ENGINE CONTROL

EFI SYSTEM (3SZ-VE, K3-VE)

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EFI SYSTEM (3SZ-VE, K3-VE)

BASIC INSPECTION

HINT:
If the malfunction cannot be determined by troubleshooting, the problem area can be narrowed down by performing the following basic inspection.

1. CHECK BATTERY VOLTAGE

(a) Check the condition of the battery.(See page CH - 3.)

2. CHECK WHETHER ENGINE CRANKS

(a) Make sure that the engine cranks.
HINT:
If the engine does not crank, check the starting systems.

3. CHECK WHETHER ENGINE STARTS

(a) Make sure that the engine starts.
HINT:
If the engine does not start, check fuel pressure and spark.

4. CHECK AIR FILTER

(a) Check the air filter.
HINT:
If the air filter is dirty, clean or replace it.

5. CHECK ENGINE IDLE SPEED (See page EM - 2)

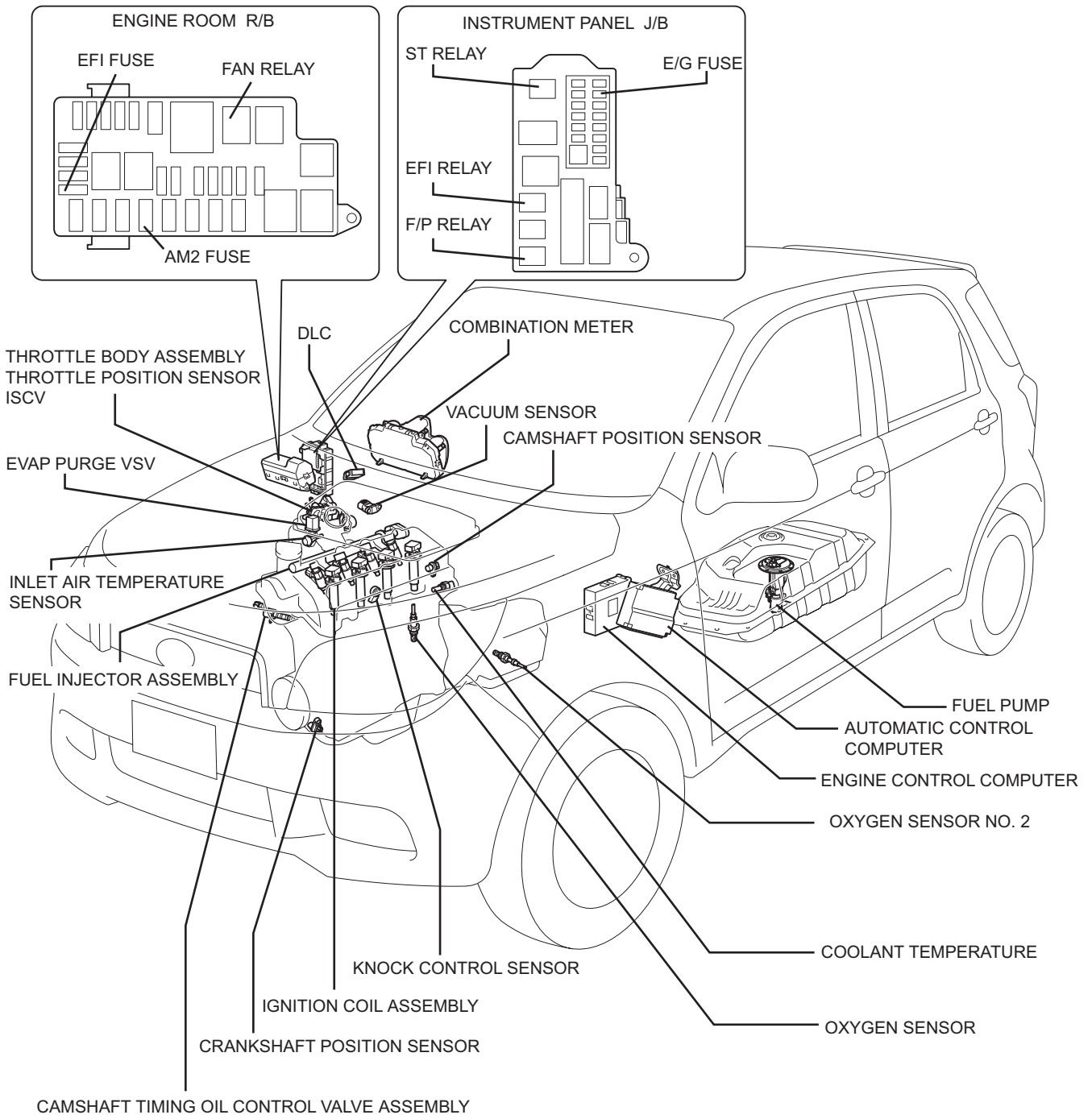
6. CHECK IGNITION TIMING (See page EM - 1)

7. CHECK FUEL PRESSURE (See page FU - 3)

8. CHECK FOR SPARK (See page IG - 1)

9. CHECK COMPRESSION (See page EM - 2)

LOCATION



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DIAGNOSTIC TROUBLE CODE CHART

DTC No.	Diagnostic Item	Lamp	Code Memory	See Page
P0105/31	Air intake pressure sensor signal system	○	○	ES - 28
P0110/43	Intake air temperature sensor signal system	○	○	ES - 31
P0115/42	Coolant temperature sensor signal system	○	○	ES - 35
P0120/41	Throttle sensor signal system	○	○	ES - 38
P0130/21	Front O2 sensor signal system	○	○	ES - 43
P0135/23	Front O2 sensor heater signal system	○	○	ES - 47
P0136/22	Rear O2 sensor signal system	○	○	ES - 50
P0141/24	Rear O2 sensor heater	○	○	ES - 47
P0171/25	Fuel system (lean malfunction)	○	○	ES - 53
P0172/26	Fuel system (rich malfunction)	○	○	ES - 53
P0300/17	Misfire	○	○	ES - 58
P0301/17	Misfire (#1 cylinder)	○	○	ES - 58
P0302/17	Misfire (#2 cylinder)	○	○	ES - 58
P0303/17	Misfire (#3 cylinder)	○	○	ES - 58
P0304/17	Misfire (#4 cylinder)	○	○	ES - 58
P0325/18	Knock sensor signal system	×	○	ES - 63
P0335/13	Engine revolution sensor signal system	○	○	ES - 66
P0340/14	Cam angle sensor signal system	○	○	ES - 69
P0350/16	Ignition primary system	○	○	ES - 72
P0443/76	EVAP purge VSV	○	○	ES - 79
P0420/27	Catalyst deterioration	○	○	ES - 75
P0500/52	Vehicle speed signal system	○	○	ES - 81
P0505/71	ISC valve system	○	○	ES - 83
P0535/44	A/C evaporator temperature sensor signal system	×	○	ES - 87
P1105/32	Atmospheric pressure sensor signal system	○	○	ES - 89
P1300/36	Ionic current system	○	○	ES - 90
P1346/75	VVT control system (valve timing fail)	○	○	ES - 94
P1349/73	VVT control (advance angle and retard angle fail)	○	○	ES - 95
P1351/62	Timing chain control system	×	○	ES - 99
P1510/54	Starter signal system	○	○	ES - 100
P1560/61	Short to back up power source	○	○	ES - 103

DTC No.	Diagnostic Item	Lamp	Code Memory	See Page
P1600/83	Keyless system/ immobiliser system communication system (malfunction in ECU)	×	○	ES - 105
P1601/81	Keyless / immobiliser system communication system (code does not match, communication error)	×	○	ES - 106
P1656/74	OCV control system	○	○	ES - 109
U0101/82	EAT/ CVT communication (reception)	○	○	ES - 112
U0121/86	ABS communication (reception)	○	○	ES - 112
U0156/87	Meter communication (receiving)	○	○	ES - 112
U1000/85	EAT communication (transmission)	○	○	ES - 112
U1002/88	CAN communication	○	○	ES - 112

ES

PROBLEM SYMPTOMS TABLE

Symptom	Suspected Area	See Page
Engine does not crank	1. Starter assembly	ST - 10
	2. Starter relay	ST - 21
	3. Neutral start switch system	AT - 57
No initial combustion (engine does not start)	1. See flowchart (ECU power source)	ES - 120
	2. Igniter system	IG - 1
	3. See flowchart (fuel pump control system)	ES - 115
	4. Injector	FU - 12
	5. Crank position sensor system	IG - 14
Incomplete combustion (engine does not start)	1. See flowchart (fuel pump control system)	ES - 115
	2. Igniter system	IG - 1
	3. Injector	FU - 12
	4. Crank position sensor system	IG - 14
Engine does not start but cranks normally)	1. Throttle body system	ES - 129
	2. See flowchart (fuel pump control system)	ES - 115
	3. Igniter system	IG - 1
	4. Spark plug	IG - 18
	5. Compression	EM - 2
	6. Injector	FU - 12
	7. Crank position sensor system	IG - 14
Engine does not start (when cold)	1. Throttle body system	ES - 129
	2. See flowchart (fuel pump control system)	ES - 115
	3. Injector	FU - 12
	4. Igniter system	IG - 1
	5. Spark plug	IG - 18
	6. Crank position sensor system	IG - 14

Symptom	Suspected Area	See Page
Engine does not start (when warm)	1. Throttle body system	ES - 129
	2. See flowchart (fuel pump control system)	ES - 115
	3. Injector	FU - 12
	4. Igniter system	IG - 1
	5. Spark plug	IG - 18
	6. Crank position sensor system	IG - 14
Fast idle problem	1. Throttle body system	ES - 129
	2. Spark plug	IG - 18
Idle speed is too high	1. Throttle body system	ES - 129
	2. See flowchart (ECU power source)	ES - 120
	3. Neutral start switch system	AT - 57
Idle speed is too low	1. Throttle body system	ES - 129
	2. Neutral start switch system	AT - 57
	3. See flowchart (fuel pump control system)	ES - 115
	4. Injector	FU - 12
Idle is unstable	1. Throttle body system	ES - 129
	2. Injector	FU - 12
	3. Igniter system	IG - 1
	4. Compression	EM - 2
	5. See flowchart (fuel pump control system)	ES - 115
	6. Spark plug	IG - 18
Hunting	1. Throttle body system	ES - 129
	2. See flowchart (ECU power source)	ES - 120
	3. See flowchart (fuel pump control system)	ES - 115
	4. Spark plug	IG - 17
Stumbling, poor acceleration	1. See flowchart (fuel pump control system)	ES - 115
	2. Injector	FU - 12
	3. Igniter system	IG - 1
	4. Spark plug	IG - 17
After fire	1. Igniter system	IG - 1
	2. Injector	FU - 12
Surging	1. See flowchart (fuel pump control system)	ES - 115
	2. Spark plug	IG - 17
	3. Injector	FU - 12
Engine stall (right after starting engine)	1. See flowchart (fuel pump control system)	ES - 115
	2. Throttle body system	ES - 129
	3. Crank position sensor system	IG - 14
	4. Igniter system	IG - 1
Engine stall (right after slowing down)	1. Injector	FU - 12
	2. Throttle body system	ES - 129
	3. Engine control computer	ES - 16
	4. Crank position sensor system	IG - 14
	5. Igniter system	IG - 1
Engine stall (when the shift lever is in the D position)	1. Neutral start switch system	AT - 57
	2. Throttle body system	ES - 129
	3. Crank position sensor system	IG - 14
	4. Igniter system	IG - 1

HOW TO PROCEED WITH TROUBLESHOOTING

1	VEHICLE BROUGHT TO WORKSHOP

2	CONDUCT CUSTOMER PROBLEM ANALYSIS AND CHECK SYMPTOMS (See page ES - 7.)

3	CHECK CAN COMMUNICATION SYSTEM (See page CA - 4.)

(a) Using the DS-II, select CAN BUS DIAGNOSIS / CHECK ECU CONNECTED TO CAN BUS LINE screen (see CA - 8), and make sure all ECU and sensors that are connected to the CAN communication are displayed on the screen.

NG → GO TO CAN COMMUNICATION SECTION

OK

4	CHECK FOR DIAGNOSTIC TROUBLE CODES (See page ES - 8.)

(a) Check for DTCs and freeze frame data.
(b) Delete DTCs and freeze frame data.
(c) Recheck for DTCs.
  (1) If DTCs are present, go to A.
  (2) If DTCs are not present, go to B.

B → GO TO STEP 7

A

5	TROUBLESHOOT USING DTCS OR DIAGNOSTIC TROUBLE CODE CHART (MAIN SUSPECTED AREAS)

(a) If the location of the problem is determined, go to A.
(b) If the location of the problem is not determined, go to B.

A → GO TO STEP 12

B → GO TO STEP 9

6	PROBLEM SYMPTOMS TABLE (See page ES - 4.)

(a) If the location of the problem is determined, go to A.
(b) If the location of the problem is not determined, go to B.

A → GO TO STEP 12

B

7	BASIC INSPECTION (See page ES - 1.)

(a) If the location of the problem is determined, go to A.
(b) If the location of the problem is not determined, go to B.

A → GO TO STEP 12

B

8	CHECK USING DS-II (See page ES - 21.)

(a) Select ECU data list or active test.
(b) If the location of the problem is determined, go to A.
(c) If the location of the problem is not determined, go to B.

A → GO TO STEP 12

B

9	CHECK VOLTAGE OF ECU VOLTAGE AND CIRCUIT (See page ES - 16.)

10	REPAIR PROBLEM AREAS

11	CHECK FOR DIAGNOSTIC TROUBLE CODES (See page ES - 8.)

END

CUSTOMER PROBLEM ANALYSIS CHECK SHEET

1. Ask the customer about problems and concerns.

(a) Follow the previous troubleshooting procedure, and use the customer problem analysis check sheet to make sure that the proper questions are asked when interviewing the customer about problems.

ES

Engine Problem Diagnosis Check Sheet

Model		Date vehicle brought in		Service history	No/Yes (__times)
VIN		Date registered		Registration No.	
		Date problem first occurred		Odometer reading	km
Accessories					

Previous vehicle	Main region/purpose of travel
Customer profile/characteristics	
Description of symptoms Warning light illumination Off/On ( )	

	System Conditions	Driving Conditions	Road Conditions	Others	Problem Frequency
Check Results	Speed problem first occurred( )km/h Shift position ( ) range ☐ Starting off ☐ Immediately after start off ☐ ( ) min after start ☐ After ( )min driving ☐ Cold ☐ Warm ☐ Idling ☐ Others ( )	☐ Starting off ☐ Cruising ☐ Increasing speed ☐ Decreasing speed ☐ Braking ☐ Turning ☐ Stopped ☐ Not related ☐ Others ( )	☐ Level ☐ Uphill ☐ Downhill ☐ Dry paved road ☐ Wet paved road ☐ Unpaved/rough road ☐ Snowy/icy road ☐ Uneven, manholes etc. ☐ Others ( )	Accelerator opening ( )% Ambient air temperature ( ) Weather ( )	☐ Always ☐ One time only ☐ Sometimes ☐ (_)times a day ☐ (_)times a week ☐ (_)times a month
	Additional Items				

Inspection Results	DTC Inspection		
	Malfunction Indicator Lamp (MIL) Off/On	☐ Normal Code(s) ☐ Malfunction code(s)(all noted)	Fuel pressure when engine stopped Fuel pressure 1 min. after engine stopped
	Problem details Driving conditions and location when problem first occurred and reoccurred		
	Reoccurrence conditions ☐ Always ☐ Occasional ☐ Once problem occurs, it continues ☐ Does not reoccur		

Dealer Name	Office	Person in charge	Technician

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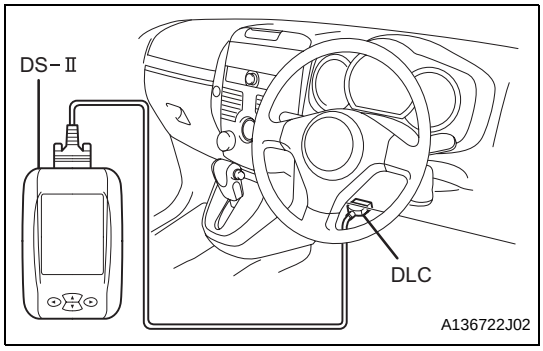
CHECK / CLEAR DTCs

1. PREPARE FOR INSPECTION

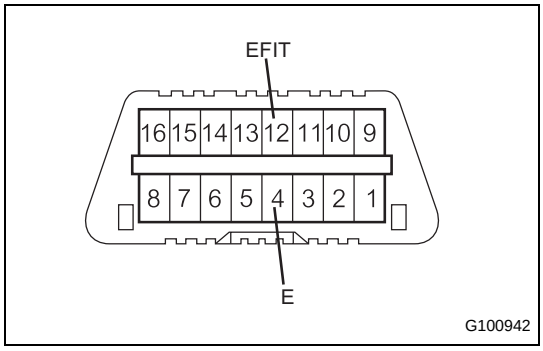
(a) Make sure that the throttle valve is fully closed.

(b) Move the shift lever to the N or P position.
(c) Turn off the air conditioner.



2. CHECK DTCs (using DS-II)

(a) Connect the DS-II to the DLC.
(b) Turn the ignition switch to the ON position.
(c) Turn the DS-II power ON.
(d) Following the prompts on the screen, select CHECK DTCs/ FREEZE FRAME DATA on the DIAGNOSIS - EFI scree, and check for DTCs.
HINT:
If a DTC is displayed on the DS-II, see IN - 30.

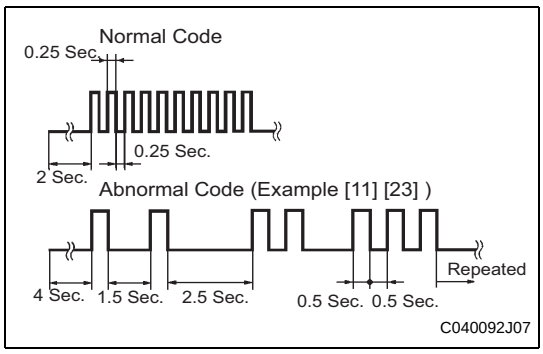


3. CHECK DTCs (using the check engine warning light)

NOTICE:

- **Turn the ignition switch to the ON position before reading the DTCs, and check that the check engine warning light is flashing.**
- **The CHECK MODE cannot be used.**

(a) Turn the ignition switch off.
(b) Using the diagnosis check wire, short terminals 12 (EFIT) and 4 (E) of the DLC.
SST 09843-18020-000
NOTICE:
- **Do not connect the diagnosis check wire to the wrong terminals. Doing so may cause malfunctions.**
- **Use only the dedicated diagnosis check wire.**



(c) Turn the ignition switch to the ON position, and count the number of flashes of the check engine warning light.
HINT:
- If the indicator light does not indicate a DTC (the light does not blink), there may be a malfunction in the TC terminal, VC terminal, or the computer.
- If the check engine warning light remains on, the wire harness may have a short circuit (due to being pinched or for other reasons) or the computer may be malfunctioning.
- If an irrelevant DTC is detected, the computer may be malfunctioning.
- If the check engine warning light comes on at engine speed of approximately1000 r/min or more and no DTC is output, turn the ignition switch to the OFF position and recheck.

(d) Disconnect diagnosis check wire No.2.

