room R/B.
  (2) Disconnect the battery positive terminal.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
Battery positive terminal – EFI fuse (1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Battery positive terminal or EFI fuse (1) – Body ground	10 kΩ or higher

  (4) Reconnect the battery positive terminal.
  (5) Reinstall the EFI fuse.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

CHECK AND REPLACE ENGINE ROOM RELAY BLOCK ASSY

DTC P0606 ECM/PCM PROCESSOR

MONITOR DESCRIPTION

The ECM continuously monitors its internal circuits. This self–check insures that the ECM is functioning properly. If a malfunction is detected, the ECM will set the appropriate DTC and illuminate the MIL.
The two CPUs, main and sub CPU inside the ECM, perform continuous mutual monitoring. If there is difference between outputs from the two CPUs that deviates from standard level ranges, the ECM concludes that there is a fault and sets a DTC.

DTC No.	DTC Detection Condition	Trouble Area
P0606	ECM internal error	• ECM

MONITOR STRATEGY

Related DTCs	P0606	ECM range check/description
Required sensors/components	ECM	
Frequency of operation	Continuous	
Duration	1 seconds	
MIL operation	Immediately	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
ECM error	

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

REPLACE ECM (See Page 10–11)

DTC P0617 STARTER RELAY CIRCUIT HIGH

MONITOR DESCRIPTION

While the engine is being cranked, the battery positive voltage is applied to terminal STA of the ECM. If the ECM detects the starter control signal (STA) while the vehicle is driving, it will conclude that there is a fault in the starter control circuit. The ECM will turn on the MIL and a DTC is set.

DTC No.	DTC Detection Condition	Trouble Area
P0617	When all conditions (a), (b) and (c) are satisfied with battery (+B) voltage 10.5 V or more for 20 seconds (a) Vehicle speed greater than 12 mph (20 km/h) (b) Engine revolution greater than 1,000 rpm (c) STA signal ON	• Short in Park/Neutral position switch circuit (A/T) • Park/Neutral position switch (A/T) • Clutch start switch (M/T) • ECM

MONITOR STRATEGY

Related DTCs	P0617	Starter signal error
Required sensors/components	Main sensors	Starter signal
	Related sensors	Vehicle speed sensor, engine speed sensor
Frequency of operation	Continuous	
Duration	20 seconds	
MIL operation	Immediately	
Sequence of operation	None	

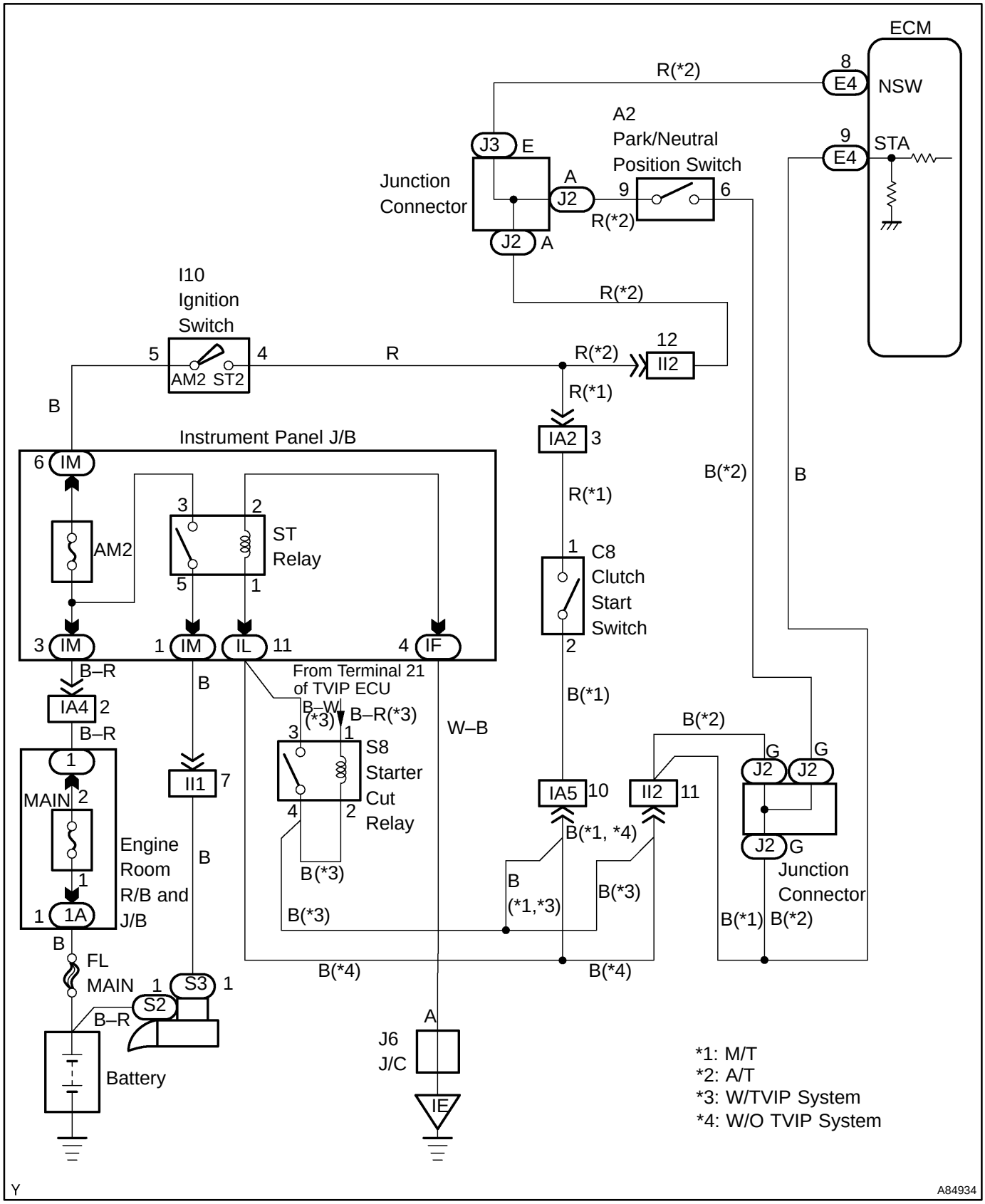
TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Battery voltage	10.5 V	–
Vehicle speed	12.4 mph (20 km/h)	–
Engine speed	1,000 rpm	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Starer signal	ON (at more than 12.4 mph (20 km/h) and more than 1,000 rpm)

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- This DTC chart is on the premise that the engine is cranked normally. If the engine is not cranked, proceed to the problem symptoms table on page 05–42.
- Read freeze frame data using the hand–held tester or the OBD II scan tool. 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.

Hand–held tester:

1	READ VALUE OF HAND–HELD TESTER(STARTER SIGNAL)

(a) Connect the hand–held tester or OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / STARTER SIG” and read the value displayed the hand–held tester.

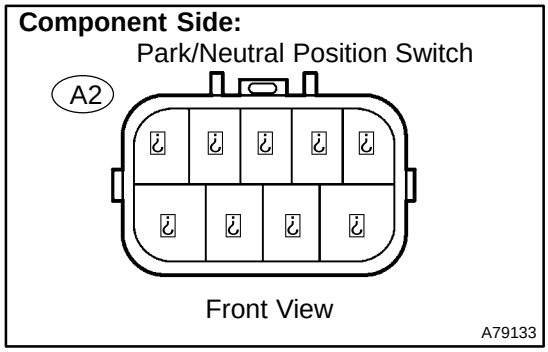
Result:

Ignition switch position	ON	START
STA Signal	OFF	ON

OK → **REPLACE ECM (See page 10–11)**

NG

2 INSPECT PARK/NEUTRAL POSITION SWITCH OR CLUTCH START SWITCH



(a) Inspect the park/neutral position switch. (A/T)

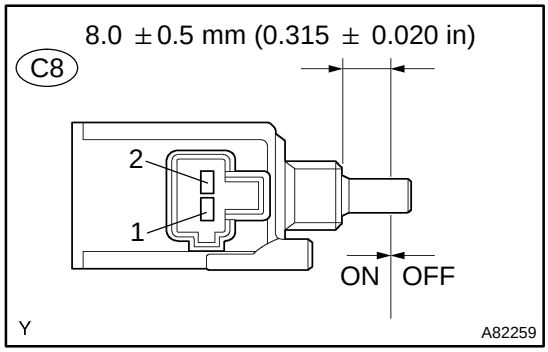
(1) Disconnect the A2 park/neutral position switch connector.

(2) Check for continuity between each terminal shown below when the shift lever is moved to each range.