4. CHECK FREEZE DATA (using DS-II)

(a) Using the DS-II, follow the prompts on the screen, and select the DTC that records the freeze data (marked !) from the DTC / FREEZE DATA screen.
HINT:
- The engine condition (ECU data) before and after DTCs are detected can be checked using the time series freeze frame data. (See page ES - 10.)
- The time series freeze frame data is helpful in troubleshooting when the symptom cannot be reproduced.

ES

5. DELETE RECORDED DTCs (using DS-II)

(a) Following the prompts on the screen, select the DTC / FREEZE DATA screen and delete the DTCs.

NOTICE:

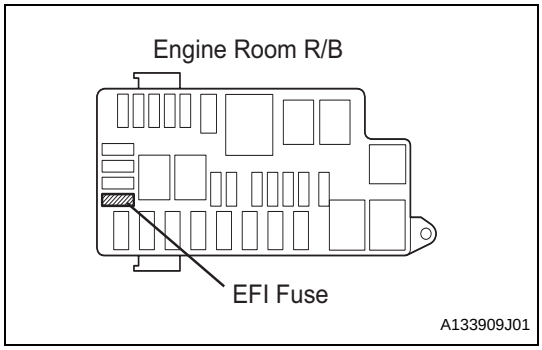
- **If the DTCs cannot be deleted, turn the ignition switch off, then perform the procedure again.**
- **Until the cause of problems are clarified, do not delete the DTCs using the DS-II.**
- **Write the DTCs down before deleting them.**

6. DELETE DTCs (by removing a fuse)

(a) The recorded codes can be deleted by removing the EFI fuse (15A) for more than 60 seconds after turning the ignition switch to the OFF position.

NOTICE:

- **Be sure to clear the DTCs and check that a normal code is output after the EFI system inspection is finished.**
- **Do not delete the DTCs by clearing the battery (removing a fuse) until the cause of the problems is clarified.**
- **Write the DTCs down before deleting them.**



Freeze Frame Data

1. CHECK FREEZE FRAME DATA

(a) If the symptom can not be reproduced even though a DTC is detected, check the freeze frame data.

(1) Connect the DS-II to the DLC.
(2) Turn the ignition switch to the ON position.
(3) Select DIAGNOSIS → EFI → DTC / FREEZE DATA.
(4) Detected DTCs will be displayed on the DTC screen.
(5) Select the DTCs to check the desired freeze data.

HINT:

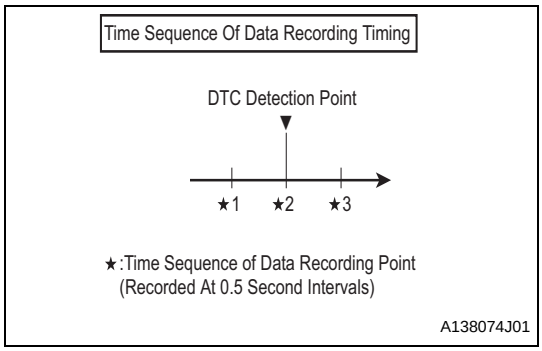
The DTCs are marked with the character, !, and the highlighted codes contain freeze data.

2. CHECK TIME SERIES FREEZE FRAME DATA

(a) Select the item to check the desired time series freeze data on the freeze data screen.

HINT:

- The previous version of freeze data recorded ECU data only when DTCs occurred (when detected), but time series freeze frame data also records ECU data before and after DTCs are detected.
- Time series freeze frame data can be checked when TIME SERIES FREEZE DATA CAN BE CHECKED is displayed on the freeze data screen.
- The time series freeze frame data can display up to 3 data points, including the DTC inspection point, 1 point for before inspection, and 1 point after inspection.

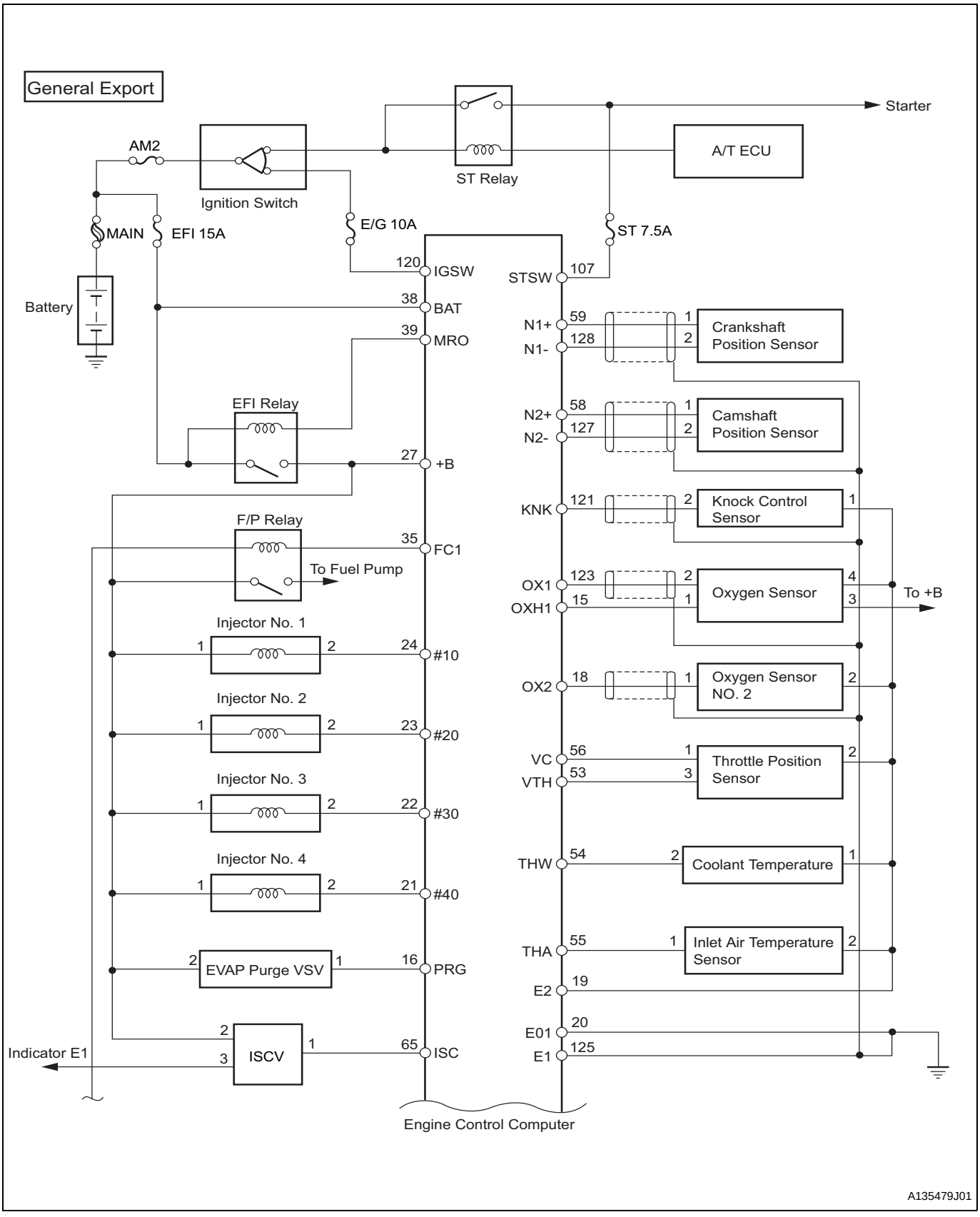


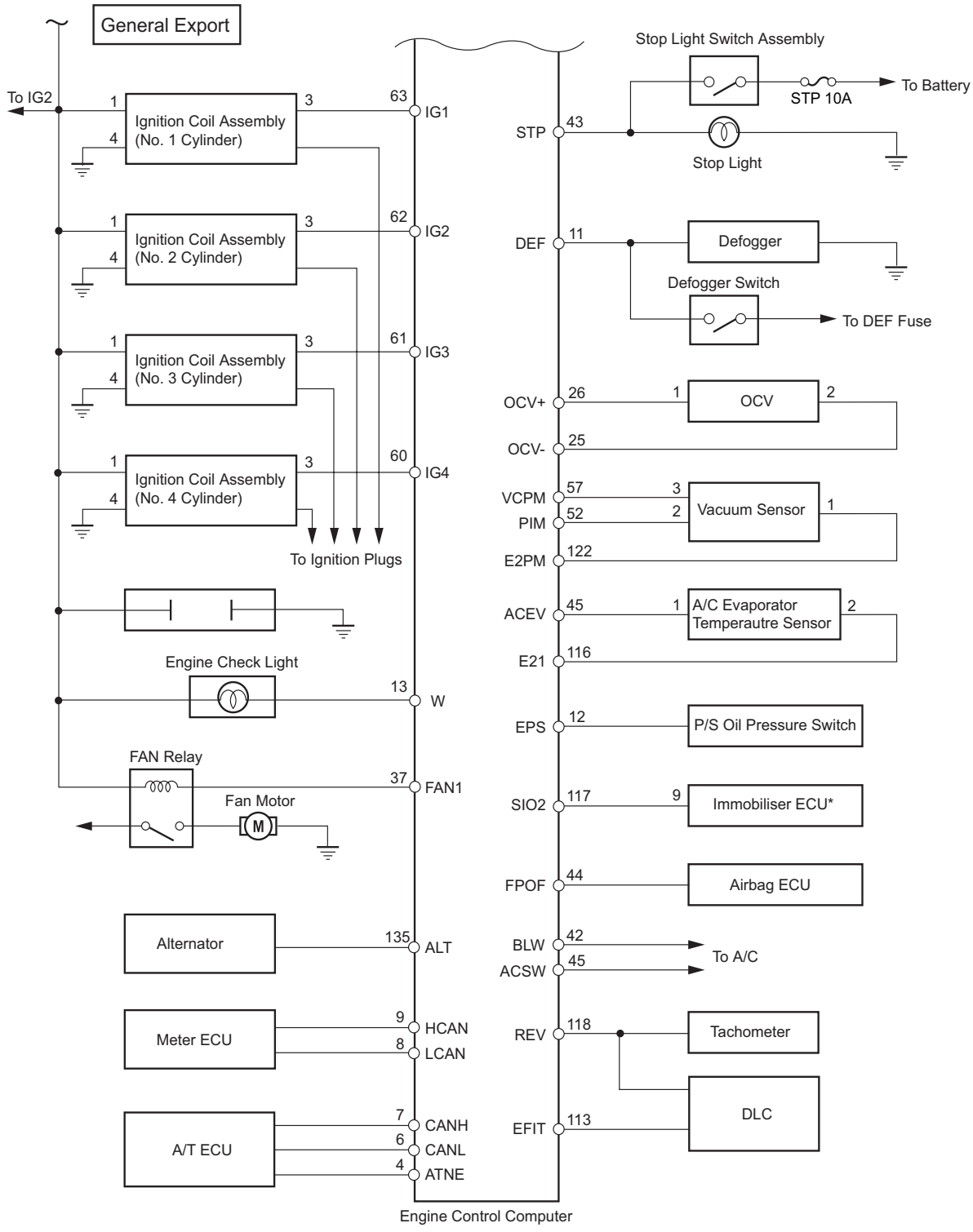
3. FREEZE DATA CHART

Item	Shorted Item
Coolant temperature	ECT
Air intake pressure	MAP
Engine speed	r/min

Item	Shorted Item
Vehicle speed	VS
Ignition timing advance angle	ITA
Injection volume	TAUX
Injection timing	TAUZ

CIRCUIT DIAGRAM





∗: Immobiliser Equipped Vehicles

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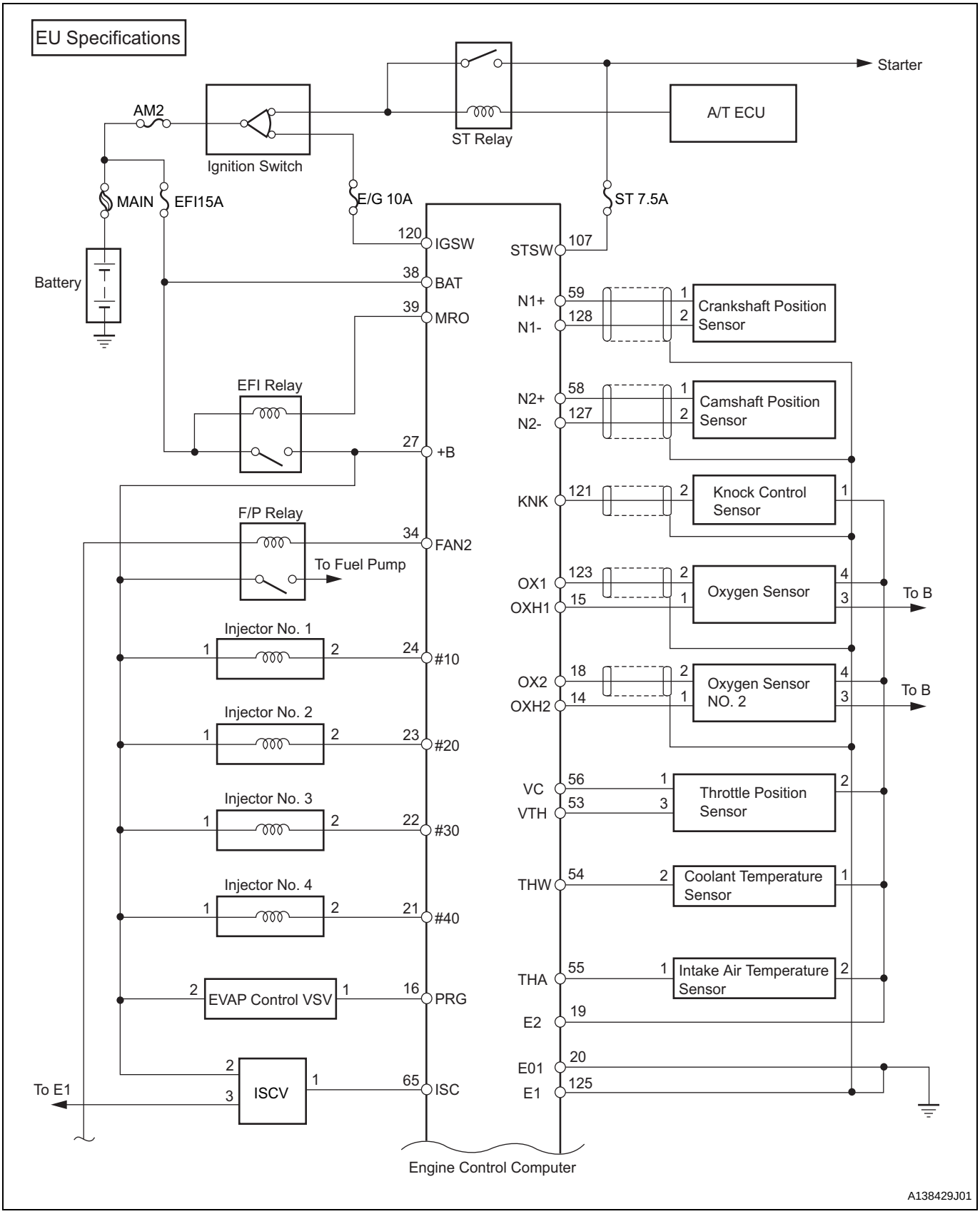
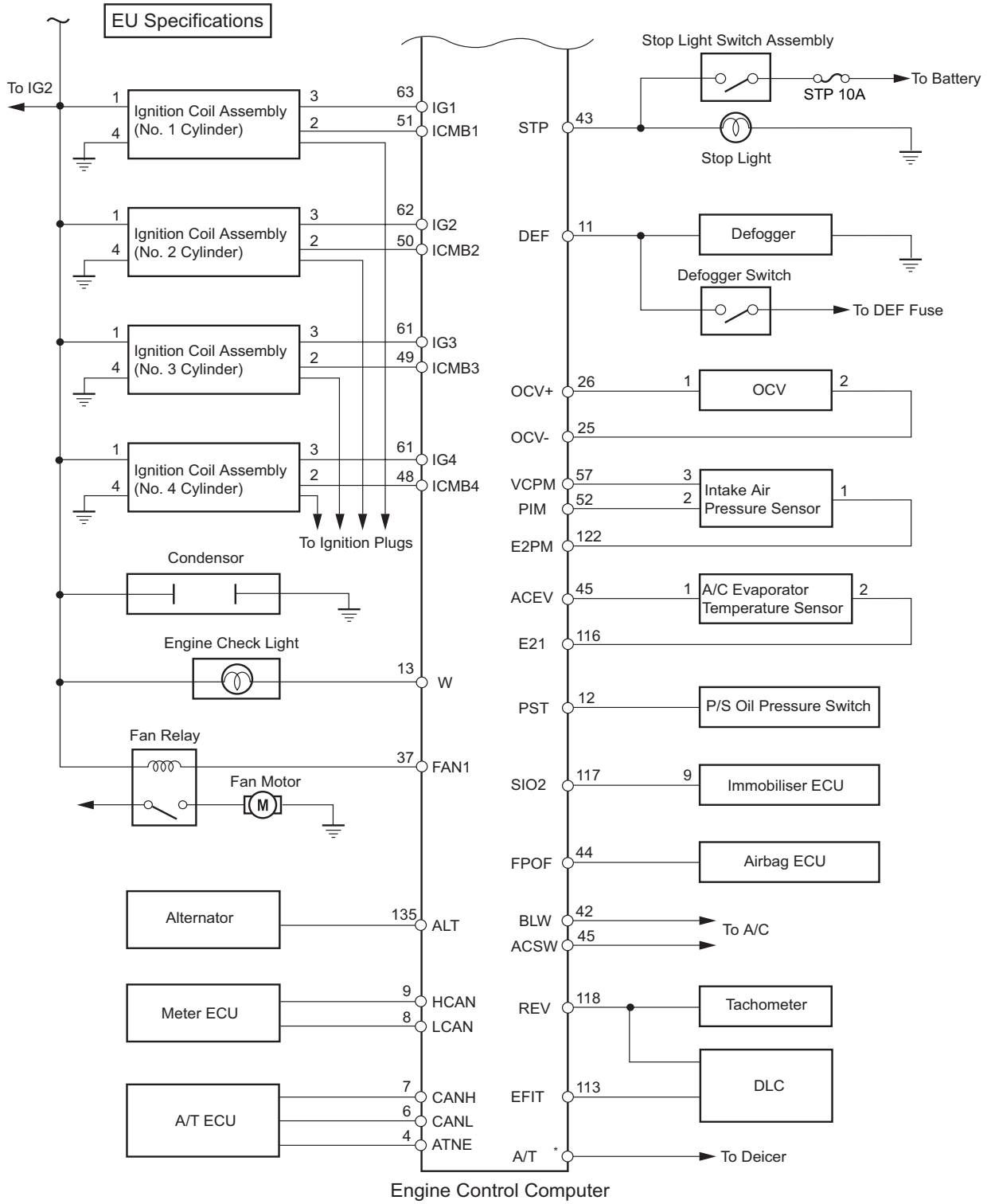

EU Specifications
Starter
AM2
Ignition Switch
ST Relay
A/T ECU
MAIN
EFI15A
E/G 10A
ST 7.5A
Battery
120
IGSW
STSW
107
38
BAT
39
MRO
EFI Relay
27
+B
F/P Relay
34
FAN2
To Fuel Pump
Injector No. 1
24
#10
Injector No. 2
23
#20
Injector No. 3
22
#30
Injector No. 4
21
#40
EVAP Control VSV
16
PRG
ISCV
65
ISC
To E1
N1+
N1-
59
128
Crankshaft Position Sensor
N2+
N2-
58
127
Camshaft Position Sensor
KNK
121
Knock Control Sensor
OX1
OXH1
123
15
Oxygen Sensor
To B
OX2
OXH2
18
14
Oxygen Sensor NO. 2
To B
VC
VTH
56
53
Throttle Position Sensor
THW
54
Coolant Temperature Sensor
THA
55
Intake Air Temperature Sensor
E2
19
E01
E1
20
125
Engine Control Computer
A138429J01



* : Specifications For Cold Region Vehicles

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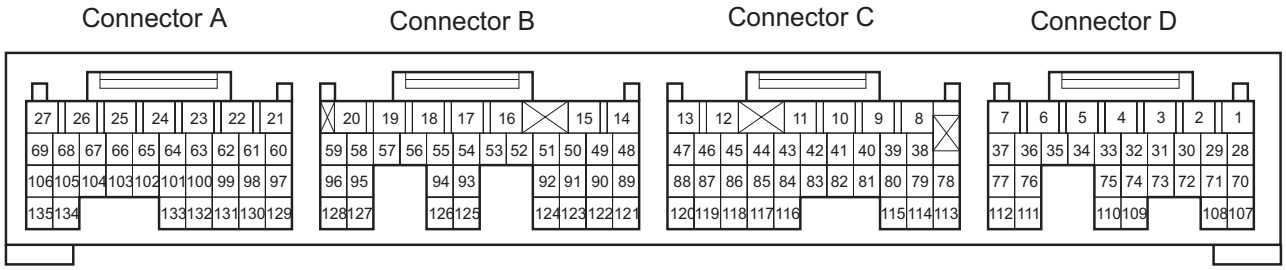
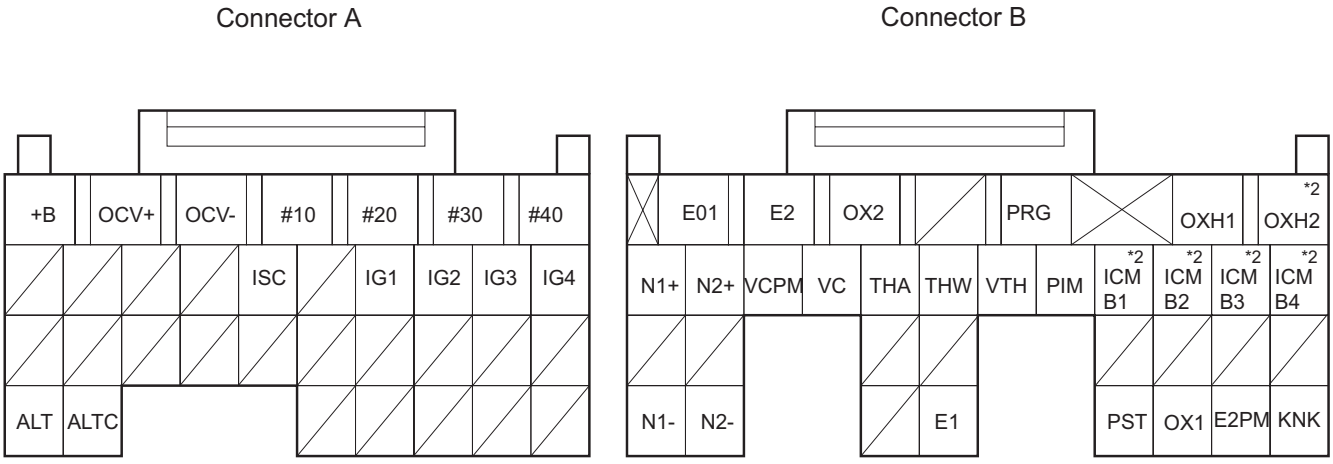
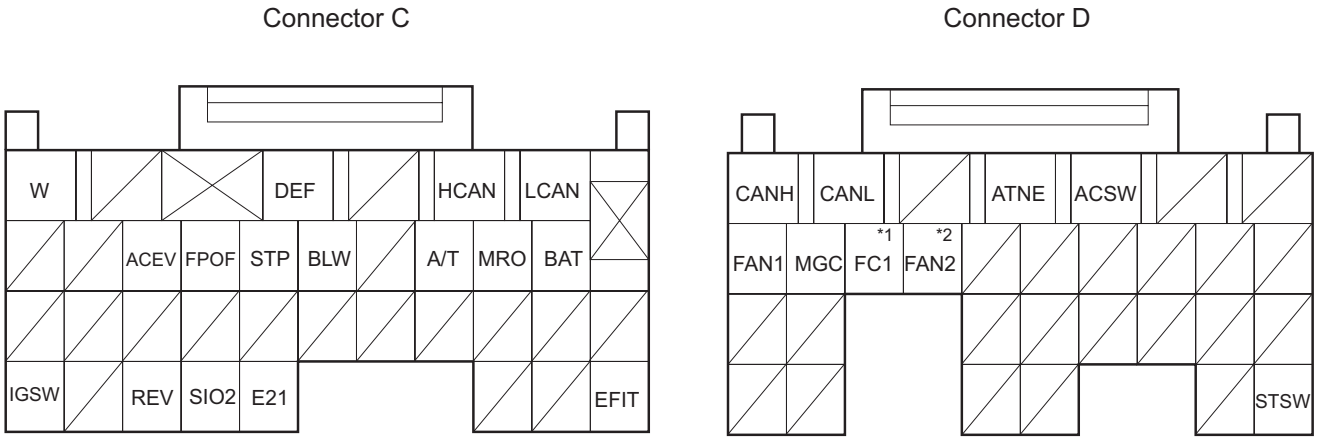
ECU TERMINALS

ES







*1 : Only For General Export

*2 : Only For Europe

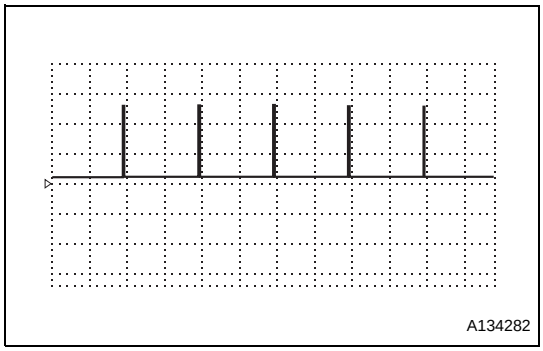
A139505J01

ECU TERMINAL VOLTAGE CHART (EFI SYSTEM)

Terminal Name (Terminal No.)	Input / Output	Measurement condition	Standard (V)
BAT ←→ E1 (38←→125)	Input	Always	10-14
+B ←→ E1 (27←→125)	Input	Engine is stopped, ignition switch is ON	10-14
IGSW ←→ E1 (120←→125)	Input	Engine is stopped, ignition switch is ON	10-14
MRO ←→ E1 (39←→125)	Input	Engine is stopped, ignition switch is ON	10-14
VC ←→ E2 (56←→19)	Input	Engine is stopped, ignition switch is ON	4.5-5.5
IG1 ←→ E1 (63←→125)	Output	Engine is idling	Pulse is generated (Waveform 1)
IG2 ←→ E1 (62←→125)	Output	Engine is idling	Pulse is generated (Waveform 1)
IG3 ←→ E1 (61←→125)	Output	Engine is idling	Pulse is generated (Waveform 1)
IG4 ←→ E1 (60←→125)	Output	Engine is idling	Pulse is generated (Waveform 1)
N1+ ←→ N1- (59←→128)	Input	Engine is idling	Pulse is generated (Waveform 2)
N2+ ←→ N2- (58 ←→ B127)	Input	Engine is idling	Pulse is generated (Waveform 3)
# 10 ←→ E1 (24←→125)	Output	Engine is idling	Pulse is generated (Waveform 4)
# 20 ←→ E1 (23←→125)	Output	Engine is idling	Pulse is generated (Waveform 4)
# 30 ←→ E1 (22←→125)	Output	Engine is idling	Pulse is generated (Waveform 4)
# 40 ←→ E1 (21←→125)	Output	Engine is idling	Pulse is generated (Waveform 4)
OX1 ←→ E2 (123←→19)	Input	O2 sensor is warmed up, constant engine speed of 3000 r/min	Pulse is generated (Waveform 5)
OX2 ←→ E2 (18←→19)	Input	O2 sensor is warmed up, constant engine speed of 3000 r/min	Pulse is generated (Waveform 5)
KNK ←→ E2 (121←→19)	Input	Engine is idling	Pulse is generated (Waveform 6)
THW ←→ E2 (54←→19)	Input	Coolant temperature 60 to 120°C	0.3-1.3
THA ←→ E2 (55←→19)	Input	Engine is warmed up	0.5-4.3
W ←→ E1 (13←→125)	Output	Engine is idling (the check engine light is off)	10-14
W ←→ E1 (13←→125)	Output	Disconnect the connector of the coolant temperature sensor. (the check engine light is on)	0-3.5
STSW ←→ E1 (107←→125)	Input	Starter switch is ON	10-14
VTH ←→ E2 (53←→19)	Input	Throttle valve is fully closed	0.4-0.8
VTH ←→ E2 (53←→19)	Input	Throttle valve is fully opened	3.2-5.0
ISC ←→ E1 (65←→125)	Output	Engine is idling Air conditioner switch is OFF → ON	Pulse is generated (Waveform 7)
OXH1 ←→ E1 (15←→125)	Output	After engine idles for more than 5 seconds	0-1

Terminal Name (Terminal No.)	Input / Output	Measurement condition	Standard (V)
OXH1 ←→ E1 (15←→125)	Output	Engine is stopped, ignition switch is ON	10-14
STP ←→ E1 (43←→125)	Input	Stop light switch is ON	10-14
STP ←→ E1 (43←→125)	Input	Stop light switch is OFF	0-0.5
ATNE ←→ E1 (16←→125)	Output	Engine is stopped, ignition switch is ON	10-14
ATNE ←→ E1 (16←→125)	Output	Engine is warmed up, accelerator pedal is depressed	Pulse is generated (Waveform 8)
FC1 ←→ E1 (35←→125)	Output	Engine is stopped, ignition switch is ON	10-14
FC1* ←→ E1 (35←→125)	Output	Engine is idling	Below 1.2
REV ←→ E1 (118←→125)	Output	Engine is idling	Pulse is generated (Waveform 9)
FAN1 ←→ E1 (37←→125)	Output	Magnetic clutch is OFF	10-14
FAN1 ←→ E1 (37←→125)	Output	Magnetic clutch is ON	Below 1
OCV+ ←→ OCV- (26←→25)	Output	Engine is stopped, ignition switch is ON	Pulse is generated (Waveform 10)
EPS ←→ E1 (12←→125)	Input	Engine is idling Steering wheel is centered	10-14
EPS ←→ E1 (12←→125)	Input	Engine is idling Steering wheel is turned	0-1
ALTC ←→ E1 (134←→125)	Input	Engine is stopped, ignition switch is ON	10-14
ALT ←→ E1 (135←→125)	Input	Engine is stopped, ignition switch is ON	10-14
VCPM ←→ E2PM (57←→122)	Input	Engine is stopped, ignition switch is ON	4.5-5.5
PIM ←→ E2PM (52←→122)	Input	Sensor adjusted to stable ambient temperature	3.1-4.1
ACEV ←→ E21 (45←→116)	Input	Air conditioning is ON	0.15-4.8
E1 ←→ Body ground (125)	Ground	Always (continuity check)	Continuity
E2 ←→ Body ground (19)	Ground	Always (continuity check)	Continuity
E01 ←→ Body ground (20)	Ground	Always (continuity check)	Continuity
E21 ←→ Body ground (116)	Ground	Always (continuity check)	Continuity

*: FAN2 terminal for European models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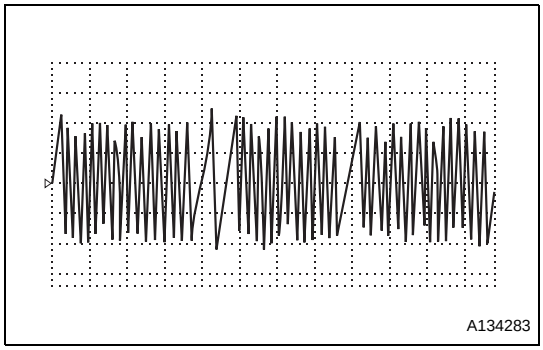
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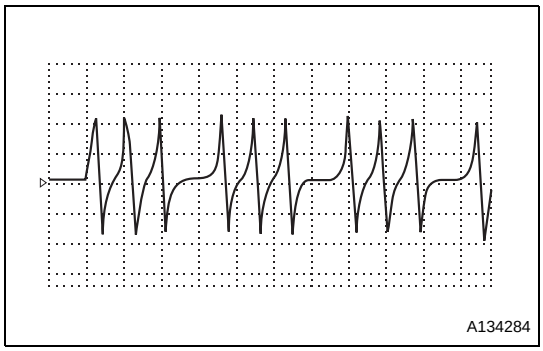
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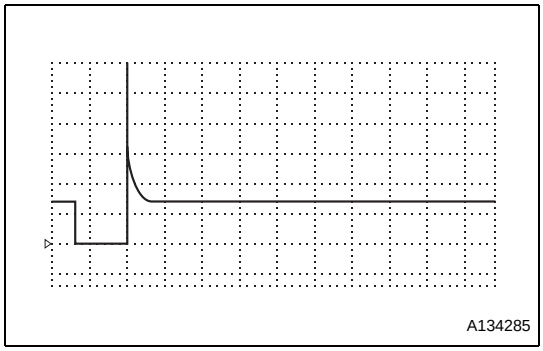

A134285

1. Oscilloscope waveform

(a) Waveform 1

Tester Connection	IG1, IG2, IG3, IG4 ⟷ E1
Tool setting	5 V/DIV, 10 ms/DIV
Measurement condition	Engine is idling after warming up

HINT:

- As the engine speed increases, the waveform cycle becomes shorter.
- The oscilloscope waveform shown as an example, does not include noise or chattering waveforms.

(b) Waveform 2

Tester Connection	N1+ ⟷ N1-
Tool setting	2 V/DIV, 20 ms/DIV
Measurement condition	Engine is idling

HINT:

- As the engine speed increases, the waveform cycle becomes shorter.
- As the engine speed increases, each waveform cycle becomes shorter.
- Noise may cause DTCs to be recorded.

(c) Waveform 3

Tester Connection	N2+ ⟷ N2-
Tool setting	2 V/DIV, 20 ms/DIV
Measurement condition	Engine is idling

HINT:

- As the engine speed increases, the waveform cycle becomes shorter.
- As the engine speed increases, each waveform cycle becomes shorter.
- Noise may cause DTCs to be recorded.

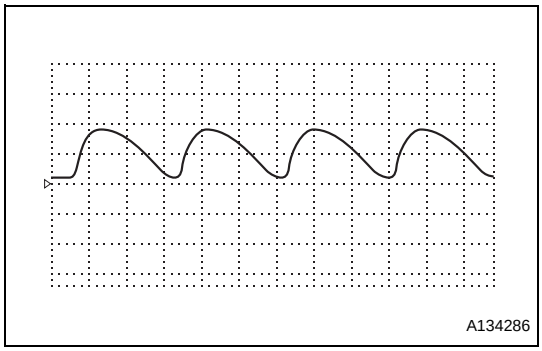
(d) Waveform 4

Tester Connection	# 10, # 20, # 30, # 40 ⟷ E1
Tool setting	20 V/DIV, 20 ms/DIV
Measurement condition	Engine is idling

HINT:

As the engine speed increases, the waveform cycle becomes shorter.

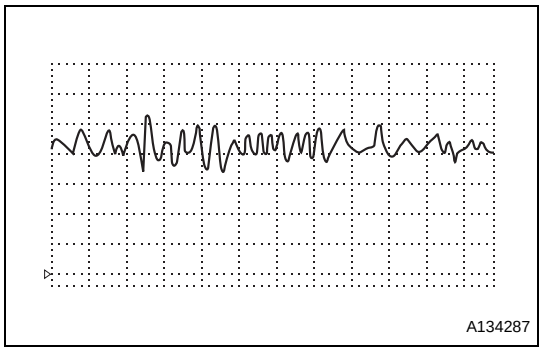
ES


A134286

(e) Waveform 5

Tester Connection	OX1, OX2 ⟷ E1
Tool setting	0.2 V/DIV, 500 ms/DIV
Measurement condition	Oxygen sensor is warmed up, constant engine speed of 3000 r/min

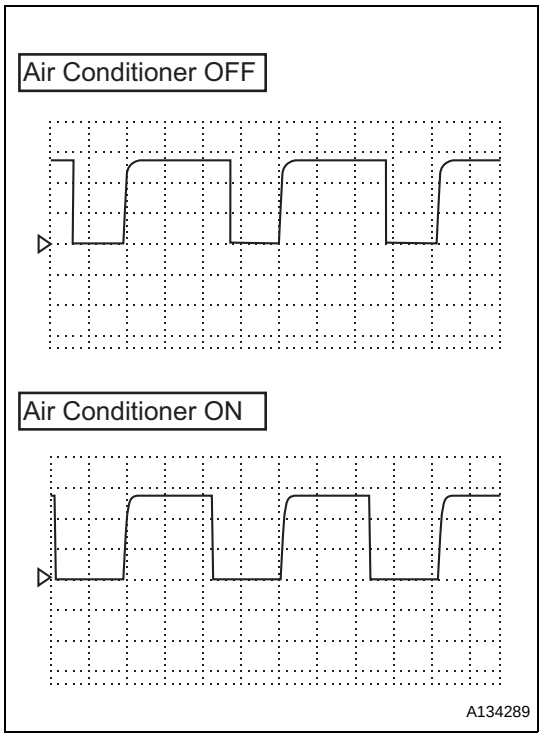
HINT:
Repeat between 0 (LEAN) ⟷ 1(RICH)V


A134287

(f) Waveform 6

Tester Connection	KNK ⟷ E1
Tool setting	1 V/DIV, 1 ms/DIV.
Measurement condition	Engine is idling

HINT:
- The oscilloscope waveform shown as an example does not include noise or chattering waveforms.
- The waveform amplitudes differ slightly depending on the vehicle.

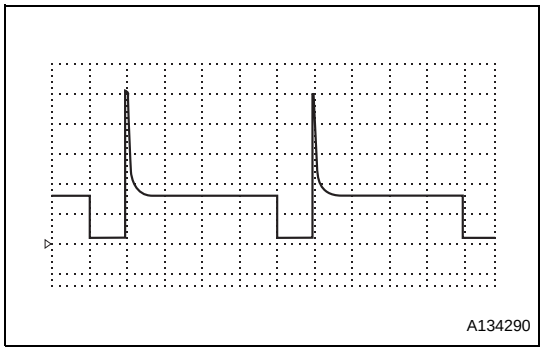


A134289

(g) Waveform 7

Tester Connection	ISC ⟷ E1
Tool setting	5 V/DIV, 1 ms/DIV
Measurement condition	Engine is idling, air conditioning is OFF → ON

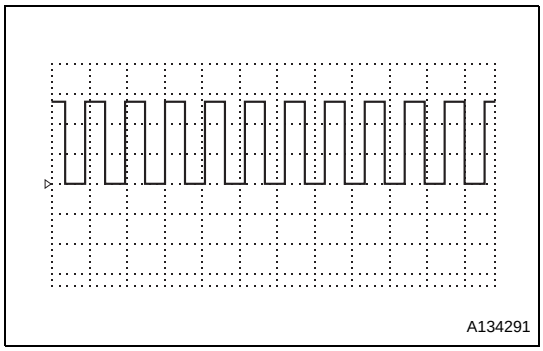
HINT:
The duty ratio changes if the air conditioning is turned ON.