Standard:

Shift Range	Tester Connection	Specified Condition
P	1 – 3, 6 – 9	Continuity
R	2 – 3	
N	3 – 5, 6 – 9	
D	3 – 7	
2	3 – 4	
L	3 – 8	

(3) Reconnect the park/neutral position switch connector.



(b) Inspect the clutch start switch. (M/T)

(1) Disconnect the C8 clutch start switch connector.

(2) Check for continuity between terminals when the switch ON and OFF.

Standard:

Switch Position	Terminal	Specified Condition
ON (pushed)	1 – 2	Continuity
OFF (free)		No continuity

(3) Reconnect the clutch start switch connector.

NG → **REPLACE PARK/NEUTRAL POSITION SWITCH OR CLUTCH START SWITCH (GO TO NEXT STEP 3 AFTER THE REPLACEMENT)**

OK

3 READ VALUE OF HAND–HELD TESTER(STARTER SIGNAL)

(a) Connect the hand–held tester to or OBD II scan tool the DLC3.

(b) Turn the ignition switch ON and push the hand–held tester main switch ON.

(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / STARTER SIG” and read its value displayed the hand–held tester.

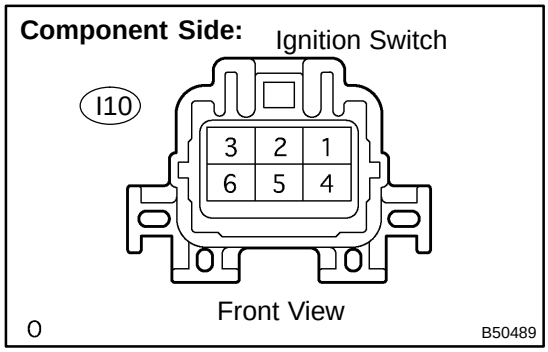
Result:

Ignition Switch Position	ON	START
STA Signal	OFF	ON

OK → **SYSTEM OK**

NG

4 INSPECT IGNITION OR STARTER SWITCH ASSY



(a) Check for continuity between the connector terminals shown in the chart below.

Switch Position	Tester Connection	Specified Condition
LOCK	All Terminals	No continuity
ACC	1–3	Continuity
ON	1–2, 1–3, 2–3, 5–6	Continuity
START	1–2, 4–5, 4–6, 5–6	Continuity

NG → **REPLACE IGNITION OR STARTER SWITCH ASSY (GO TO NEXT STEP 5 AFTER THE REPLACEMENT**

OK

5 READ VALUE OF HAND–HELD TESTER(STARTER SIGNAL)

(a) Connect the hand–held tester or OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / STARTER SIG” and read its value displayed the hand–held tester.

Result:

Ignition Switch Position	ON	START
STA Signal	OFF	ON

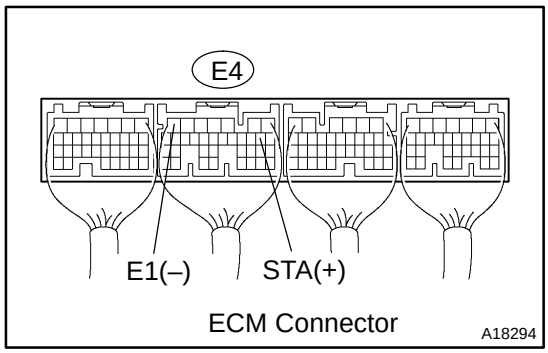
OK → **SYSTEM OK**

NG

REPAIR OR REPLACE HARNESS AND CONNECTOR

OBD II scan tool (excluding hand–held tester):

1	INSPECT ECM



(a) Turn the ignition switch ON.

(b) Measure the voltage between the terminals of the E4 ECM connector.

Standard:

Tester Connection	Specified Condition
STA (E4–9) – E1 (E4–7)	0 V

(c) Measure the voltage between the terminals of the E4 ECM connector when the engine is cranked.

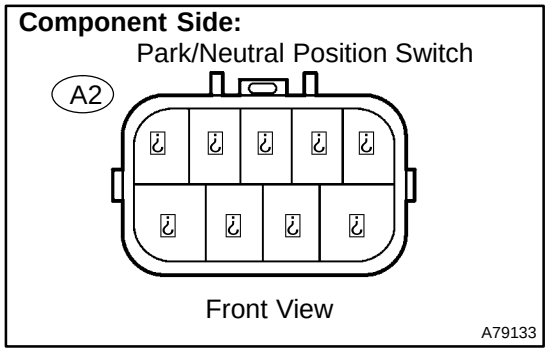
Standard:

Tester Connection	Specified Condition
STA (E4–9) – E1 (E4–7)	5.5 V or more

OK → **REPLACE ECM (See page 10–11)**

NG

2 INSPECT PARK/NEUTRAL POSITION SWITCH OR CLUTCH START SWITCH



(a) Inspect the park/neutral position switch. (A/T)

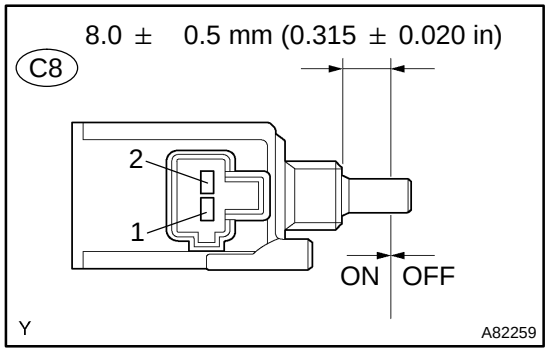
(1) Disconnect the A2 park/neutral position switch connector.

(2) Check for continuity between each terminal shown below when the shift lever is moved to each range.

Standard:

Shift Range	Terminal No.	Specified Condition
P	1 – 3, 6 – 9	Continuity
R	2 – 3	
N	3 – 5, 6 – 9	
D	3 – 7	
2	3 – 4	
L	3 – 8	

(3) Reconnect the park/neutral position switch connector.



(b) Inspect the clutch start switch. (M/T)

(1) Disconnect the C8 clutch start switch connector.

(2) Check for continuity between terminals when the switch ON and OFF.

Standard:

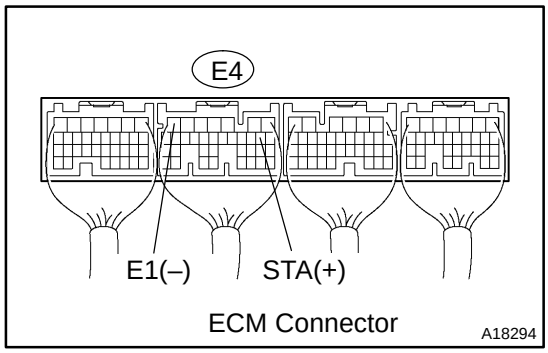
Switch Position	Between Terminals	Specified Condition
ON (pushed)	1 – 2	Continuity
OFF (free)		No continuity

(3) Reconnect the clutch start switch connector.

NG → **REPLACE PARK/NEUTRAL POSITION SWITCH OR CLUTCH START SWITCH (GO TO NEXT STEP 3 AFTER THE REPLACEMENT)**

OK

3 INSPECT ECM



(a) Turn the ignition switch ON.

(b) Measure the voltage between the terminals of the E4 ECM connector.

Standard:

Tester Connection	Specified Condition
STA (E4–9) – E1 (E4–7)	0 V

(c) Measure the voltage between the terminals of the E4 ECM connector when the engine is cranked.

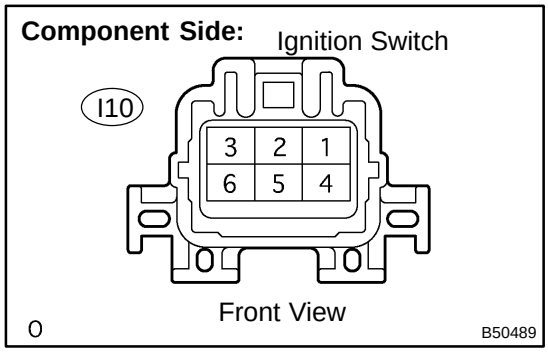
Standard:

Tester Connection	Specified Condition
STA (E4–9) – E1 (E4–7)	5.5 V or more

OK → **SYSTEM OK**

NG

4 INSPECT IGNITION OR STARTER SWITCH ASSY



(a) Disconnect the I10 ignition switch connector.
(b) Check for continuity between the connector terminals shown in the chart below.