A134290

(h) Waveform 8

Tester Connection	ATNE ⟷ E1
Tool setting	5 V/DIV, 50 ms/DIV
Measurement condition	Engine is idling

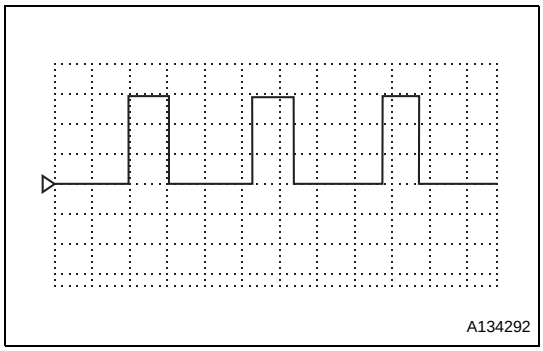
HINT:
If the waveform shown in the illustration is not indicated, idle the engine for 10 minutes and recheck the waveform.


A134291

(i) Waveform 9

Tester Connection	REV ⟷ E1
Tool setting	5 V/DIV, 10 ms/DIV
Measurement condition	Engine is idling

HINT:
As the engine speed increases, the waveform cycle becomes shorter.


A134292

(j) Waveform 10

Tester Connection	OCV+ ⟷ OCV-
Tool setting	5 V/DIV, 1 ms/DIV
Measurement condition	Engine is idling

HINT:
As the engine speed increases, the waveform cycle becomes shorter.

ECU DATA LIST / ACTIVE TEST

1. ECU DATA LIST CHART

NOTICE:

- **As the data list values may vary widely depending on slight measurement errors, the measurement environment, or the state of the vehicle due to wear and tear, it is very difficult to indicate specific standard values (reference values).Therefore, in some cases, an error may occur within the range of reference values.**
- **For delicate symptoms such as stumbling, rough idle, obtain and compare multiple test data using the same vehicle under the same conditions, and determine problems wholistically by considering all suspected items on the data list.**

CARB SPECIFIED DATA CHART

Item (Shorted Item)	Item Description	Inspection Condition	Reference Value	Problem Area
MIL status (MIL)	•Illumination condition of the check engine warning light •ON: on, OFF: off	Check engine warning light is on → off	ON → OFF	W voltage

Item (Shorted Item)	Item Description	Inspection Condition	Reference Value	Problem Area
Number of power train trouble codes (DIAG)	•Indicates the number of DTCs •Displayed range: 0 to 255	-	0	-
Fuel system status of bank 1 (FS1)	•Fuel system status of bank 1 is indicated •OL (open loop): conditions are not satisfied to go from open loop to closed loop •CL (close loop): oxygen sensor is used as feedback for fuel control •OL - Drive: open loop due to drive condition •OL - Fault: open loop due to detected system malfunction •CL- Fault: close loop, but at least one oxygen sensor is malfunctioning. Only one oxygen sensor is used for fuel control	Engine is idling after warming up	CL	OX1 Voltage
Fuel system status of bank 2 (FS2)	•Fuel system status of bank 2 is indicated •OL (open loop): conditions are not satisfied to go from open loop to closed loop •CL (close loop): oxygen sensor is used as feedback for fuel control •OL - Drive: open loop due to drive condition •OL - Fault: open loop due to detected system malfunction •CL- Fault: close loop, but at least one oxygen sensor is malfunctioning. Only one oxygen sensor is used for fuel control	-	-	-
O2 sensor position (O2S11)	•Existence of bank 1 sensor 1 is indicated •ON: yes, OFF: no	-	ON	-
O2 sensor position (O2S12)	•Existence of bank 1 sensor 2 is indicated •ON: yes, OFF: no	-	ON	-
O2 sensor position (O2S13)	•Existence of bank 1 sensor 3 is indicated •ON: yes, OFF: no	-	-	-
O2 sensor position (O2S14)	•Existence of bank 1 sensor 4 is indicated •ON: yes, OFF: no	-	-	-
O2 sensor position (O2S21)	•Existence of bank 2 sensor 1 is indicated •ON: yes, OFF: no	-	-	-
O2 sensor position (O2S22)	•Existence of bank 2 sensor 2 is indicated •ON: yes, OFF: no	-	-	-

Item (Shorted Item)	Item Description	Inspection Condition	Reference Value	Problem Area
O2 sensor position (O2S23)	•Existence of bank 2 sensor 3 is indicated •ON: yes, OFF: no	-	-	-
O2 sensor position (O2S24)	•Existence of bank 2 sensor 4 is indicated •ON: yes, OFF: no	-	-	-
OBD requirements (OBD)	OBD requirements are indicated (EOBD)	-	EOBD	-
Calculated load value (LOAD)	•Engine load amount is indicated •Displayed range: 0 to 100%	Engine is idling (air conditioner is OFF, shift lever is in N position)	0-5%	Air cleaner condition Throttle valve condition
Calculated load value (LOAD)	•Engine load amount is indicated •Displayed range: 0 to 100%	Engine speed is 2000 r/min (air conditioning is OFF, shift lever is in N position)	5-7%	Air cleaner condition Throttle valve condition
Coolant temperature (ECT)	•Indicates engine coolant temperature •Displayed range: -40 to 140°C	Engine warmed up completely	80 to 102°C	THW Voltage
Coolant temperature (ECT)	•Indicates engine coolant temperature •Displayed range: -40 to 140°C	Short circuit in sensor	119 to 140°C	THW Voltage
Coolant temperature (ECT)	•Indicates engine coolant temperature •Displayed range: -40 to 140°C	Short circuit in sensor	-40°C	THW voltage
Air intake pressure (MAP)	•Air intake pressure is indicated as absolute pressure •Displayed range: 0 to 120 kPa	Ignition switch is in ON position, engine is stopped	70 to 104 kPa	•VCPM voltage •PIM voltage
Air intake pressure (MAP)	•Air intake pressure is indicated as absolute pressure •Displayed range: 0 to 120 kPa	Engine is warmed up and idling, air conditioner is OFF	20 to 40 kPa	•VCPM voltage •PIM voltage
Engine speed (R/MIN)	Indicates the engine speed	Engine is stopped (IG ON)	0 r/min	N voltage
Engine speed (R/MIN)	Indicates the engine speed	Constant engine speed	No significant fluctuation	N voltage
Vehicle speed (VS)	Indicates vehicle speed	The vehicle is stopped	0 km/h	SPD voltage
Vehicle speed (VS)	Indicates vehicle speed	Vehicle is running at constant speed	No significant fluctuation	SPD voltage
Ignition timing advance angle (ITA)	•Indicates ignition timing of the 1-cylinder •Displayed range: BTDC 63.5 to ATDC 64°	Engine is cranking (air conditioner is OFF, shift lever is in N position)	4-8°	IG voltage Each sensor voltage
Ignition timing advance angle (ITA)	•Indicates ignition timing of the No.1 cylinder •Displayed range: BTDC 63.5 to ATDC 64°	Engine is idling (air conditioner is OFF, shift lever is in N position)	0-15°	IG voltage Each sensor voltage
Ignition timing advance angle (ITA)	•Indicates ignition timing of the No.1 cylinder •Displayed range: BTDC 63.5 to ATDC 64°	Engine speed is 2000 r/min (air conditioner is OFF, shift lever is in N position)	20-40°	IG voltage Each sensor voltage

Item (Shorted Item)	Item Description	Inspection Condition	Reference Value	Problem Area
Intake air temperature (IAT)	•Indicates air temperature •Displayed range: -40 to 140°C	IG ON	Equivalent to ambient temperature	THW voltage
Intake air temperature (IAT)	•Indicates intake air temperature •Displayed range: -40 to 140°C	Short circuit in sensor	119 to 140°C	THW voltage
Intake air temperature (IAT)	•Indicates intake air temperature •Displayed range: -40 to 140°C	Short circuit in sensor	-40°C	THW voltage
Opening angle of absolute throttle sensor (TP)	•Indicates opening angle of throttle valve 1 •Displayed range: 0 to 100 %	Accelerator pedal fully depressed (IG ON)	10-24%	VC, VTH voltage (Throttle position sensor No.1)
Opening angle of absolute throttle sensor (TP)	•Indicates opening angle of throttle valve 1 •Displayed range: 0 to 100 %	Accelerator pedal fully released (IG ON)	64-96%	VC, VTH voltage (Throttle position sensor No.1)
FrO2 sensor output voltage (O2FV)	•Indicates front O2 sensor output voltage •Displayed range: 0 to 1.275 V	2500 r/min Constant engine speed	0 to 1.0 V	OX1 voltage
FrO2 short-term fuel trim (O2FP)	•Indicates front O2 sensor feedback trim ratio •Displayed range: -100 to 99.2%	2500 r/min Constant engine speed	-20-20%	OX1 voltage
RrO2 sensor output voltage (O2RV)	•Indicates rear O2 sensor output voltage •Displayed range: 0 to 1.275 V	2500 r/min Constant engine speed	0.1 to 0.95 V	OX2 voltage
RrO2 short-term fuel trim (O2RP)	•Indicates rear O2 sensor feedback trim factor •Displayed range: -100 to 99.2%	2500 r/min Constant engine speed	10-70%	OX2 voltage
Driven distance at time of malfunction (DWM)	•Indicates distance driven at time DTC is recorded •Displayed range: 0 to 65535 km	-	0 to 65535 km	-
Evaporation purge output (EVAP)	•Indicates duty ratio of evaporation purge VSV output •Displayed range: 0 to 100 %	Engine is idling after warming up	0 %	PRG voltage Voltage of each sensor
Barometric pressure (BARO)	•Indicates barometric pressure •Displayed range: 0 to 255 kPa	Ignition switch is in ON position, engine is stopped	73 to 110 kPa	-
Power source voltage (BAT)	•Indicates battery voltage •Displayed range: 0 to 16 V	IG ON	11 to 14 V	BAT voltage

DMC SPECIFIED DATA CHART

Item (Shorted Item)	Item Description	Inspection Condition	Reference Value	Problem Area
Electrical load (DSW)	Indicates that there is electrical load	Light, defogger OFF → ON	OFF → ON	Voltage of each switch
Air conditioner signal [A/C]	Indicates that air conditioner is operating	Air conditioner OFF → ON	OFF → ON	Voltage of each switch
Injection timing (TAUZ)	• Indicates injection timing • Displayed range: 0 to 200 msec	Engine is cool when started → completely warmed up	1.4 to 2.5 msec	PIM, THW, OX1 voltage
Injection timing (TAUZ)	• Indicates injection timing • Displayed range: 0 to 200 msec	Engine warmed up and idling (air conditioner is OFF, shift lever is in N position)	1.4 to 1.8 msec	PIM, THW, OX1 voltage
Injection timing (TAUZ)	• Indicates injection timing • Displayed range: 0 to 200 msec	Engine speed is 2000 r/min (air conditioner is OFF, shift lever is in N position)	1.3 to 1.8 msec	PIM, THW, OX1 voltage
Injection timing (TAUZ)	• Indicates injection timing • Displayed range: 0 to 200 msec	Engine speed is 3000 r/min (air conditioner is OFF, shift lever is in N position)	1.0 to 1.5 msec	PIM, THW, OX1 voltage
ISC duty ratio (ISCD)	• Indicates duty ratio of ISC drive signal • Displayed range: 0 to 100%	Engine warmed up and idling (air conditioner is OFF, shift lever is in N position)	6-14%	VC voltage VTH voltage THW voltage
ISC duty ratio (ISCD)	• Indicates duty ratio of ISC drive signal • Displayed range: 0 to 100%	Engine warmed up and idling (air conditioner is ON, shift lever is in N position)	20-60%	VC voltage VTH voltage THW voltage
Actual displacement angle (VT)	• Indicates actual displacement angle of VVT • Displayed range: 0 to 50°	Engine is idling after warming up	0-5°	OCV voltage
Actual displacement angle (VT)	• Indicates actual displacement angle of VVT • Displayed range: 0 to 50°	Engine is warmed up and running at constant speed	0-10°	OCV voltage
Target displacement angle (VTT)	• Indicates target displacement angle of VVT control • Displayed range: 0 to 50°	Engine is idling after warming up	0-5°	OCV voltage
Target displacement angle (VTT)	• Indicates target displacement angle of VVT control • Displayed range: 0 to 50°	Engine is warmed up and running at constant speed	0-10°	OCV voltage
O2 sensor signal (OX)	• Indicates whether air-fuel ratio measured by front O2 sensor is lean or rich	2500 r/min Constant engine speed	-	OX voltage
VF monitor (VF)	• Indicates learned value of air-fuel ratio compensation • Displayed range: 0.75 to 1.25 V	2500 r/min Constant engine speed	0.75 to 1.25 V	OX voltage
Idle signal (IDL)	• Indicates whether the idle switch is ON or OFF (if the vehicle does not have an idle switch, the ON status is when the throttle is completely closed from the open status)	Accelerator pedal fully depressed → released	ON → OFF	VC voltage VTH voltage

Item (Shorted Item)	Item Description	Inspection Condition	Reference Value	Problem Area
ISC learned value (DLRN)	• Indicates ISC learned value • Displayed range: 0 to 100%	Engine warmed up and idling (air conditioner is OFF, shift lever is in N position)	6-14%	ISC voltage Voltage of each sensor
ISC learned value (DLRN)	• Indicates ISC learned value • Displayed range: 0 to 100%	Engine warmed up and idling (air conditioner is ON, shift lever is in N position)	6-14%	ISC voltage Voltage of each sensor
Purge trim ratio (FPG)	• Indicates purge trim ratio • Displayed range: 0 to 0.5V	Engine is idling after warming up	0	PRG voltage Voltage of each sensor
Knocking trim advance angle (AKNK)	• Indicates knock sensor trim advance angle • Displayed range: 0 to 20°	Engine is idling after warming up	0-3°	KNK voltage
Knocking trim advance angle (AKNK)	• Indicates knock sensor trim advance angle • Displayed range: 0 to 20°	4000 r/min Constant engine speed	0-3°	KNK voltage
TVVT angle equivalency (VTB)	• Indicates VVT angle equivalency • Displayed range: 15 to 90°	Engine is warmed up and idling	15-52°	VTH voltage
TVVT angle equivalency (VTB)	• Indicates VVT angle equivalency • Displayed range: 15 to 90°	3000 r/min Constant engine speed	15-62°	VTH voltage
Control duty ratio (DVT)	• Indicates duty ratio of VVT control • Displayed range: 0 to 100%	Engine is warmed up and idling	20-50%	VTH voltage
Control duty ratio (DVT)	• Indicates duty ratio of VVT control • Displayed range: 0 to 100%	3000 r/min Constant engine speed	20-50%	VTH voltage
Actual air intake pressure (PMVTB)	• Indicates the actual air intake pressure • Displayed range: 0 to 120 kPa	Engine is stopped	80 to 110 kPa	PIM voltage
Actual air intake pressure (PMVTB)	• Indicates the actual air intake pressure • Displayed range: 0 to 120 kPa	Engine is warmed up and idling	20 to 40 kPa	PIM voltage
Actual air intake pressure (PMVTB)	• Indicates the actual air intake pressure • Displayed range: 0 to 120 kPa	2000 r/min Constant engine speed	19 to 39 kPa	PIM voltage
Power steering signal (PST)	• Indicates power steering signal input	Steering wheel is centered → turned	OFF → ON	EPS voltage
Stop lamp signal (STP)	• Indicates stop lamp signal input	Brake pedal is released → depressed	OFF → ON	STP voltage
Number of DTCs (DIAG)	• Indicates the number of DTCs • Displayed range: 0 to 255	-	-	-

2. ACTIVE TEST

Item	Condition	Constraint Condition
Fuel pump	Fuel pump is ON (active) / OFF (stopped)	-
Purge VSV	Purge control VSV is ON (current) / OFF (no current)	-
All VSV	All VSV for purge control are ON (current) / OFF (no current)	-

Item	Condition	Constraint Condition
T terminal	T terminal is ON (short) / OFF (short released)	-
Radiator fan	Radiator fan is ON (active) / OFF (stopped)	-
ISC stepper	ISC active duty ratio setting (50 % open / 5 % open)	Vehicle is stopped, engine is idling

FAIL-SAFE CHART

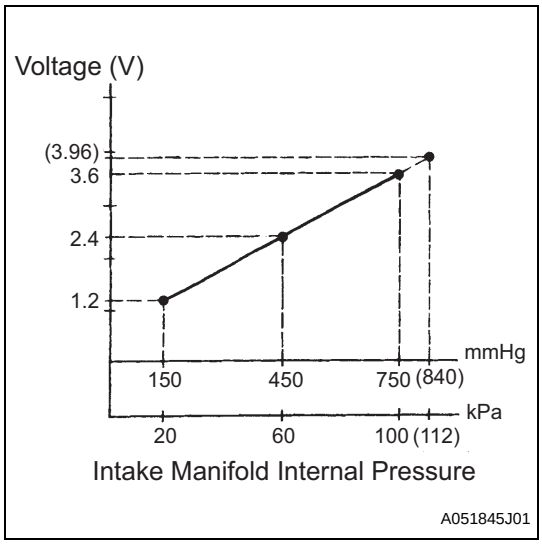
If the codes shown below are recorded on the ECU, it will go to a fail-safe mode.