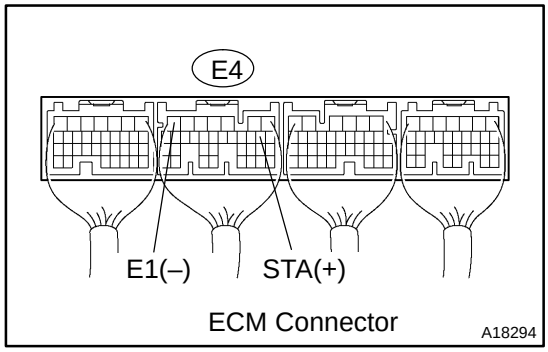
Switch Position	Terminal No.	Specified Condition
LOCK	All Terminals	No continuity
ACC	1–3	Continuity
ON	1–2, 1–3, 2–3, 5–6	Continuity
START	1–2, 4–5, 4–6, 5–6	Continuity

(c) Reconnect the ignition switch connector.

NG → **REPLACE IGNITION OR STARTER SWITCH ASSY (GO TO NEXT STEP 5 AFTER THE REPLACEMENT)**

OK

5 INSPECT ECM



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E4 ECM connector.
Standard:

Tester Connection	Specified Condition
STA (E4–9) – E1 (E4–7)	0 V

(c) Measure the voltage between the terminals of the E4 ECM connector when the engine is cranked.
Standard:

Tester Connection	Specified Condition
STA (E4–9) – E1 (E4–7)	5.5 V or more

OK → **SYSTEM OK**

NG

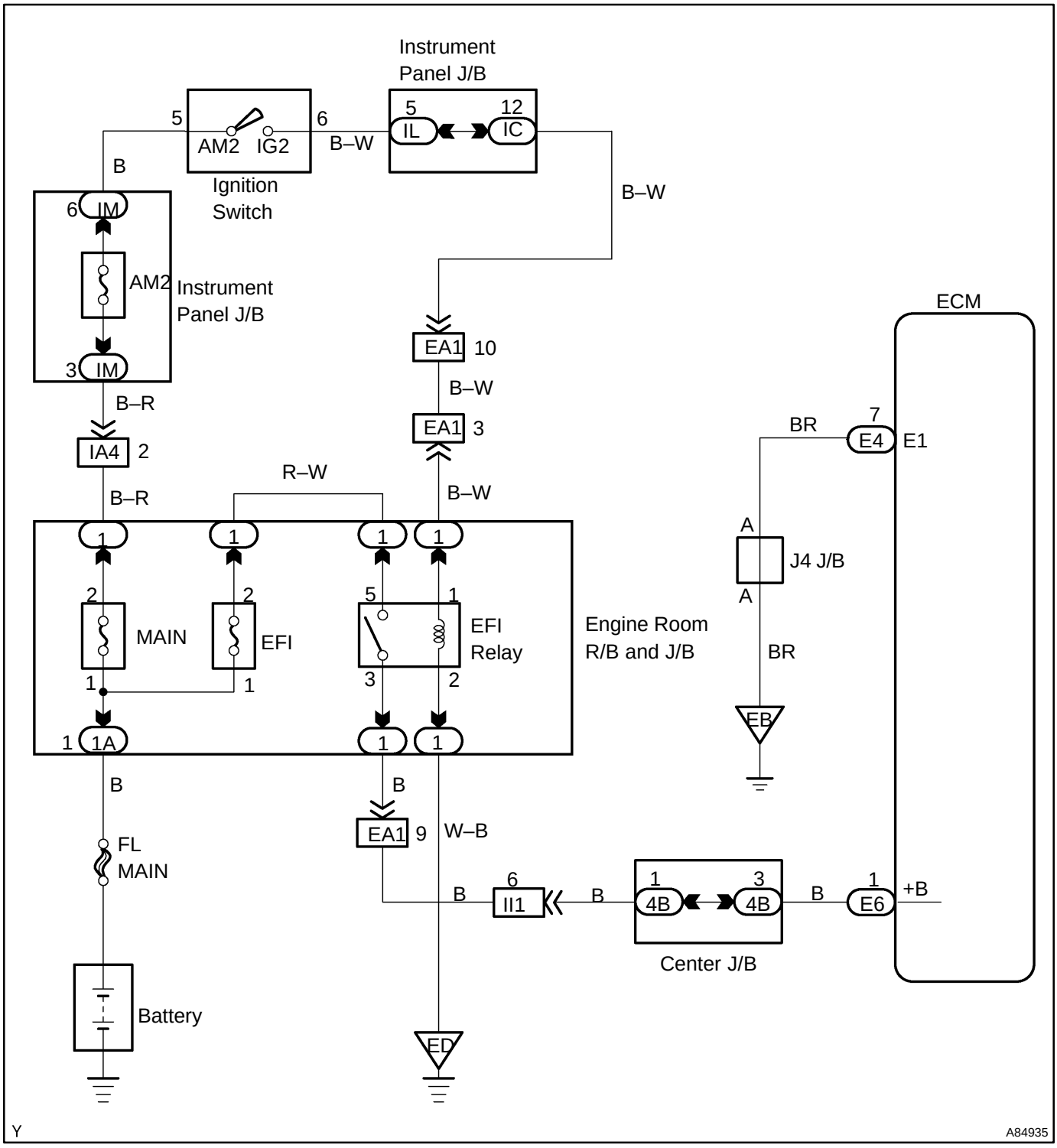
REPAIR OR REPLACE HARNESS OR CONNECTOR

ECM POWER SOURCE CIRCUIT

CIRCUIT DESCRIPTION

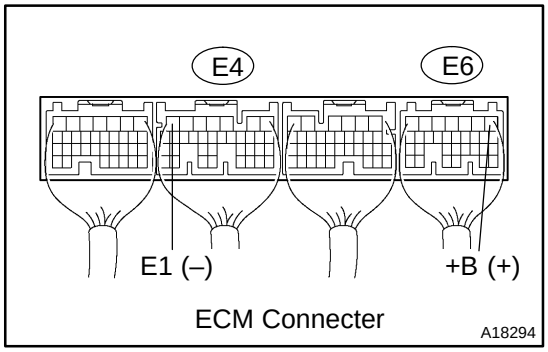
When the ignition switch is turned ON, battery positive voltage is applied to the coil which closes the contacts of the EFI main relay (Marked: EFI) and supplies power to terminal +B of the ECM.
This signal causes current to flow to the coil, closing the contacts of the EFI relay and supplying power to terminal +B of the ECM.
If the ignition switch is turned off, the ECM continues to switch on the EFI relay for a maximum of 2 seconds for the initial setting of the ISC valve.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT ECM(+B VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E4 and E6 ECM connectors.

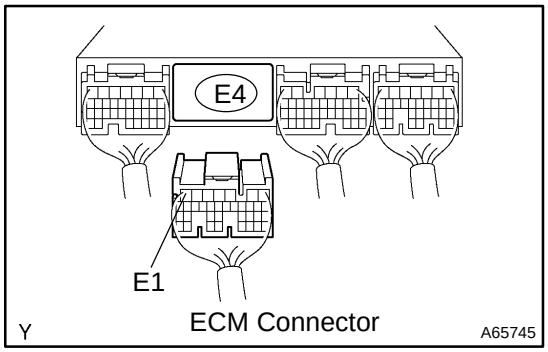
Standard:

Tester Connection	Specified Condition
+B (E6–1) – E1 (E4–7)	8 to 14 V

OK → **REPLACE ECM (See page 10–11)**

NG

2 CHECK HARNESS AND CONNECTOR(ECM – BODY GROUND)



(a) Disconnect the E4 ECM connector.
(b) Check the resistance between the wire harness side connectors.

Standard (Check for open):

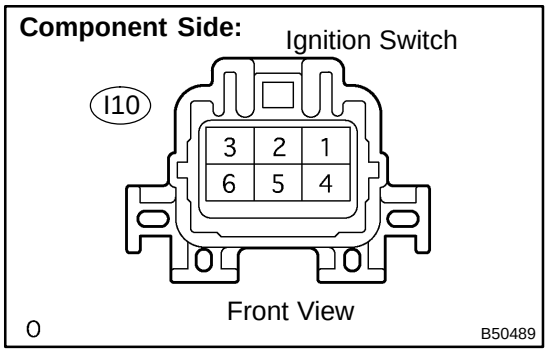
Tester Connection	Specified Condition
E1 (E4–7) – Body ground	Below 1 Ω

(c) Reconnect the ECM connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3 INSPECT IGNITION OR STARTER SWITCH ASSY



(a) Disconnect the I10 ignition switch connector.
(b) Check for continuity between the connector terminals shown in the chart below.