Diagnostic Trouble Code	Fail-safe Operation	Fail-safe Mode Deactivation Condition
P0105/31	• Vacuum sensor value is the pressure estimated from the throttle opening angle and the engine speed.If the signal from the throttle position sensor is abnormal, use the signal from the vacuum sensor as the constant value. • If both the throttle opening angle and the engine speed exceed the constant value, decrease the fuel amount.	Return to normal condition
P0110/43	Use the signal from the intake air temperature sensor as the constant value.	Return to normal condition
P0115/42	Use the signal from the coolant temperature sensor as the constant value.	Return to normal condition
P0120/41	Use the signal from the throttle position sensor as the constant value.	Return to normal condition
P0136/22	Set feedback control to open control.	Return to normal condition
P0325/18	Lag the ignition timing.	Return to normal condition
P0350/16	Stop the fuel injection to the cylinder that has ignition signal problems.	Return to normal condition
P0535/44	Turn off the air conditioner.	Return to normal condition
P1600/83 P1601/81	Stop fuel injection and ignition.	Return to normal condition
P1656/74	Prohibit the oil control valve current control.	Return to normal condition

DTC	P0105/31	AIR INTAKE PRESSURE SENSOR SIGNAL SYSTEM

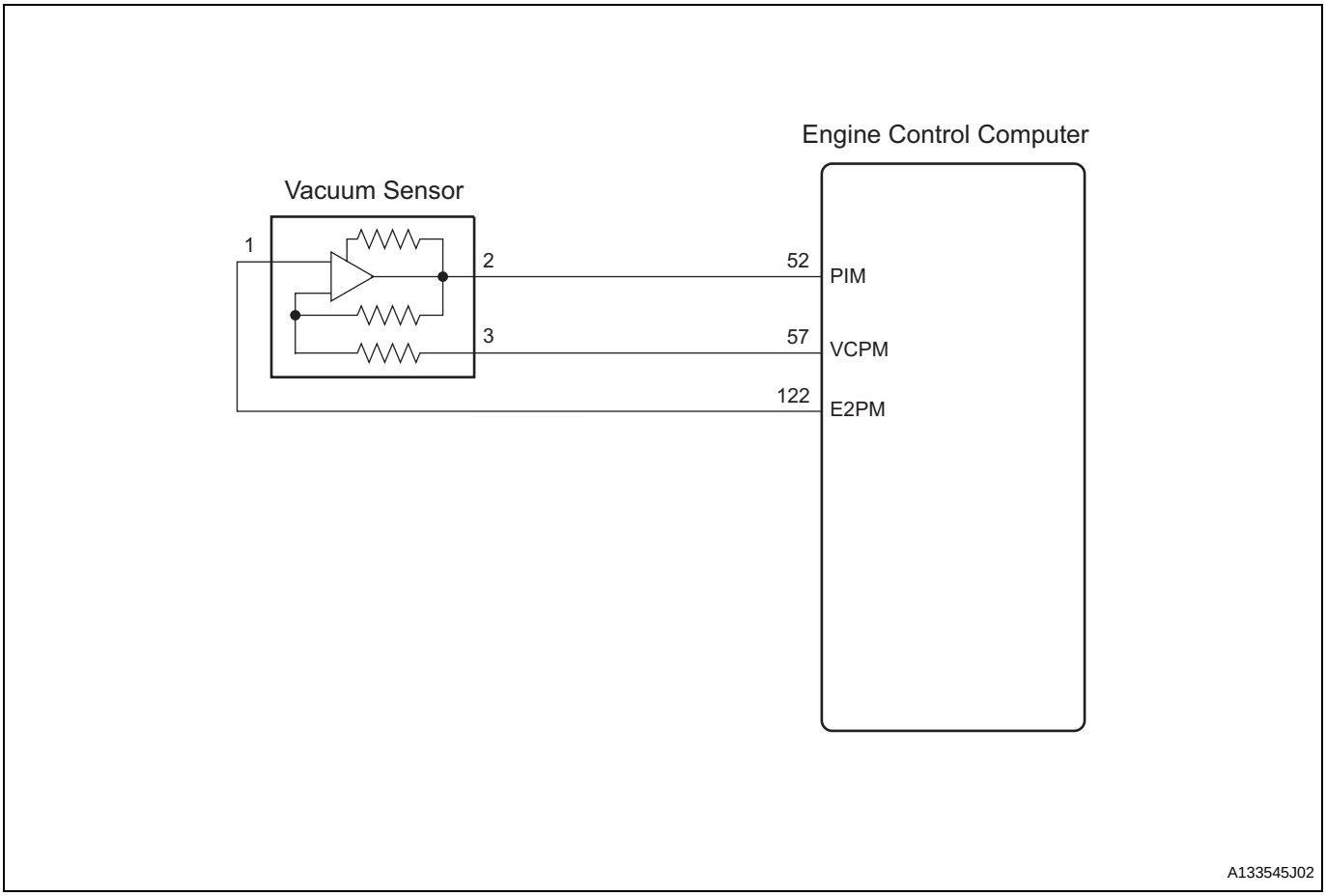
DESCRIPTION

Using a built-in sensor, the vacuum sensor detects the intake manifold pressure as voltage. At the same time, the engine control computer determines the basic injection and ignition timing based on this voltage.The vacuum sensor does not detect barometric pressure as a standard value, but it detects the absolute pressure of the inside of the intake manifold, so it is not effected by high latitude or other barometric pressure changes.Therefore, a constant standard air-fuel ratio is maintained under all conditions.



DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0105/31	1. IG ON 2. Open or short to vacuum sensor circuit 3. 0.5 seconds or more 4. 1 trip	• Vacuum sensor • Wire harness and connector • Engine control computer

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the DS-II. Freeze data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1	READ DS-II DATA (AIR INTAKE PRESSURE)

(a) Connect the DS-II to the DLC.

(b) Read the air intake pressure shown on the DS-II while the ignition switch is turned to the ON position and the engine is stopped.

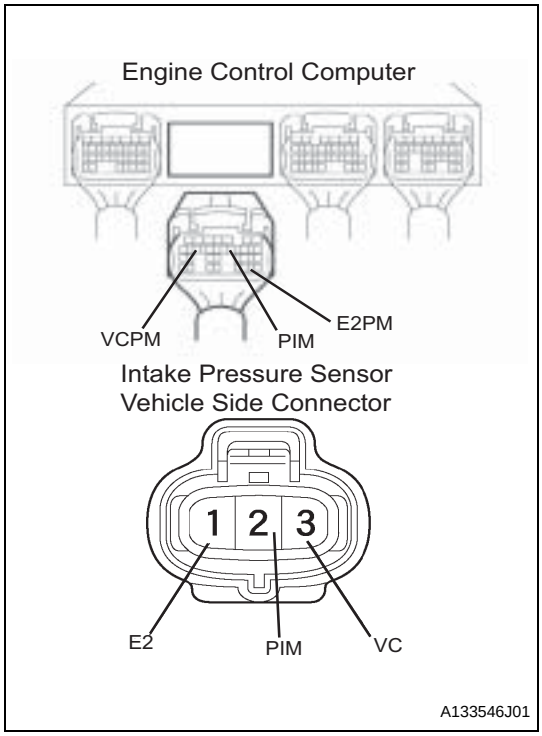
Result

Vehicle Condition	Standard
Engine is stopped, ignition switch is ON	80 to 110 kPa
Engine is warmed up and idling (air conditioner is OFF)	20 to 40 kPa
Engine is running at a constant speed of 2000 r/min (air conditioner is OFF)	19 to 39 kPa

OK → CHECK FOR INTERMITTENT PROBLEMS

NG

2	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER VACUUM SENSOR)



(a) Disconnect the vacuum sensor connector and the engine control computer connector B.

(b) Using a tester, check whether there is continuity or a short between the engine control computer and the vacuum sensor.(For terminal layout, see page ES - 16.)

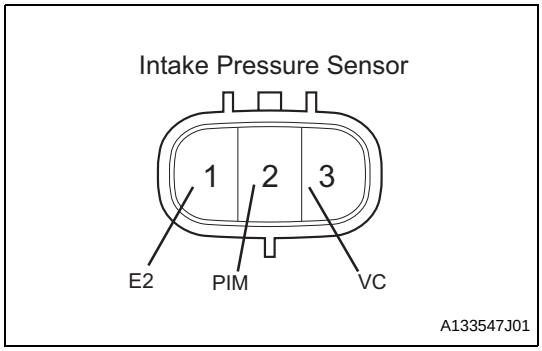
Standard

Inspection Terminal (Terminal Name) Engine control computer ⟷ Vacuum sensor	Standard
57 (VCPM) ⟷ 3 (VC)	There is continuity and no shorts between other terminals and body ground
52 (PIM) ⟷ 2 (PIM)	
122 (E2PM) ⟷ 1 (E2)	There is continuity, and no short between other terminals

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

OK

3	CHECK VACUUM SENSOR



(a) Turn the ignition switch to the ON position.

(b) Measure the voltage between the terminals of the vacuum sensor connecter using the tester.

Standard

Inspection Terminal (Terminal Name)	Standard
3 (VC) ⟷ 1 (E2)	4.5 to 5.5 V
2 (PIM) ⟷ 1 (E2)	3.1 to 4.1 V

(c) Remove the fuel pump relay and crank the engine, then measure the voltage between the terminals of the vacuum sensor connector.

Standard

Inspection Terminal (Terminal Name)	Standard
2 (PIM) ⟷ 1 (E2)	Voltage value fluctuates

OK → **REPLACE THE VACUUM SENSOR**

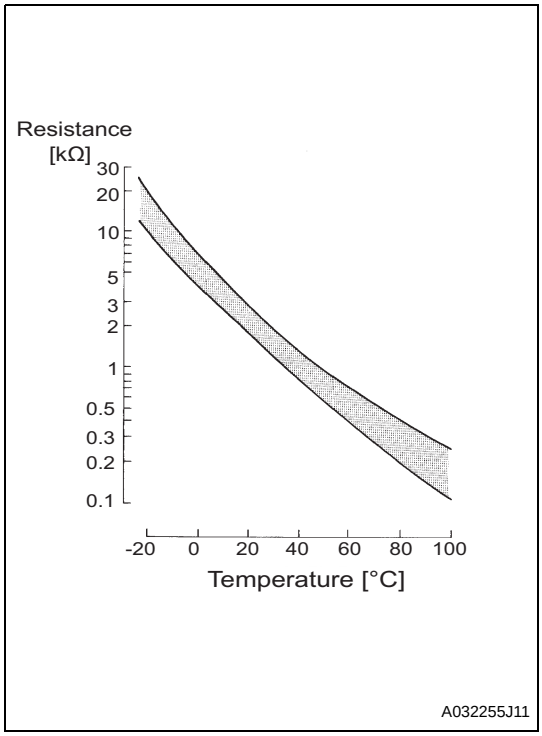
NG

CHECK AND REPLACE ENGINE ECU

DTC	P0110/43	INTAKE AIR TEMPERATURE SENSOR SIGNAL SYSTEM

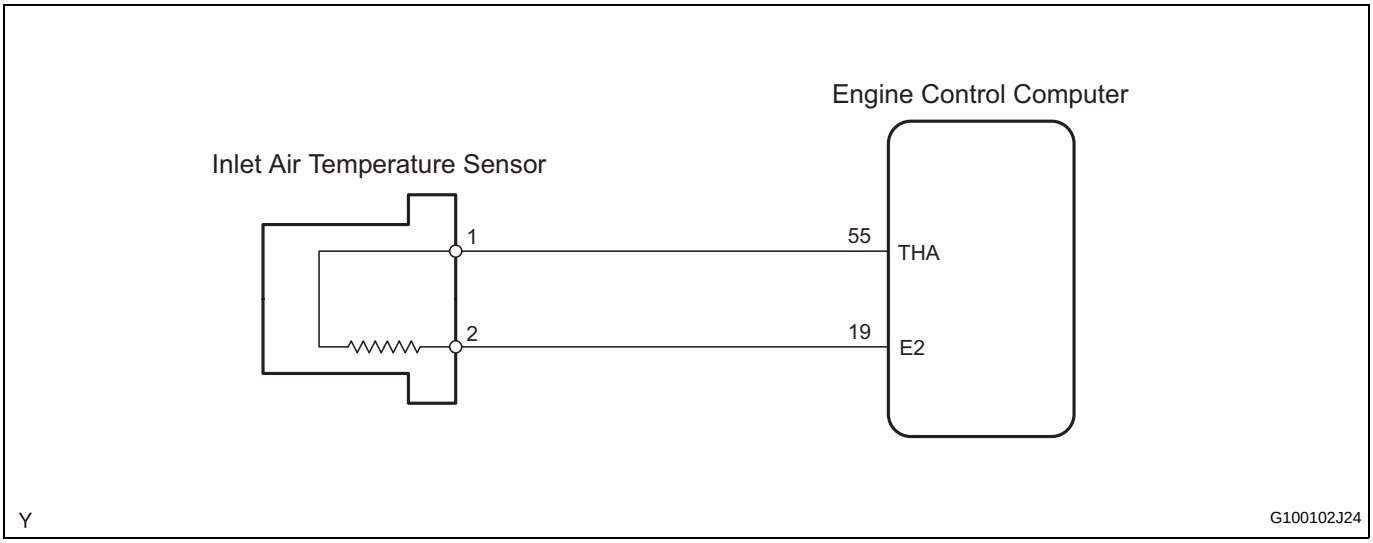
DESCRIPTION

The intake air temperature sensor detects the intake air temperature. The resistance of the thermistor built into intake air temperature sensor changes depending on the temperature of the intake air. When the intake air temperature is low, the resistance of the thermistor increases. Conversely, when the temperature of the intake air is high, the resistance of the thermistor drops. The intake air temperature sensor is connected to the engine control computer, and, through resistance R, 5V power source voltage is supplied to the intake air temperature sensor from terminal THA of the engine control computer. Because resistance R and the intake air temperature sensor are connected in series, the resistance changes depending on the intake air temperature and the potential of terminal THA changes. Based on this signal, the engine control computer increases the fuel injection volume to improve drivability during cold engine operation.



DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0110/24	1. IG ON 2. Open or short to intake air temperature sensor circuit 3. 0.5 seconds or more 4. 1 trip	• Wire harness or connector • INTAKE AIR TEMPERATURE SENSOR • Engine control computer

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read the freeze frame data using the DS-II.Freeze data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1	READ DS-II DATA (INTAKE AIR TEMPERATURE)

(a) Connect the DS-II to the DLC.
(b) Read the intake air temperature indicated on the DS-II while the ignition switch is turned to the ON position and the engine is stopped.

Result

Tester Display	Proceed to
-40°C	A
140°C	B
Equivalent to ambient temperature	C

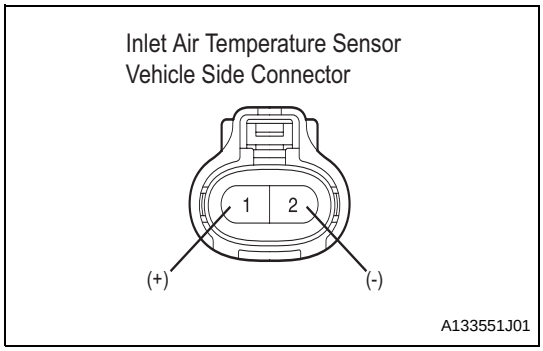
B → GO TO STEP 4

C → CHECK FOR INTERMITTENT PROBLEMS

A

2	READ DS-II DATA (WIRE HARNESS OPEN CIRCUIT INSPECTION)

SST 09843-18020



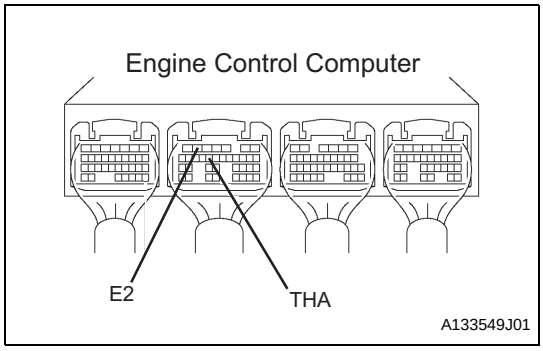
(a) Disconnect the intake air temperature sensor connector.
(b) Short the circuit between terminals 2 (-) and 1 (+) of the inlet air temperature sensor vehicle side connector using the SST (diagnosis check wire).
(c) Connect the DS-II to the DLC.
(d) Turn the ignition switch to the ON position.
(e) Read the inlet air temperature displayed on the DS-II.
Standard:
140°C

OK → **REPLACE INTAKE AIR TEMPERATURE SENSOR**

NG

3	READ DS-II DATA (CHECK FOR OPEN IN ENGINE CONTROL COMPUTER)

SST 09843-18020



(a) Short the circuit between terminals 55 (THA) and 19 (E2) of the engine control computer using the SST (diagnosis check wire).
(b) Read the intake air temperature displayed on the DS-II.
Standard:
140°C

NG → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

OK

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

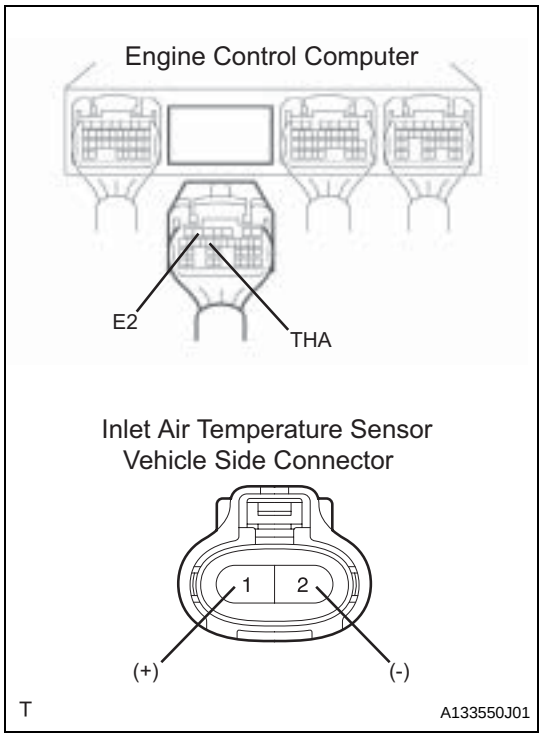
4	READ DS-II DATA (INSPECT WIRE HARNESS SHORT CIRCUIT)

(a) Disconnect the intake air temperature sensor connector.
(b) Turn the ignition switch to the ON position.
(c) Read the intake air temperature displayed on the DS-II.
Standard:
-40°C

OK → **REPLACE INTAKE AIR TEMPERATURE SENSOR**

NG

5	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER INTAKE TEMPERATURE SENSOR)



(a) Disconnect the engine control computer connector B and the intake air temperature sensor connector.

(b) Using a tester, check whether there is continuity or a short between the engine control computer vehicle side connector and the intake air temperature sensor vehicle side connector.(For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine control computer ⟷ Inlet air temperature sensor	Standard
55(THA) ⟷ 1(+)	There is continuity and no shorts between other terminals and body ground
19(E2) ⟷ 2(-)	There is continuity, and no short between other terminals

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

OK → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

DTC	P0115/42	COOLANT TEMPERATURE SENSOR SIGNAL SYSTEM

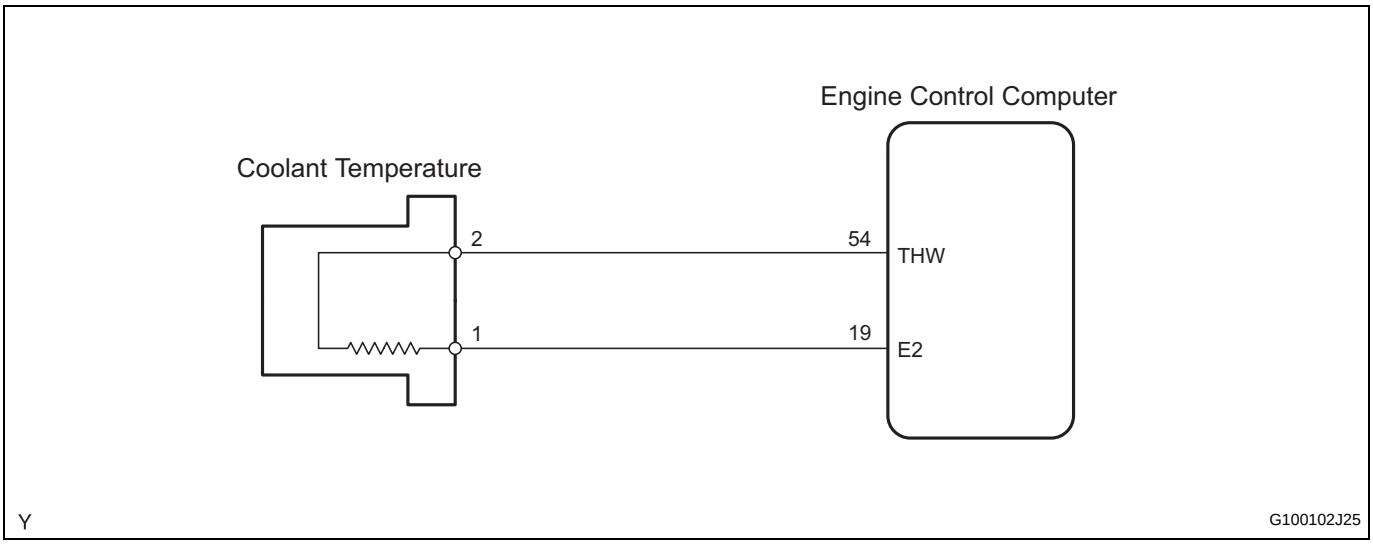
DESCRIPTION

The resistance of the thermistor built into the coolant temperature sensor varies according to the coolant temperature.

DTC No.	DTC Detection Condition 1. Diagnosis Condition 2. Malfunction Condition 3. Malfunction Time 4. Other	Suspected Area
P0115/22	1. IG ON 2. Open or short in coolant temperature circuit 3. 0.5 seconds or more 4. 1 trip	• Wire harness or connector • Coolant temperature • Engine control computer

ES

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1	READ DS-II DATA (COOLANT TEMPERATURE)

(a) Connect the DS-II to the DLC.
(b) Read the engine coolant temperature displayed on the DS-II while the ignition switch is turned to the ON position and the engine is stopped.

Result

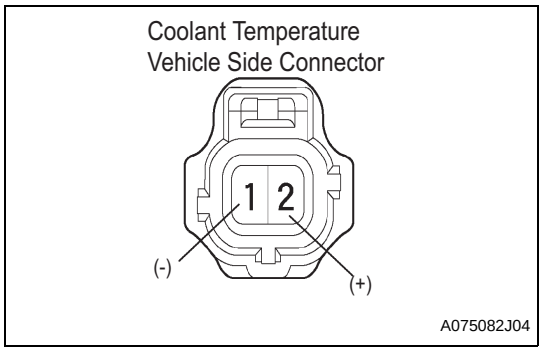
Tester Display	Proceed to
-40 °C	A
140 °C	B
Equivalent to actual coolant temperature	C

B	GO TO STEP 4

C → CHECK FOR INTERMITTENT PROBLEMS

A

2 READ DS-II DATA (INSPECT WIRE HARNESS OPEN CIRCUIT)



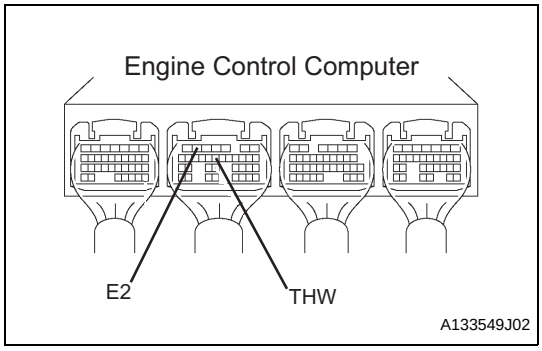
SST 09843-18020

(a) Disconnect the connector of the coolant temperature sensor.
(b) Short the circuit between terminals 2 (+) and 1 (-) of the water temperature vehicle side connector using the SST (diagnosis check wire No.2).
(c) Connect the DS-II to the DLC.
(d) Turn the ignition switch to the ON position.
(e) Read the engine coolant temperature displayed on the DS-II.
Standard:
140°C

OK → REPLACE COOLANT TEMPERATURE SENSOR

NG

3 READ DS-II DATA (CHECK FOR OPEN IN ENGINE CONTROL COMPUTER)



SST 09843-18020

(a) Short the circuit between terminals 54 (THW) and 19 (E2) of the engine control computer using the SST (diagnosis check wire No.2).(For terminal layout, see page ES - 16.)
(b) Read the engine coolant temperature displayed on the DS-II.
Standard:
140°C

NG → CHECK AND REPLACE ENGINE CONTROL COMPUTER

OK

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

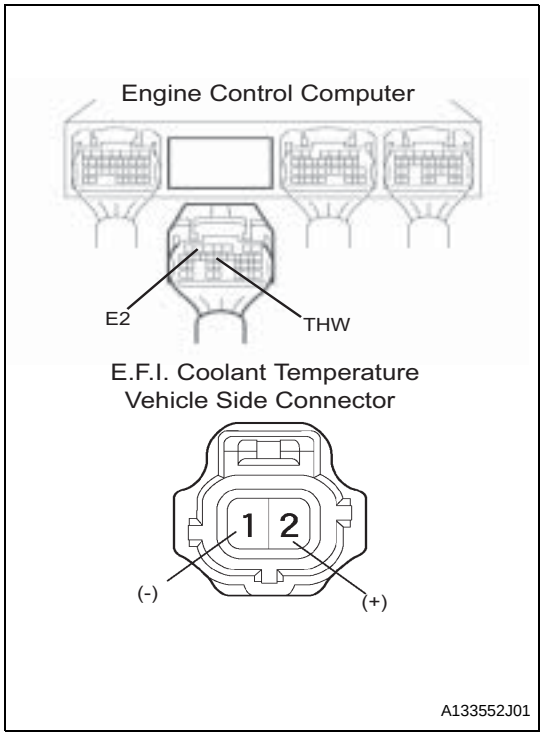
4 READ DS-II DATA (INSPECT WIRE HARNESS SHORT CIRCUIT)

(a) Disconnect the connector of the coolant temperature sensor.
(b) Turn the ignition switch to the ON position.
(c) Read the engine coolant temperature displayed on the DS-II.
Standard:
-40°C

OK → REPLACE COOLANT TEMPERATURE SENSOR

NG

5	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER COOLANT TEMPERATURE)



(a) Disconnect connector B of the engine control computer and the connector of the coolant temperature sensor.

(b) Using a tester, check whether there is continuity or a short between the vehicle side connector or the engine control computer and the vehicle side connector of the coolant temperature sensor.(For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine control computer ⟷ Coolant temperature	Standard
54(THW) ⟷ 2(+)	There is continuity and no short between other terminals and body ground
19(E2) ⟷ 1(-)	There is continuity, and no short between other terminals

NG → REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

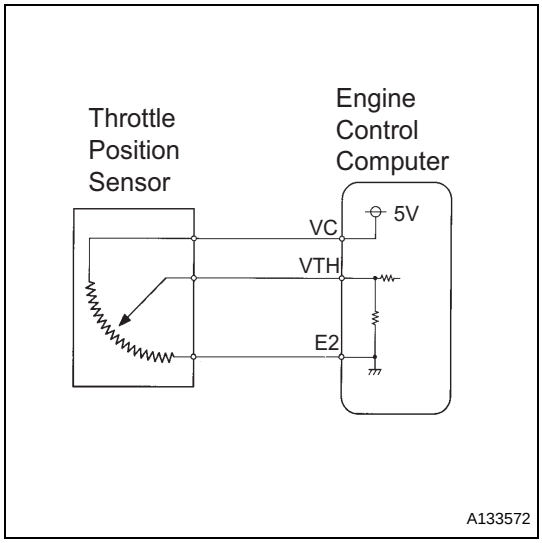
ES

DTC P0120/41 THROTTLE SENSOR SIGNAL SYSTEM

DESCRIPTION

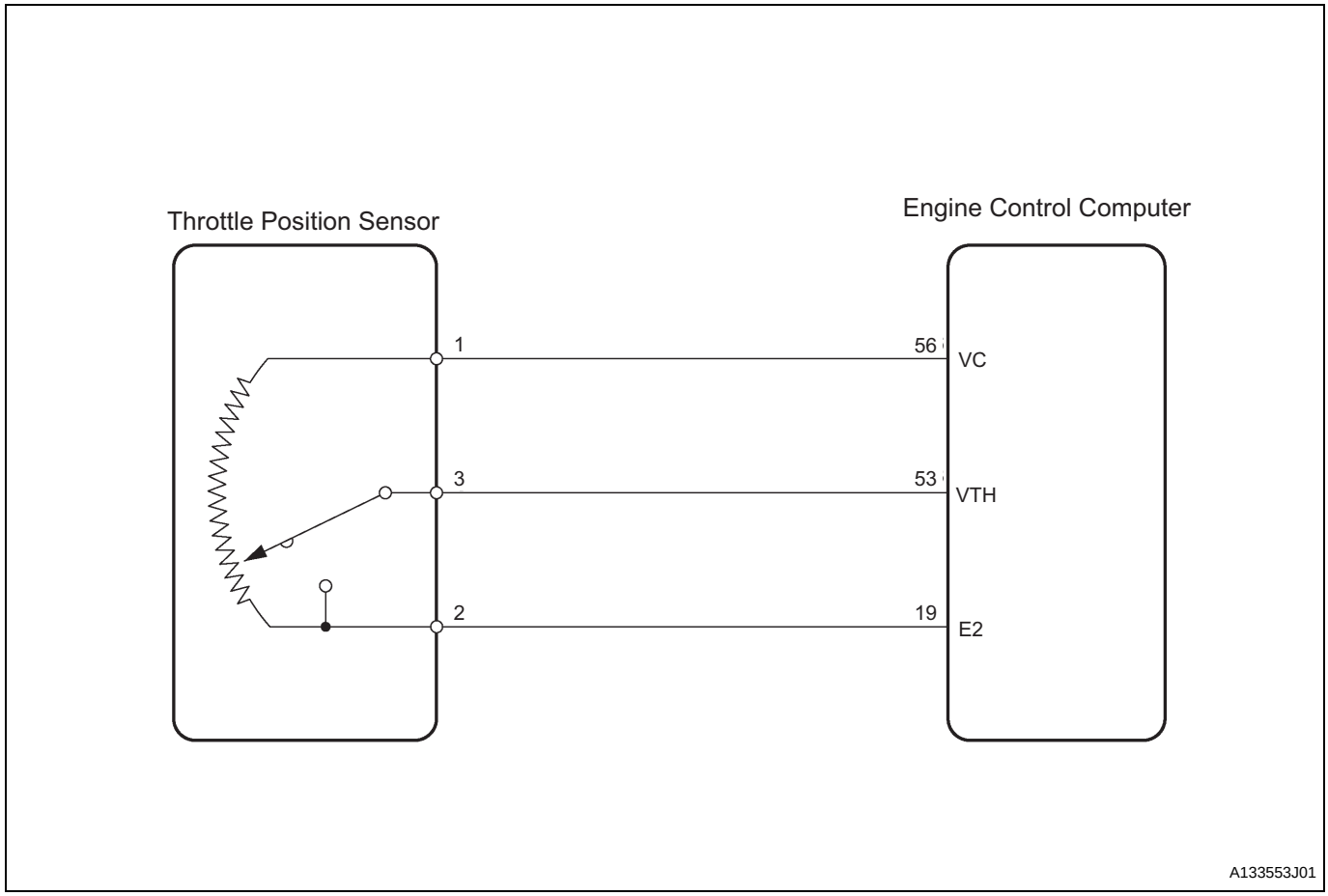
The throttle position sensor is mounted on the throttle body to detect the opening angle of the throttle valve.

When the throttle valve is fully closed, voltage of approximately 0.7 V is applied to the VTH terminal of the engine control computer.The voltage that is applied to the VTH terminal of the engine control computer increases in proportion to the opening angle of the throttle valve, and the voltage increases from approximately 3.5 V to 5.0 V when the throttle valve is fully opened.The engine control computer determines the operating condition of the vehicle by the voltage input from the VTH terminal, and adjusts the air-fuel ratio, performs fuel-cut control, etc.



DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Trouble Area
P0120/41	1. IG ON 2. Open or short circuit in throttle position sensor circuit 3. 0.5 seconds or more 4. 1 trip	• Throttle position sensor • Wire harness or connector • Engine control computer

CIRCUIT DIAGRAM

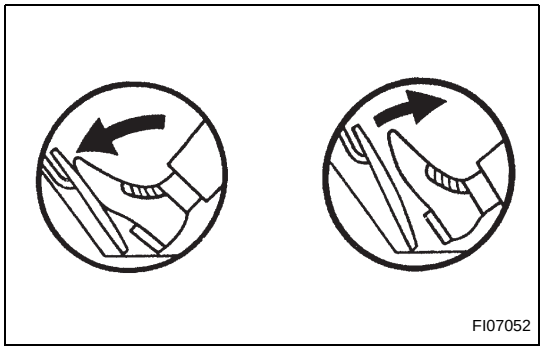


INSPECTION PROCEDURE

HINT:

- Read the freeze frame data using the DS-II. Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1	READ DS-II DATA (ABSOLUTE THROTTLE OPENING ANGLE)



(a) Connect the DS-II to the DLC.

(b) Read the opening angle of the throttle valve.

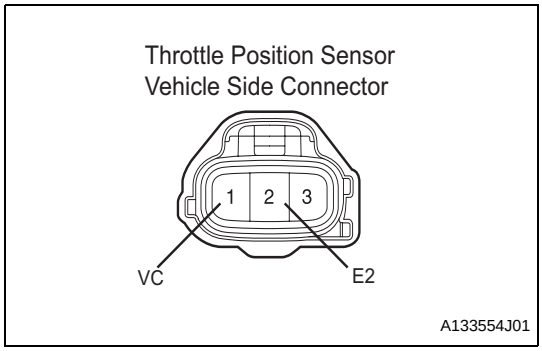
Result

Throttle Valve	Standard
Fully open	64-96%
Fully Closed	10-24%

OK → **CHECK FOR INTERMITTENT PROBLEMS**

NG

2 **CHECK WIRE HARNESS OR CONNECTOR (CHECK VOLTAGE)**

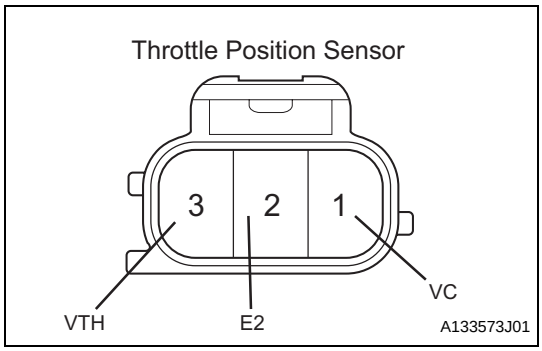


(a) Disconnect the connector of the throttle position sensor.
(b) Turn the ignition switch to the ON position.
(c) Using a tester, measure the voltage between terminal 1(VC) and 2 (E2) of the vehicle side connector of the throttle position sensor.
Standard:
4.5 to 5.5 V

NG → **GO TO STEP 6**

OK

3 **INSPECT THROTTLE POSITION SENSOR**



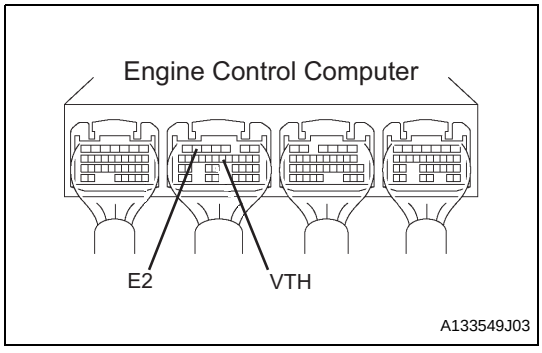
(a) Disconnect the connector of the throttle position sensor.
(b) Using a tester, measure the resistance between the connector terminals of the throttle position sensor.
Standard

Tester Connection (Terminal Symbol)	Throttle Valve	Resistance
1 (VC) to 3 (VTH)	-	2.5 to 5.9 k
3 (VTH) to 2 (E2)	Fully closed	0.2 to 5.7 k
3 (VTH) to 2 (E2)	Fully open	2.0 to 10.2 k

NG → **REPLACE THROTTLE POSITION SENSOR**

OK

4 **INSPECT ENGINE CONTROL COMPUTER**



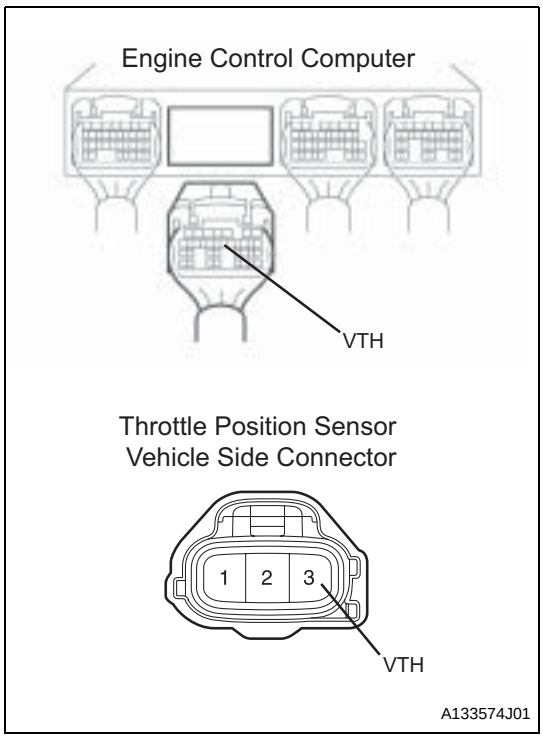
SST 09842-97209
(a) Connect the SST (sub harness, EFI computer check) to the engine control computer.
(b) Turn the ignition switch to the ON position.
(c) Using a tester, measure the voltage between terminal 53 (VTH) and 19 (E2) of the engine control computer connector.(For terminal layout, see page ES - 16.)
Standard

Throttle Valve	Standard
Fully closed	0.3 to 1.0 (V)
Fully open	2.7 to 5.2 (V)

OK → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

NG

5	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER THROTTLE POSITION SENSOR)



(a) Disconnect the engine control computer connector B and the throttle position sensor connector.

(b) Using a tester, check whether there is continuity or a short between the engine control computer vehicle side connector and the throttle position sensor vehicle side connector.(For terminal layout, see page ES - 16.)

Standard

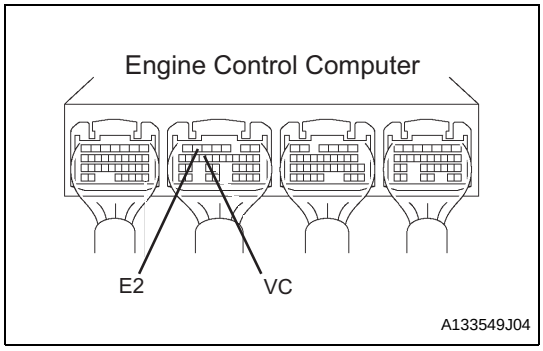
Inspection Terminal (Terminal Name) Engine control computer ←→ Throttle position sensor	Standard
53 (VTH) ←→ 3 (VTH)	There is continuity and no short between other terminals and body ground

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

OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

6	INSPECT ENGINE CONTROL COMPUTER



SST 09842-97209

(a) Connect the SST (sub harness, EFI computer check) to the engine control computer.

(b) Turn the ignition switch to the ON position.

(c) Using a tester, measure the voltage between terminals 56 (VC) and 19 (E2) of the engine control computer connector. (For terminal layout, see page ES - 16.)

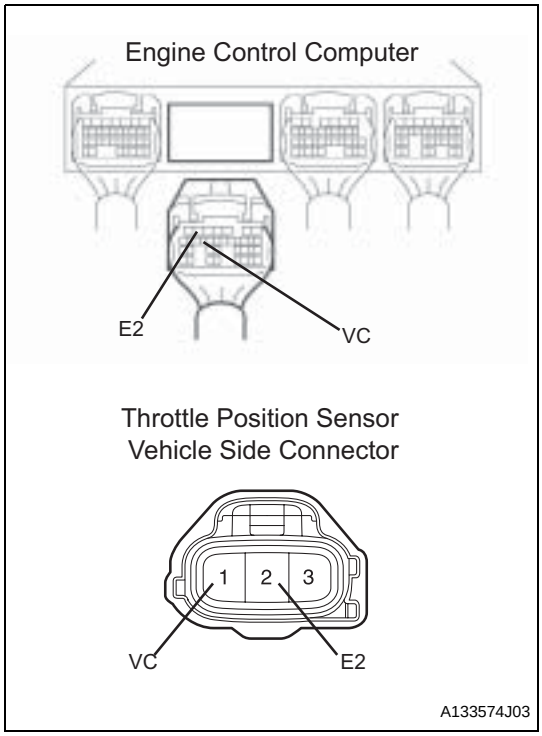
Standard:

4.5 to 5.5 V

NG → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

OK

7	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER THROTTLE POSITION SENSOR)



(a) Disconnect the engine control computer connector B and the throttle position sensor connector.