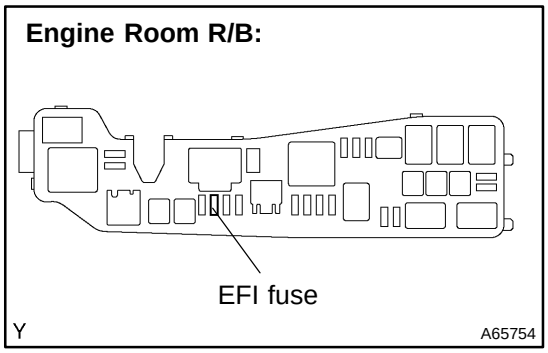
Switch Position	Tester Connection	Specified Condition
LOCK	All Terminals	No continuity
ACC	1–3	Continuity
ON	1–2, 1–3, 2–3, 5–6	Continuity
START	1–2, 4–5, 4–6, 5–6	Continuity

(c) Reconnect the ignition switch connector.

NG → **REPLACE IGNITION OR STARTER SWITCH ASSY**

OK

4 CHECK FUSE(EFI FUSE)

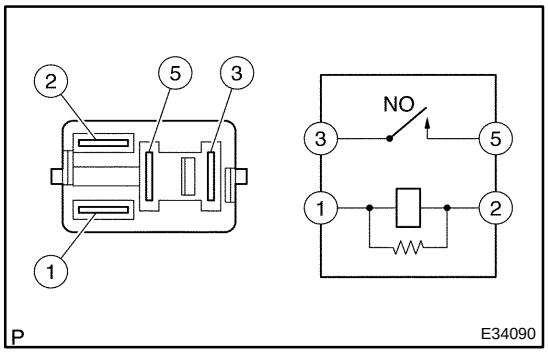


(a) Remove the EFI fuse from the engine room R/B.
(b) Check for continuity in the EFI fuse.
Standard: Continuity
(c) Reinstall the EFI fuse.

NG → **CHECK FOR SHORT IN ALL HARNESSES AND COMPONENTS CONNECTED FUSE**

OK

5 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B.
(b) Check for continuity in the circuit EFI relay.
Standard:

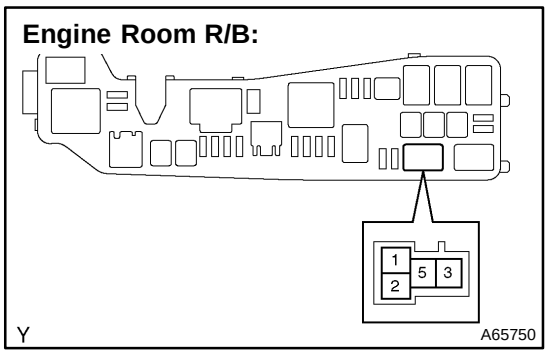
Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No continuity
	Continuity (Apply battery voltage to terminals 1 and 2)

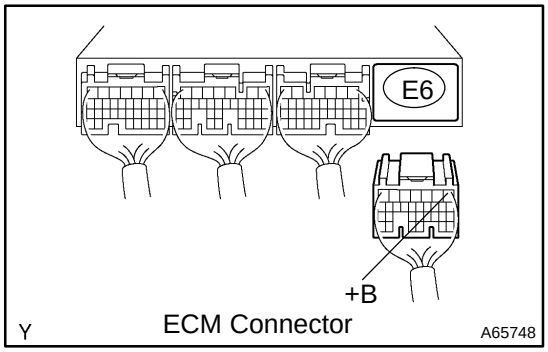
(c) Reinstall the EFI fuse.

NG → **REPLACE EFI RELAY**

OK

6	CHECK HARNESS AND CONNECTOR(EFI RELAY – ECM, EFI RELAY – BODY GROUND)





(a) Check the harness and connector between the EFI relay and ECM.
  (1) Remove the EFI relay from the engine room R/B.
  (2) Disconnect the E6 ECM connector.
  (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
EFI relay (3) – +B (E6–1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
EFI relay (3) or +B (E6–1) – Body ground	10 kΩ or higher

  (4) Reconnect the ECM connector.
  (5) Reinstall the EFI relay.

(b) Check the harness and connector between the EFI relay and body ground.
  (1) Remove the EFI relay from the engine room R/B.
  (2) Check the resistance between the wire harness side connector and body ground.

Standard (Check for open):

Tester Connection	Specified Condition
EFI relay (2) – Body ground	Below 1 Ω

  (3) Reinstall the EFI relay.

OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

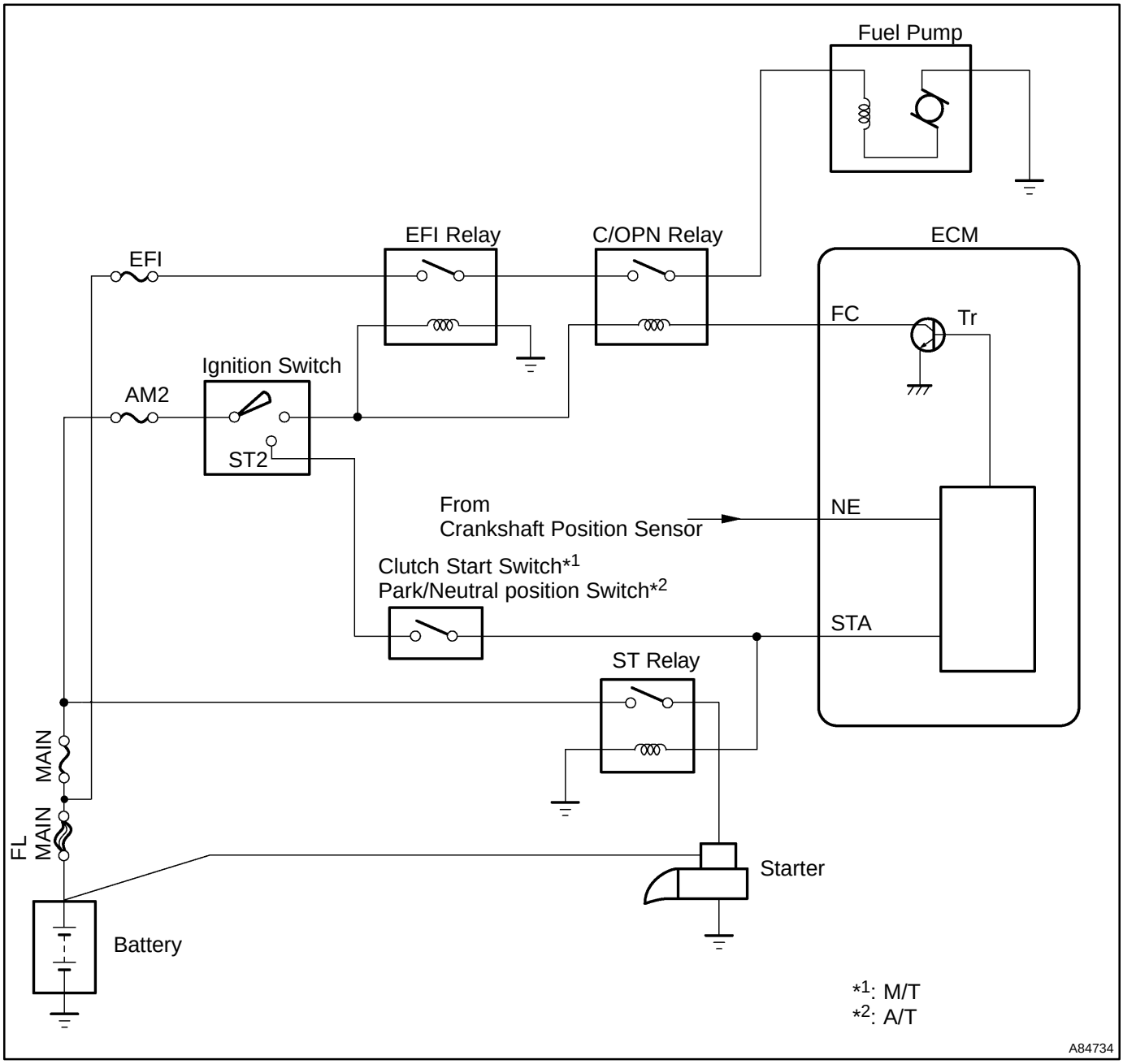
NG

CHECK AND REPAIR HARNESS AND CONNECTOR (TERMINAL +B OF ECM – BATTERY POSITIVE TERMINAL)