(b) Using a tester, check whether there is continuity or a short between the engine control computer vehicle side connector and the throttle position sensor vehicle side connector.(For terminal layout, see page ES - 16.)

Standard

Inspection Terminal (Terminal Name) Engine control computer ←→ Throttle position sensor	Standard
56 (VC) ←→ 1 (VC)	There is continuity and no short between other terminals and body ground
19 (E2) ←→ 2 (E2)	There is continuity, and no short between other terminals

OK → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

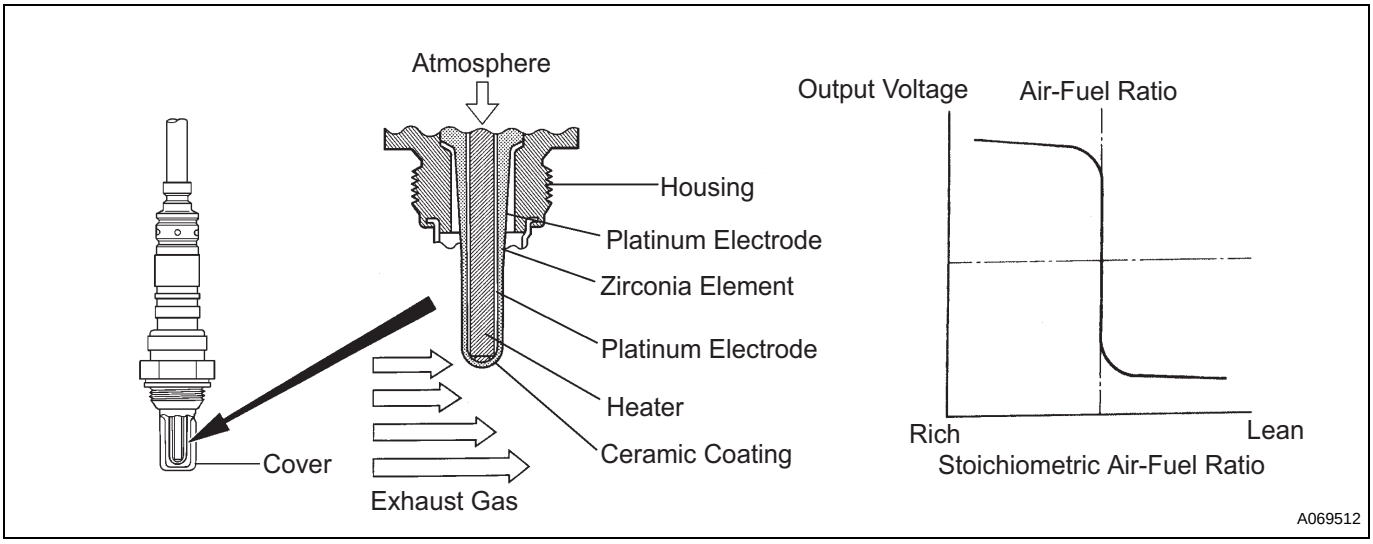
NG

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

DTC P0130/21 FRONT 02 SENSOR SIGNAL SYSTEM

DESCRIPTION

A three-way catalytic converter is used to efficiently remove CO, HC and NO_x from the exhaust gas. The three-way catalytic converter works most efficiently when the air-fuel ratio is close to the stoichiometric ratio.Therefore, if the engine does not operate close to the stoichiometric air-fuel ratio. CO, HC and NO_x cannot be converted efficiently. An oxygen sensor is provided in order help the system maintain the stoichiometric ratio. The oxygen sensor is used to detect the oxygen concentration of the exhaust gas. The oxygen sensor has a characteristic where its voltage output changes suddenly near the stoichiometric air-fuel ratio, if normal combustion is occurring. The engine control computer uses this signal characteristic to allow air-fuel ratio control. When the air-fuel ratio is lean, the oxygen level in the exhaust gas increases. The engine control computer recognizes the lean air-fuel ratio detected by the oxygen sensor. (Low voltage variation: < 0.45 V) When the air-fuel ratio is rich, oxygen levels in the exhaust gas decrease, and the engine control computer recognizes the rich air-fuel ratio detected by the oxygen sensor. (High voltage variation: > 0.45 V) The engine control computer determines whether the air-fuel ratio is rich or lean by the electromotive force signal of the oxygen sensor, and controls injection volume. The oxygen sensor has a heater which warms a zirconium element. The heater is controlled by the engine control computer, which applies current to the heater in order to prevent sensor inaccuracy that may occur if the sensor gets cold when the exhaust gas temperature is low (such as when there is a low amount of intake air).



DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0130/21	1. Engine warmed up and engine speed lower than 2,500 r/min 2. Steady oxygen sensor output voltage of less than 0.3 V or more than 0.6 V 3. 400 seconds or more after engine started 4. 2 trip	• Wire harness or connector • Oxygen sensor • Engine control computer

HINT:

Using the DS-II, check the FrO2 sensor output voltage on the data monitor screen. If the FrO2 sensor output voltage stays at 0.02 V or less, the O2 sensor voltage system circuit may be open.

DESCRIPTION

1. Start the engine and drive the vehicle for more than 20 seconds at speed above 10 km/h.[*1]

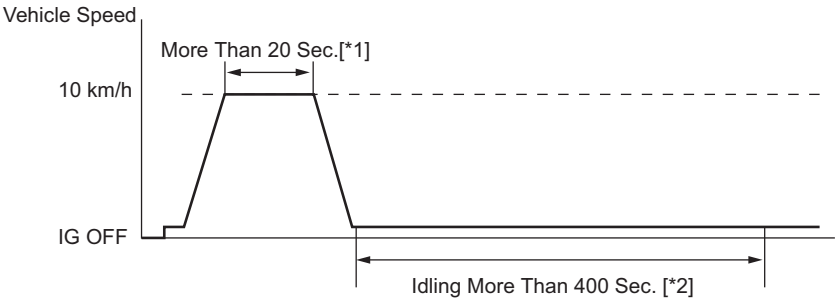
2. Allow the engine to idle for approximately 400 seconds.[*2]

3. Check the voltage of the FrO2 sensor output.

NOTICE:

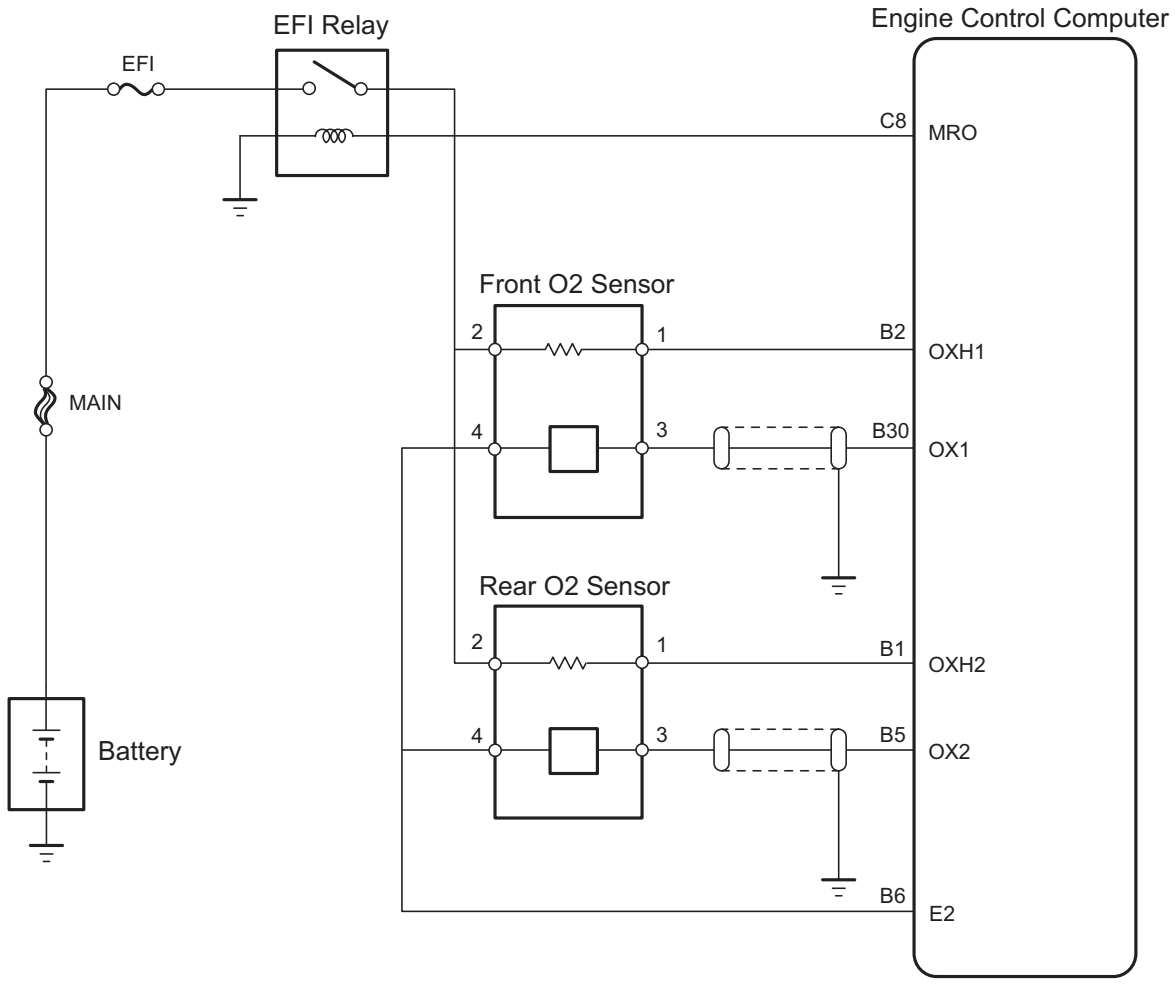
If this test is not performed accurately, it will be impossible to determine exactly where problems are occurring.

HINT:
If there are any abnormalities, the check warning light will remain on while the procedure is performed. [*2].



A140624J01

CIRCUIT DIAGRAM



A135516

INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1 **READ DS-II DATA (FrO2 SENSOR OUTPUT VOLTAGE)**

(a) Connect the DS-II to the DLC.

(b) Start the engine and warm it up until it reaches a temperature that allows the oxygen sensor to start feedback.

(c) Warm up the oxygen sensor for approximately 90 seconds at an engine speed of 2500 r/min.

(d) Using the DS-II, read FrO2 sensor voltage B1S1 while the engine is idling.

Result:

Repeated output of voltage that is less than 0.3 V or more than 0.6 V.

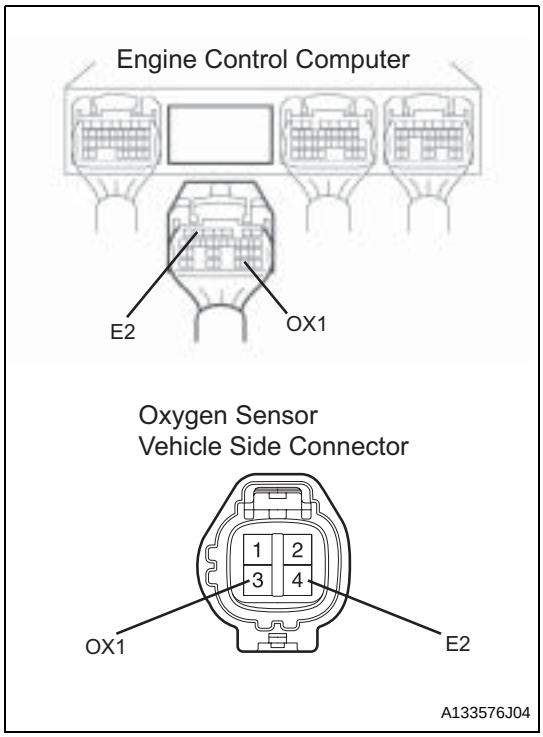
HINT:

- It is easier to see the changes in the line graph mode on the monitor screen.

OK → **GO TO STEP 3**

NG

2 **CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER OXYGEN SENSOR)**



(a) Disconnect the engine control computer connector B and the oxygen sensor connector.

(b) Using a tester, check whether there is continuity or a short between the engine control computer and the oxygen sensor (For terminal layout, see page ES - 16).

Standard

Tester Connection (Terminal Symbol) Engine control computer ⟷ Oxygen sensor	Standard
123 (OX1) ⟷ 3 (OX1)	There is continuity and no short between other terminals and body ground
19 (E2) ⟷ 4 (E2)	There is continuity, and no short between other terminals

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

OK

REPLACE OXYGEN SENSOR

3	ROAD TEST TO CHECK OPERATION

(a) Connect the DS-II to the DLC.
(b) Turn the ignition switch to the ON position, and delete the DTCs by following the prompts on the DS-II screen.
(c) To check the system, warm up the oxygen sensor by performing a road test.
HINT:
Refer to DESCRIPTION for the procedure.

ES

NEXT

4	READ DTCS

(a) Connect the DS-II to the DLC.
(b) Turn the ignition switch to the ON position, and read the DTCs by following the prompts on the DS-II screen.
(1) Check if DTC P0130/21 is indicated.

Result

Tester Display	Proceed to
Indicates P0130/21	A
Indicates a normal code	B

B → CHECK FOR INTERMITTENT PROBLEMS

A

CHECK AND REPLACE ENGINE CONTROL COMPUTER

DTC	P0135/23	FRONT 02 SENSOR HEATER SIGNAL SYSTEM

DTC	P0141/24	REAR 02 SENSOR HEATER

DESCRIPTION

See ES - 43.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0135/23	1. IG ON 2. Open in oxygen sensor heater circuit 3. 1.2 seconds or more 4. 2 trip	• Wire harness or connector • Oxygen sensor • Engine control computer
P0141/24	1. IG ON 2. Open in oxygen sensor No.2 heater circuit 3. 1.2 seconds or more 4. 2 trip	• Wire harness or connector • OXYGEN SENSOR NO.2 • Engine control computer

ES

CIRCUIT DIAGRAM

HINT:

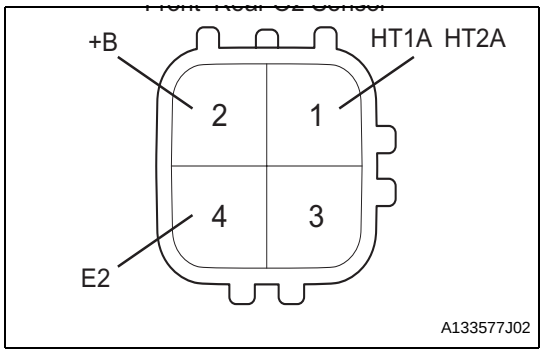
For the wiring diagram, see page ES - 44.

INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1	INSPECT OXYGEN SENSOR



(a) Disconnect the oxygen sensor connector.

(b) CHECK SENSOR HEATER RESISTANCE

(1) Using a tester, measure the resistance between the terminals.

Standard

Sensor	Tester Connection (Terminal Symbol)	Standard (Measurement Condition)
Oxygen sensor	2 (+B) ⟷ 1 (HT1A)	5 to 10 (20°C)
Oxygen sensor No.2	2 (+B) ⟷ 1 (HT2A)	5 to 10 (20°C)

(c) Check short in sensor heater

(1) Using the tester, check for the short between terminals 1 (HT1A) and 4 (E2).

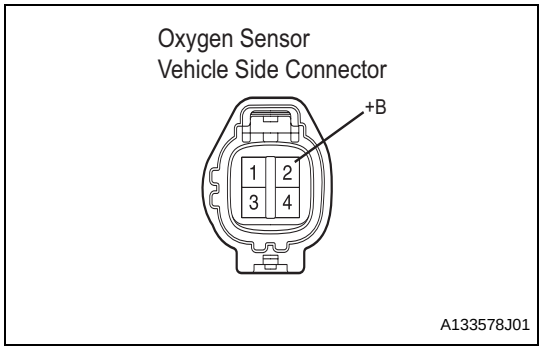
Standard

Sensor	Tester Connection (Terminal Symbol)	Standard
Oxygen sensor	1 (HT1A) ⟷ 4 (E2)	No continuity
Oxygen sensor No.2	1 (HT2A) ⟷ 4 (E2)	No continuity

NG	REPLACE OXYGEN SENSOR

OK

2 CHECK WIRE HARNESS AND CONNECTOR (SENSOR HEATER POWER SOURCE CIRCUIT)



(a) Disconnect the oxygen sensor connector.
(b) Turn the ignition switch to the ON position.
(c) Using a tester, measure the voltage of the terminals of the oxygen sensor vehicle side connecter.

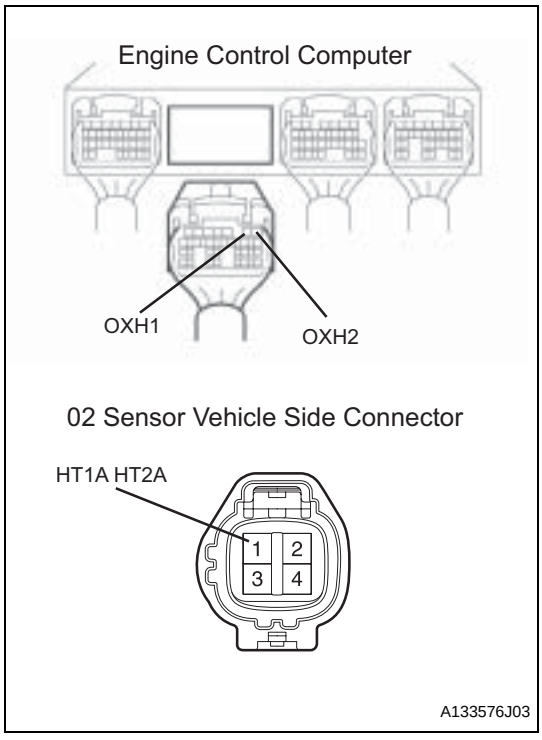
Standard

Installed position	Tester Connection (Terminal Symbol)	Standard
Front, rear	2 (+B) ⟷ body ground	10 to 14 V

NG → GO TO STEP 4

OK

3 CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER OXYGEN SENSOR)



(a) Disconnect the engine control computer connector B and the oxygen sensor connector.
(b) Using a tester, check whether there is continuity or a short between the engine control computer and the oxygen sensor. (For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine control computer ⟷ Oxygen sensor	Standard
15 (OXH1) ⟷ 1 (HT1A)	There is continuity and no short between other terminals and body ground
14 (OXH2) ⟷ 1 (HT2A)	There is continuity and no short between other terminals and body ground

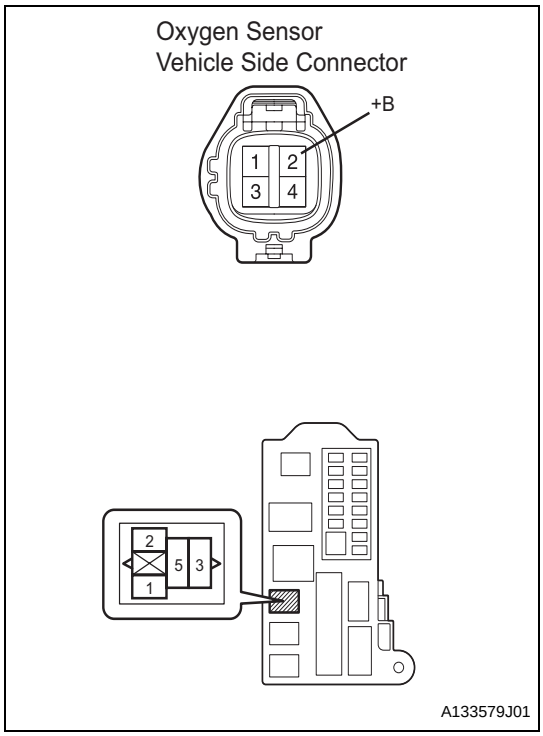
NG → REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

4 CHECK WIRE HARNESS AND CONNECTOR (OXYGEN SENSOR EFI RELAY)

(a) Disconnect the oxygen sensor connector.