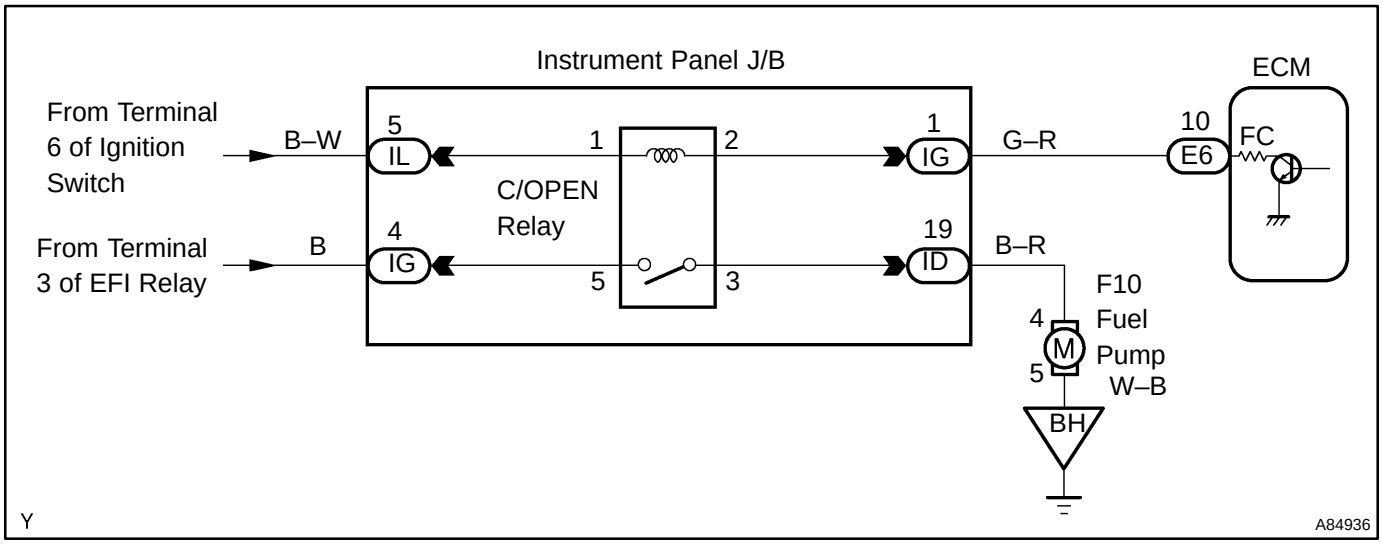
FUEL PUMP CONTROL CIRCUIT

CIRCUIT DESCRIPTION

In the diagram below, when the engine is cranked, current flows from terminal ST2 of the ignition switch to the starter relay coil and also current flows to terminal STA of the ECM (STA signal).
When the STA signal and NE signal are input to the ECM, Tr is turned ON, current flows to the coil of the circuit opening relay, the relay switches on, power is supplied to the fuel pump and the fuel pump operates. While the NE signal is generated (engine running), the ECM keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.



WIRING DIAGRAM



INSPECTION PROCEDURE

Hand–held tester:

1	**PERFORM ACTIVE TEST BY HAND–HELD TESTER(OPERATION OF CIRCUIT OPENING RELAY)**

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester main switch ON.
(c) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / FUEL PUMP / SPD”.
(d) Check the relay operation while operating it with the hand–held tester.
Standard: Operating noise can be heard from the relay.

OK	**Go to step 6**

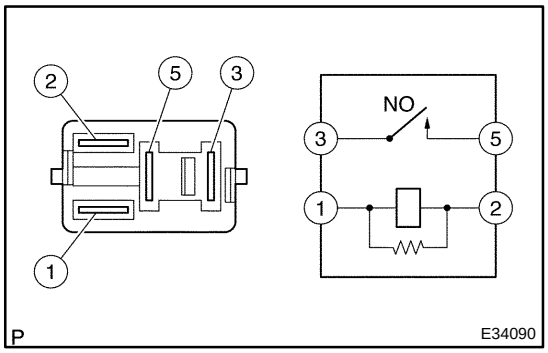
NG

2	**INSPECT ECM POWER SOURCE CIRCUIT (See page 05–273)**

NG	**REPAIR OR REPLACE POWER SOURCE CIRCUIT**

OK

3 INSPECT CIRCUIT OPENING RELAY



(a) Remove the circuit opening relay from the instrument panel J/B.

(b) Check for continuity in the circuit opening relay.

Standard:

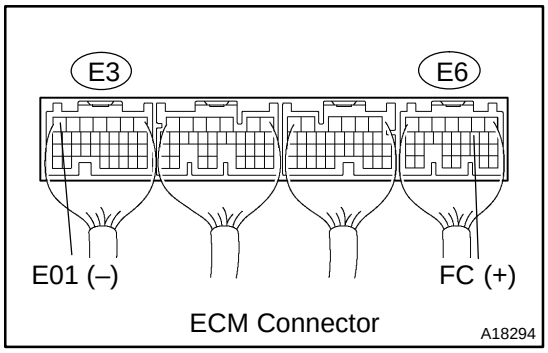
Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No continuity
	Continuity (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the circuit opening relay.

NG → **REPLACE CIRCUIT OPENING RELAY**

OK

4 INSPECT ECM(FC VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage between the terminals of the E3 and E6 ECM connectors.

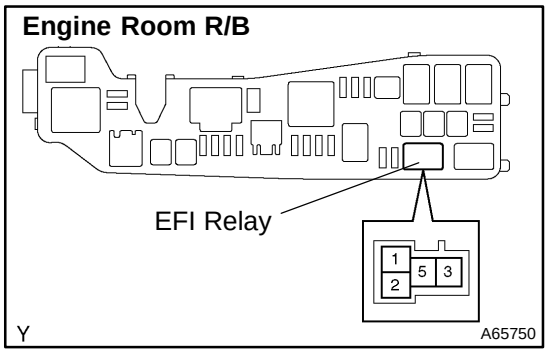
Standard:

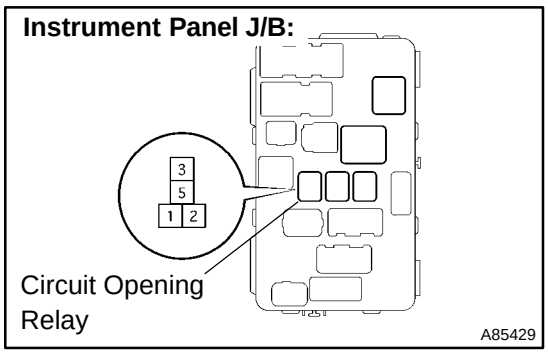
Tester Connection	Specified Condition
FC (E6–10) – E01 (E3–7)	9 to 14 V

OK → **REPLACE ECM (See page 10–11)**

NG

5 CHECK HARNESS AND CONNECTOR(EFI RELAY – CIRCUIT OPENING RELAY)





(a) Remove the EFI relay from the engine room R/B.
(b) Remove the circuit opening relay from the instrument panel J/B.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
EFI relay (1) – Circuit opening relay (1)	Below 1 Ω
EFI relay (3) – Circuit opening relay (5)	

Standard (Check for short):

Tester Connection	Specified Condition
EFI relay (1) or Circuit opening relay (1) – Body ground	10 kΩ or higher
EFI relay (3) or Circuit opening relay (5) – Body ground	

(d) Reinstall the circuit opening relay.
(e) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

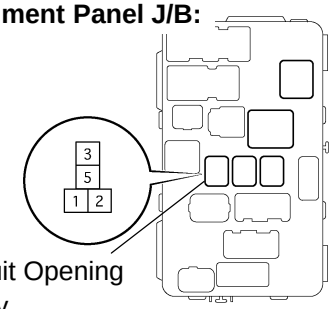
6 INSPECT FUEL PUMP (See page 11–7)

NG → **REPAIR OR REPLACE FUEL PUMP (See page 11–16)**

OK

7	CHECK HARNESS AND CONNECTOR(CIRCUIT OPENING RELAY – FUEL PUMP, FUEL PUMP – BODY GROUND)

Instrument Panel J/B:



Wire Harness Side:

F10 Fuel Pump Connector

(a) Remove the circuit opening relay from the instrument panel J/B.

(b) Disconnect the F10 fuel pump connector.

(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
Circuit opening relay (3) – Fuel pump (F10–4)	Below 1 Ω
Fuel pump (F10–5) – Body ground	

Standard (Check for short):

Tester Connection	Specified Condition
Circuit opening relay (3) or Fuel pump (F10–4) – Body ground	10 kΩ or higher

(d) Reconnect the fuel pump connector.

(e) Reinstall the circuit opening relay.

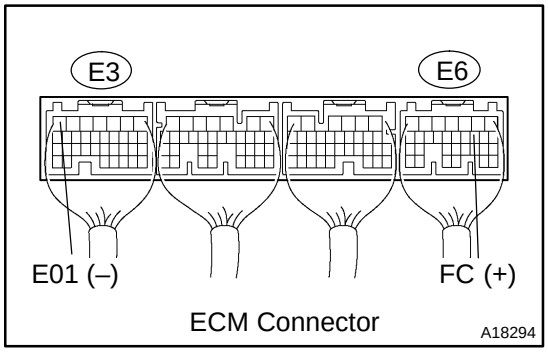
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

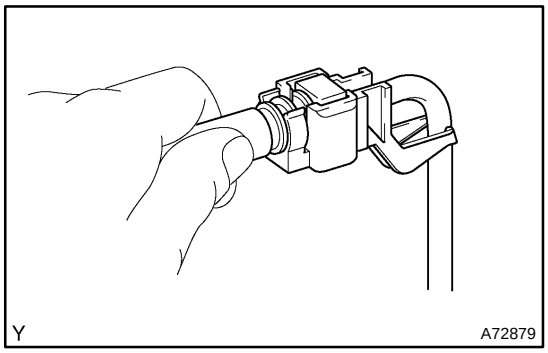
OBD II scan tool (excluding hand–held tester):

1	CHECK OPERATION OF FUEL PUMP



(a) Turn the ignition switch ON.
(b) Connect between terminals FC and E01 of the ECM connector.
(c) Check for fuel pressure in the fuel inlet hose when it is pinched off.
Result: There is pressure in fuel inlet hose.

HINT:
At this time, you will hear the fuel flowing sound.



OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN ON PROBLEM SYMPTOMS TABLE (See page 05–42)**

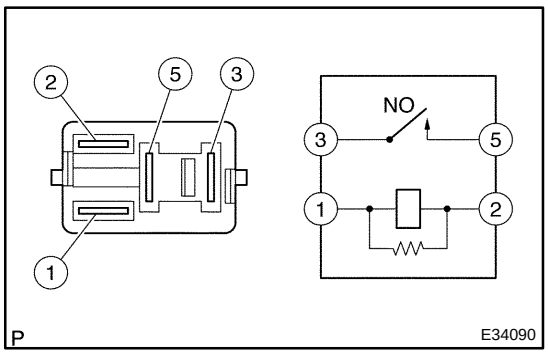
NG

2	INSPECT ECM POWER SOURCE CIRCUIT (See page 05–273)

NG → **REPAIR OR REPLACE ECM POWER SOURCE CIRCUIT**

OK

3	INSPECT CIRCUIT OPENING RELAY



(a) Remove the circuit opening relay from the instrument panel J/B.
(b) Check for continuity in the circuit opening relay.
Standard:

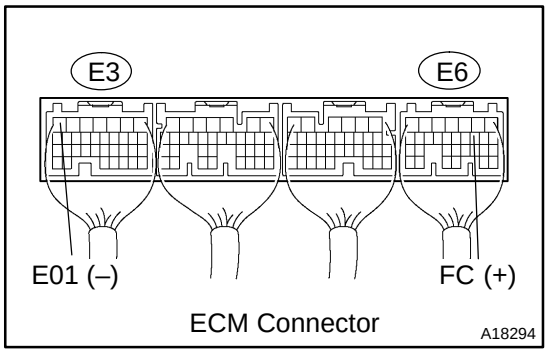
Tester Connection	Specified Condition
1 – 2	Continuity
3 – 5	No continuity
	Continuity (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the circuit opening relay.

NG → **REPLACE CIRCUIT OPENING RELAY**

OK

4 INSPECT ECM(FC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E3 and E6 ECM connectors.

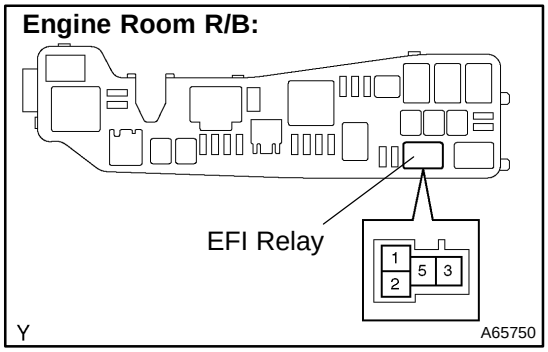
Standard:

Tester Connection	Specified Condition
FC (E6–10) – E01 (E3–7)	9 to 14 V

OK → **REPLACE ECM (See page 10–11)**

NG

5 CHECK HARNESS AND CONNECTOR(EFI RELAY – CIRCUIT OPENING RELAY)



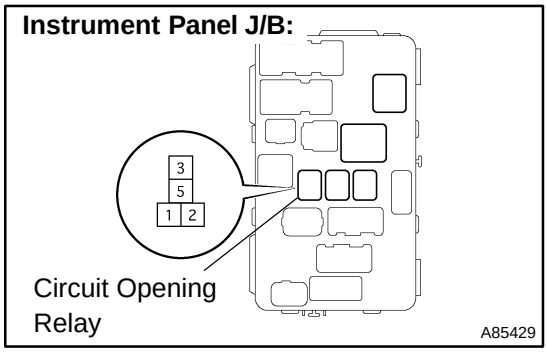
(a) Remove the EFI relay from the engine room R/B.
(b) Remove the circuit opening relay from the instrument panel J/B.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
EFI relay (1) – Circuit opening relay (1)	Below 1 Ω
EFI relay (3) – Circuit opening relay (5)	

Standard (Check for short):

Tester Connection	Specified Condition
EFI relay (1) or Circuit opening relay (1) – Body ground	10 kΩ or higher
EFI relay (3) or Circuit opening relay (5) – Body ground	



(d) Reinstall the circuit opening relay.
(e) Reinstall the EFI relay.

NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM (See page 10–11)

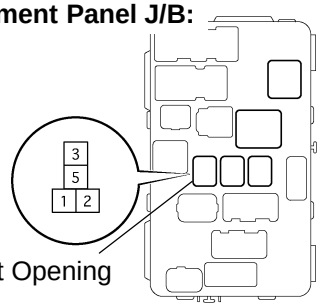
6 INSPECT FUEL PUMP

NG → **REPAIR OR REPLACE FUEL PUMP**

OK

7	CHECK HARNESS AND CONNECTOR(CIRCUIT OPENING RELAY – FUEL PUMP,FUEL PUMP – BODY GROUND)

Instrument Panel J/B:



Wire Harness Side

F10 Fuel Pump Connector

(a) Remove the circuit opening relay from the instrument panel J/B.
(b) Disconnect the F10 fuel pump connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
Circuit opening relay (3) – Fuel pump (F10–4)	Below 1 Ω
Fuel pump (F10–5) – Body ground	

Standard (Check for short):

Tester Connection	Specified Condition
Circuit opening relay (3) or Fuel pump (F10–4) – Body ground	10 kΩ or higher

(d) Reconnect the fuel pump connector.
(e) Reinstall the circuit opening relay.

NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

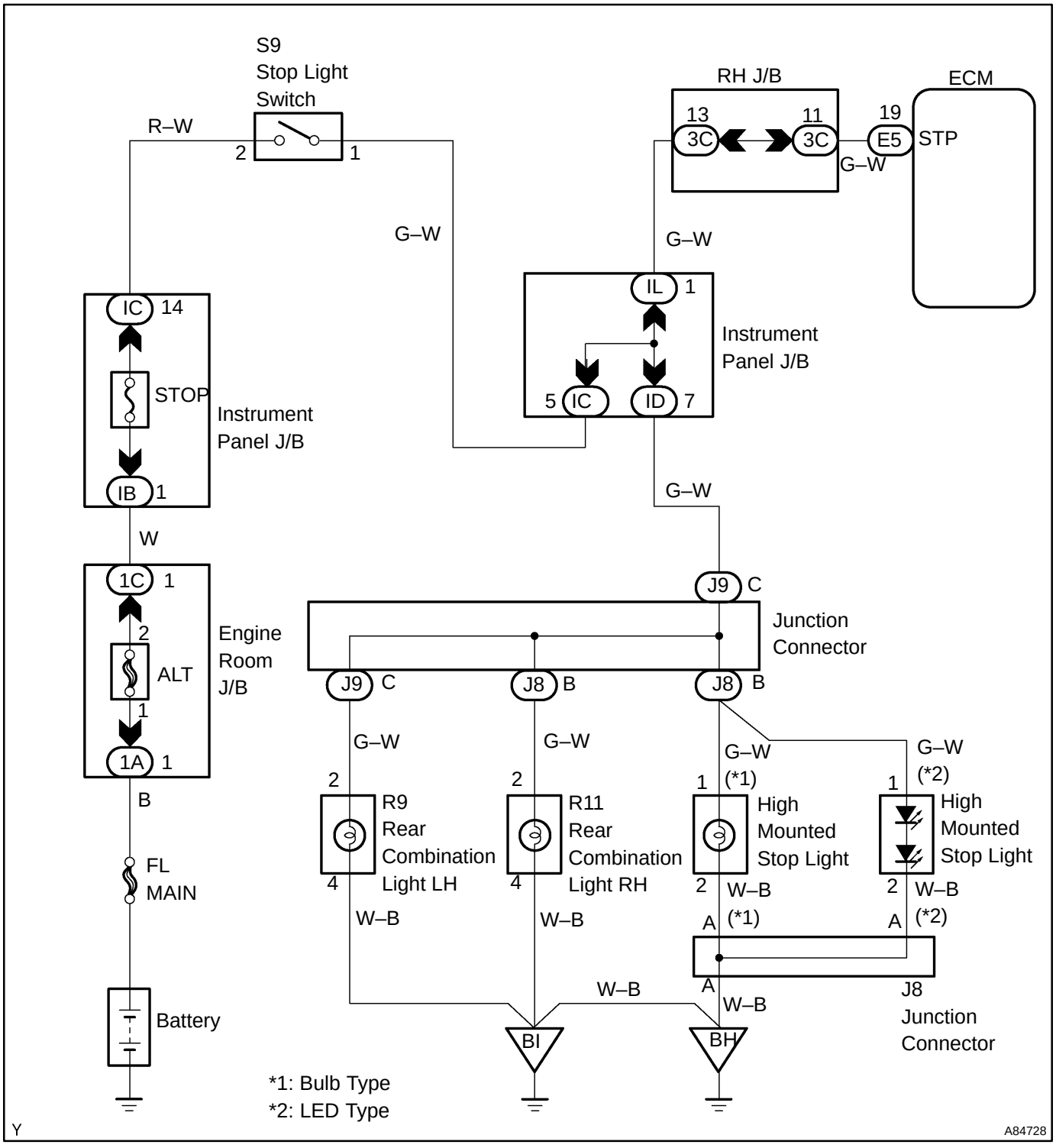
REPLACE ECM (See page 10–11)

STOP LIGHT SWITCH CIRCUIT

CIRCUIT DESCRIPTION

This signal is used to detect that the brakes have been applied. The STP signal voltage is the same as the one supplied to the stop lights.
The STP signal is used mainly to control the fuel cut–off engine speed (The fuel cut–off engine speed is reduced slightly when the vehicle is braking.).

WIRING DIAGRAM



INSPECTION PROCEDURE

Hand–held tester:

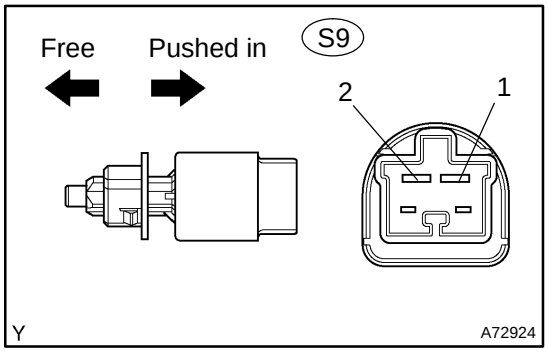
1	CHECK OPERATION OF STOP LIGHT

(a) Check if the stop lights go on and off normally when the brake pedal is depressed and released.

NG → **REPAIR OR REPLACE STOP LIGHT SWITCH ASSY**

OK

2	INSPECT STOP LIGHT SWITCH ASSY



(a) Check the resistance between the terminals when the switch is turned ON and OFF.

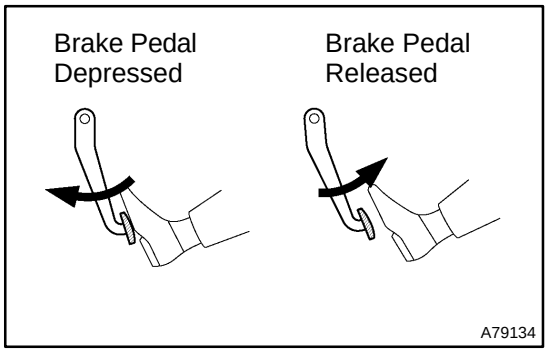
Standard:

Switch Position	Tester Connection	Specified Condition
ON (free)	1 – 2	Below 1 Ω
OFF (pushed in)		10 kΩ or higher

NG → **REPLACE STOP LIGHT SWITCH ASSY**

OK

3	READ VALUE OF HAND–HELD TESTER(STP SIGNAL)



(a) Turn the ignition switch ON.
(b) Select the item ”DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / STOP LIGHT SW” and read its value displayed on the hand–held tester.

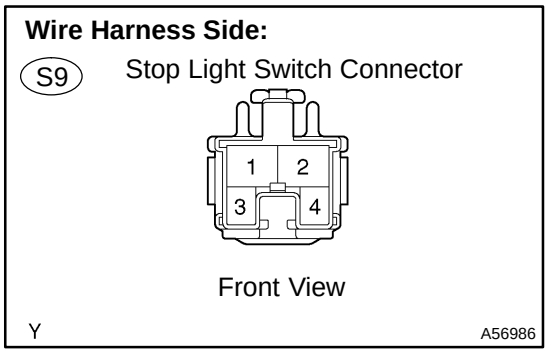
Standard:

Brake Pedal	Specified Condition
Depressed	STP Signal ON
Released	STP Signal OFF

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

NG

4	CHECK HARNESS AND CONNECTOR(STOP LIGHT SWITCH – ECM)



(a) Disconnect the S9 stop light switch connector.
(b) Disconnect the E5 ECM connector.
(c) Check the resistance between the wire harness side connectors.

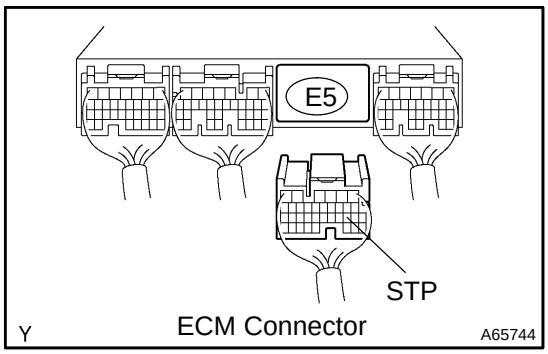
Standard (Check for open):

Tester Connection	Specified Condition
Stop light switch (S9–1) – STP (E5–19)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Stop light switch (S9–1) or STP (E5–19) – Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the stop light switch connector.



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

OBD II scan tool (excluding hand–held tester):

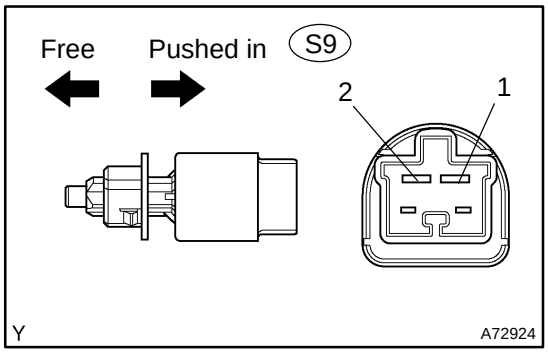
1	CHECK OPERATION OF STOP LIGHT

(a) Check if the stop lights go on and off normally when the brake pedal is depressed and released.

NG → **REPAIR OR REPLACE STOP LIGHT SWITCH CIRCUIT**

OK

2 INSPECT STOP LIGHT SWITCH ASSY



(a) Check the resistance between terminals when the switch ON and OFF.

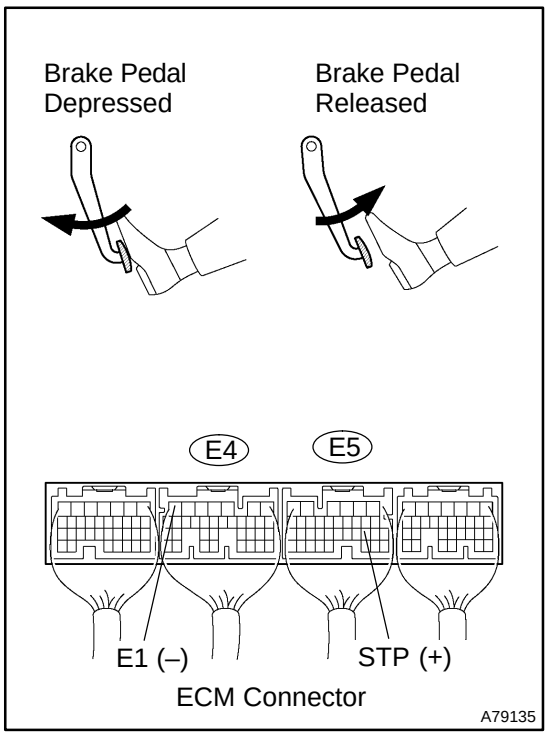
Standard:

Switch Position	Tester Connection	Specified Condition
ON (free)	1 – 2	Below 1 Ω
OFF (pushed in)		10 kΩ or higher

NG → **REPLACE STOP LIGHT SWITCH ASSY**

OK

3 INSPECT ECM(STP VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage between the terminals of the E4 and E5 ECM connectors.

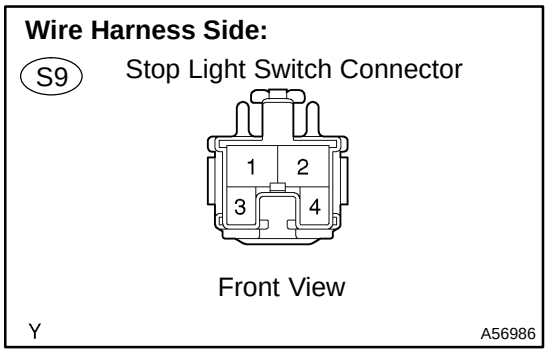
Standard:

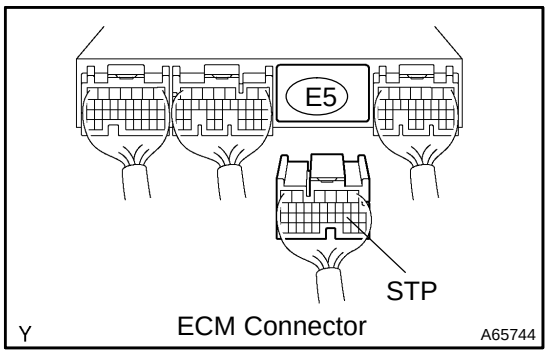
Between Terminals	Brake Pedal position	Specified Condition
STP (E5–19) – E1 (E4–7)	Depressed	8 to 14 V
	Released	Below 1.5 V

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

NG

4 CHECK HARNESS AND CONNECTOR(STOP LIGHT SWITCH – ECM)





(a) Disconnect the S9 stop light switch connector.
(b) Disconnect the E5 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Between Terminals	Specified Condition
Stop light switch (S9–1) – STP (E5–19)	Below 1 Ω

Standard (Check for short):

Between Terminals	Specified Condition
Stop light switch (S9–1) or STP (E5–19) – Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the stop light switch connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM (See page 10–11)

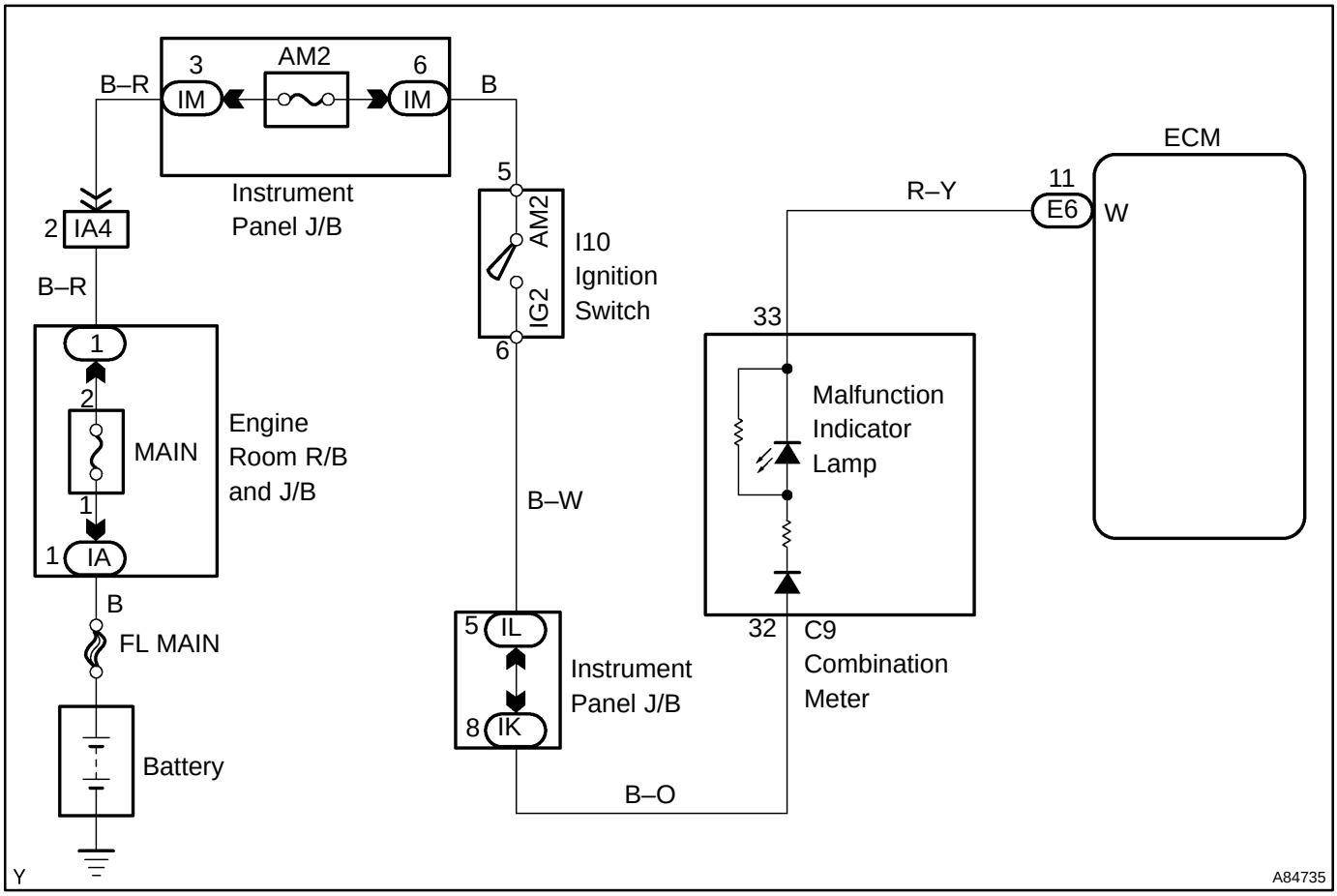
MIL CIRCUIT

CIRCUIT DESCRIPTION

The ignition switch provides circuit power and the ECM provides the circuit ground that illuminates the MIL. MIL operation is checked visually:

It should be illuminated when the ignition is first turned on. If the MIL is off all of the time or on all of the time, use the procedure below to troubleshoot it. The MIL is used to indicate the ECM's detection of a vehicle malfunction. Follow this procedure using the hand–held tester or an OBD II scan tool to determine the cause of the problem and to check the MIL.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Troubleshoot each trouble symptom in accordance with the chart below.

MIL remains on	Start inspection from step 1
MIL is not illuminated	Start inspection from step 3

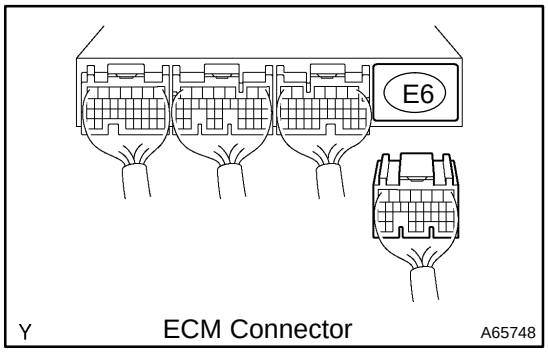
1	CLEAR DTC

(a) Connect the hand–held tester or the OBD II scan tool to the DLC 3.
(b) Turn the ignition switch ON and push the hand–held tester or the OBD II scan tool main switch ON.
(c) Read the DTC (See page 05–9).
(d) Clear the DTC (See page 05–9).
(e) Check that MIL is not illuminated.
Standard: MIL is not illuminated

OK	REPAIR CIRCUIT INDICATED BY OUTPUT CODE (See page 05–35)

NG

2	CHECK HARNESS AND CONNECTOR(CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the E6 ECM connector.
(b) Turn the ignition switch ON.
(c) Check that MIL is not illuminated.
Standard: MIL is not illuminated
(d) Reconnect the ECM connector.

OK	REPLACE ECM (See page 10–11)

NG

CHECK AND REPAIR HARNESS AND CONNECTOR (COMBINATION METER – ECM)

3	CHECK THAT MIL IS ILLUMINATED

(a) Check that MIL is illuminated when turning the ignition switch ON.
Standard: MIL is illuminated

OK	SYSTEM OK

NG

4	INSPECT COMBINATION METER ASSY (MIL CIRCUIT)

(a) See the combination meter troubleshooting on page (See page 05–638).

NG	REPAIR OR REPLACE BULB OR COMBINATION METER ASSEMBLY

OK

CHECK AND REPAIR HARNESS AND CONNECTOR (COMBINATION METER – ECM)