(b) Remove the EFI relay.

(c) Using a tester, check whether there is continuity or a short between the relay block holder for the EFI relay and the oxygen sensor.

Standard

Installed position	Tester Connection (Terminal Symbol) Relay block holder for EFI relay ⟷ Oxygen sensor	Standard
Front, rear	4 ⟷ 3 (+B)	There is continuity and no short between other terminals and body ground

ES

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

OK

CHECK ECU POWER SOURCE SYSTEM (SEE ECU POWER SOURCE SYSTEM)

DTC P0136/22 REAR 02 SENSOR SIGNAL SYSTEM

DESCRIPTION

(See Page ES - 43)

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0136/27	1. During feedback after engine is warmed up 2. Open in oxygen sensor circuit or no rich signals are input during feedback 3. 500 seconds or more 4. 2 trip	• Wire harness or connector • Oxygen sensor No.2 • Engine control computer

ES

HINT:

- Using the DS-II, check the RrO2 sensor output voltage on the data monitor screen. If the RrO2 sensor output voltage stays at 0.1 V or less, there be an open in the RrO2 sensor voltage circuit.
- The conditions of the oxygen sensor No.2 output voltage and the air-fuel ratio feedback (F/B calibration value) can be read by using DS-II.

DESCRIPTION

1. Start the engine and drive the vehicle for more than 20 seconds at speed above 10 km/h.[*1]

2. Allow the engine to idle for approximately 400 seconds.[*2]

3. Warm up the engine. [*3]

4. Drive the vehicle for 50 seconds or more at a vehicle speed of 70 km/h or more. [*4]

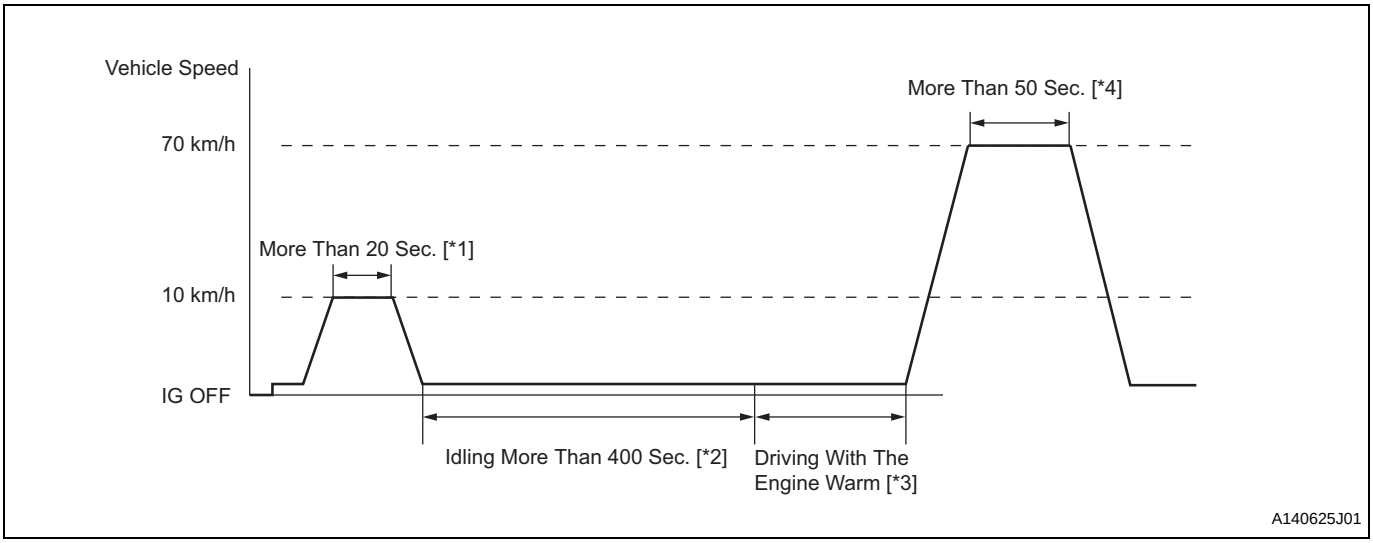
5. Check the voltage of the RrO2 sensor output.

NOTICE:

If this test is not performed accurately, it will be impossible to determine exactly where problems are occurring.

HINT:

- Because oxygen sensor No.2 does not have heater control, drive with a moderate level of load after the engine is completely warmed up.
- If there are any abnormalities, the check engine warning light will remain on while the procedure is performed. [*4].



CIRCUIT DIAGRAM

(See Page ES - 44)

INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful whnen troubleshooting.

1	READ DTCs

(a) Connect the DS-II to the DLC.

(b) Turn the ignition switch to the ON position, and delete the DTCs by following the prompts on the DS-II screen.(See page ES - 8.)

(c) Perform a road test.

(d) Check for DTCs following the prompts on the DS-II screen. (See page ES - 8.)

(1) Check if DTC P0136/27 is indicated.

Result

Tester Display	Proceed to
Indicates P0136/27	A
Indicates P036/27 and other codes	B
Indicates a normal code	C

HINT:

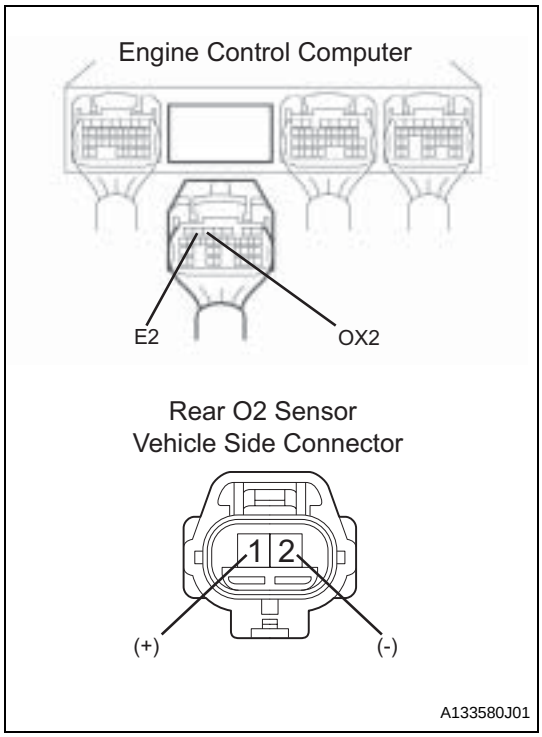
If DTC P0136/27 and other DTCs are output at the same time, check the other codes first.

B → GO TO RELEVANT DTC CHART

C → CHECK FOR INTERMITTENT PROBLEMS

A

2	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER OXYGEN SENSOR NO.2)



(a) Disconnect the engine control computer connector B and the oxygen sensor No.2 connector.

(b) Using a tester, check whether there is continuity or a short between the engine control computer and oxygen sensor No.2. (For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine Control Computer ←→ Oxygen Sensor No.2	Standard
18 (O2X2) ←→ 1 (+)	There is continuity and no short between other terminals and body ground
19(E2) ←→ 2(-)	There is continuity, and no short between other terminals

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

OK

3	READ DS-II DATA (RrO2 SENSOR OUTPUT VOLTAGE)

(a) Connect the DS-II to the DLC.

(b) Following the prompts on the DS-II screen, select ECU DATA MONITOR, then RrO2 SENSOR OUTPUT VOLTAGE. Then select MODE CHANGE and LINE GRAPH.

(c) Warm up oxygen sensor No.2 for approximately 90 seconds at an engine speed of 2500 r/min.

(d) Read the voltage of the RrO2 sensor output while racing the engine at a speed of 4000 r/min several times.

Result:

Voltage output is 0.4 V or less and 0.5 V or more

HINT:

- Oxygen sensor No.2 does not have a heater control, so perform the tests after the engine is completely warm.
- If changes are difficult to see, perform a road test.(See DESCRIPTION.)

NG → **REPLACE OXYGEN SENSOR NO.2**

OK

REPLACE ENGINE CONTROL COMPUTER

DTC	P0171/25	FUEL SYSTEM (LEAN MALFUNCTION)

DTC	P0172/26	FUEL SYSTEM (RICH MALFUNCTION)

DESCRIPTION

There are two types of air-fuel ratio corrections. One is the normal operating air-fuel ratio correction (air-fuel ratio F/B). The other is the memory air-fuel ratio correction (air-fuel ratio F/B learned). Air-fuel ratio F/B is the air-fuel ratio correction that is used to maintain a stoichiometric ratio. The oxygen sensors send signals to the engine control computer indicating whether the current air-fuel ratio is rich or lean comparing to the stoichiometric ratio. When the signal indicates that the condition is rich the injection volume is decreased. When the signal indicates that the condition is lean the injection volume is increased. Air-fuel ratio F/B learned value refers to a value that shows the air-fuel ratio F/B value over a long period of time. Because of differences specific to each engine (such as differences caused by wear over time and changes in the operating environment) this air-fuel ratio F/B learned value varies from a central value.If either the air-fuel ratio F/B value or the air-fuel ratio F/B learned value exceeds a certain value and becomes lean or rich, the engine control computer illuminates the check warning light.

ES

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0171/25	1. While operating the vehicle at 70 km/h with the engine warm, during a normal air-fuel ratio F/B 2. Fuel trim is corrected heavily on the increase side (approx.+ 40 %) 3. 60 seconds or more 4. 2 trip	• Intake system • Fuel system • Ignition system • Wire harness or connector • Oxygen sensor • Engine control computer • Gas leakage from exhaust system
P0172/26	1. While operating the vehicle at 70 km/h with the engine warm, during a normal air-fuel ratio F/B 2. Fuel trim is corrected heavily on the decrease side (approx.+ -35%) 3. 60 seconds or more 4. 2 trip	• Intake system • Fuel system • Ignition system • Wire harness or connector • Oxygen sensor • Engine control computer • Gas leakage from exhaust system

HINT:
If the total of the air-fuel F/B value and the air-fuel F/B learned value is within 25%, the system is normal.

CIRCUIT DIAGRAM

See Page ES - 44.

INSPECTION PROCEDURE

HINT:

- Check if the engine has stopped in the past because of a fuel cut.If so, the DTC P0171/25 may be recorded.
- Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1	INSPECT EMISSION CONTROL SYSTEM

HINT:
For inspection procedures, see page EC - 1.

NG → **REPAIR OR REPLACE EMISSION CONTROL SYSTEM**

OK

2	INSPECT FUEL INJECTOR ASSEMBLY

SST 09843-97201, O9268-41047

(a) Check the resistance.

(1) Using the tester, measure the resistance between the injector terminals.

Resistance:

12 (20°C)

HINT:

If the value is not within the standard range, replace with a known-good part.

(b) Fuel injection volume

NOTICE:

Work in a location with good air ventilation and watch out for fire.

(1) Connect the SST (injection measuring tool set) to the fuel pipe (vehicle side).

NOTICE:

Be extremely careful when handling the fuel tube connector.

(2) Attach the injector to a graduated cylinder.

HINT:

To prevent fuel from spraying, install the correct-sized vinyl tube, etc.

(3) Connect the DS-II to the DLC and operate the fuel pump.

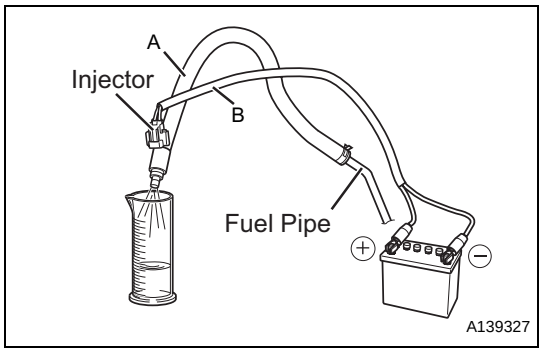
(4) Connect the injector to the SST (EFI inspection wire).

(5) Connect the SST (EFI inspection wire) to the battery, perform fuel injection (15 seconds each) 2 or 3 times, and calculate the average value.

SST:

09842-30055

Standard



Injection Volume	Difference Between Individual Injectors
60 to 73ml	13 ml or less

HINT:

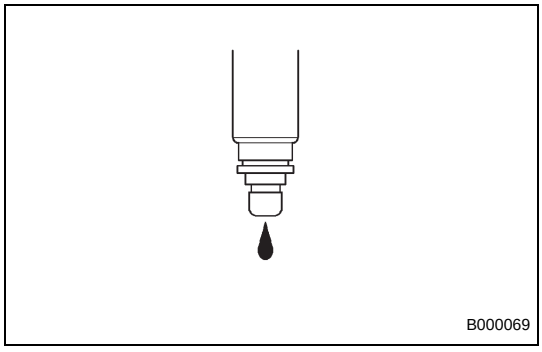
If the value is not within the standard range, replace with known-good parts.

(c) Check for leakage.

(1) When removing the SST from the battery under the conditions described above, check that there is no leakage from the injector.

Standard:

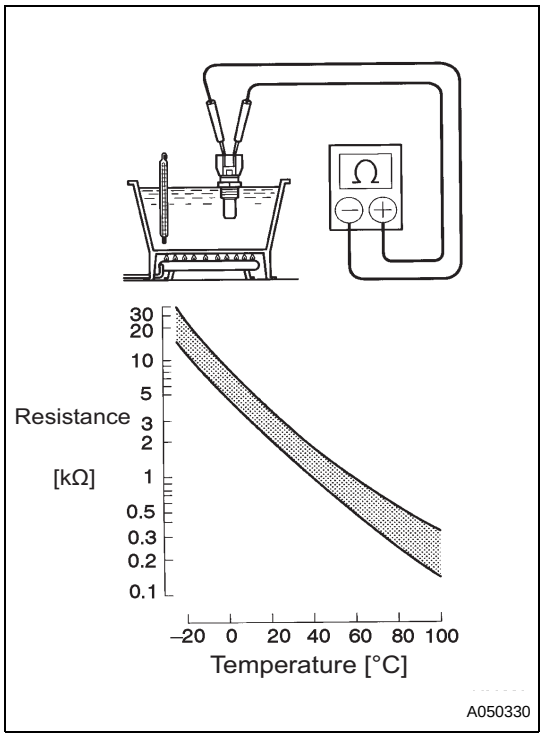
1 drop or less per 12 minutes



NG → **REPLACE FUEL INJECTOR ASSEMBLY**

OK

3	CHECK COOLANT TEMPERATURE



(a) Check the resistance.

(1) Using the tester, inspect the resistance between the terminals.

Standard

Measurement Condition	Standard
When approx. 20°C	2.32 to 2.59 kΩ
When approx. 80°C	0.310 to 0.326 kΩ

NOTICE:

Protect the terminal area from getting wet when checking the sensor by applying water.Also, wipe the sensor dry after the check.

NG → **REPLACE COOLANT TEMPERATURE SENSOR**

OK

4	INSPECT THE IGNITION SYSTEM

HINT:

For inspection procedures, see page IG - 1.

NG → **REPAIR OR REPLACE IGNITION SYSTEM**

OK

5	CHECK FUEL SYSTEM

HINT:

For inspection procedures, see page FU - 3.

NG → **REPAIR OR REPLACE FUEL SYSTEM**

OK

6	CHECK FOR EXHAUST GAS LEAKS

NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE AREA**

OK

7	READ DS-II DATA (FrO2 SENSOR OUTPUT VOLTAGE)

(a) Warm up the oxygen sensor for approx. 90 seconds at an engine speed of 2500 r/min.
(b) Using the DS-II, read the output voltage of the oxygen sensor while the engine is idling.

Standard:

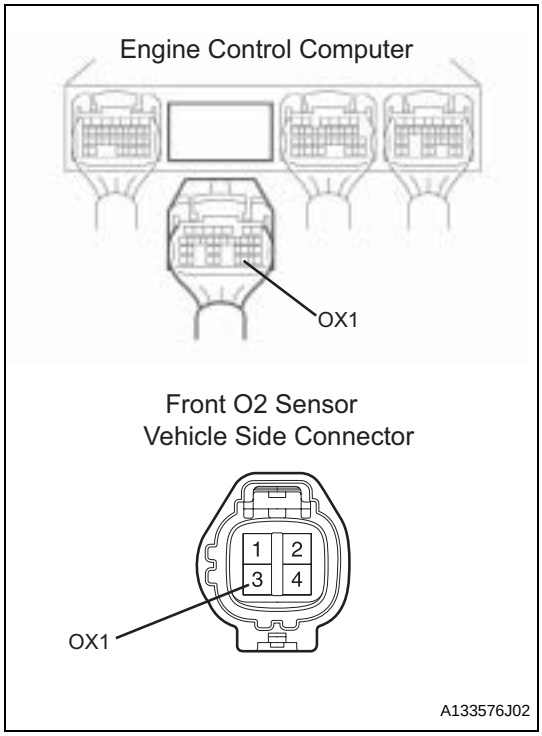
Repeated output of voltage that is less than 0.3 V or more than 0.6 V

ES

OK → **GO TO STEP 9**

NG

8	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER OXYGEN SENSOR)



(a) Disconnect connector B of the engine control computer.
(b) Disconnect the connector of the oxygen sensor.
(c) Using a tester, check whether there is continuity or a short between the engine control computer and the oxygen sensor connector.(For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine Control Computer ⟷ Oxygen Sensor	Standard
123 (OX1) ⟷ 3 (OX1)	There is continuity and no short between other terminals and body ground

OK → **REPLACE OXYGEN SENSOR**

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

9	ROAD TEST TO CHECK OPERATION

(a) Connect the DS-II to the DLC.
(b) Turn the ignition switch to the ON position, and delete the DTCs by following the prompts on the DS-II screen.
(c) To check the system, warm up the oxygen sensor by performing a road test.

HINT:

Refer to the oxygen sensor output voltage inspection procedure.

GO

10	READ DTCs

(a) Connect the DS-II to the DLC.
(b) Turn the ignition switch to the ON position, and read the DTC by following the prompts on the DS-II screen.
(1) Check if DTC P0171/25 is detected.

Result

A	B
P0171/25 is not output again	P0171/25 is output again

ES

B → CHECK AND REPLACE ENGINE CONTROL COMPUTER

A

CHECK FOR INTERMITTENT PROBLEMS

DTC	P0300/17	MISFIRE

DTC	P0301/17	MISFIRE (#1 CYLINDER)

DTC	P0302/17	MISFIRE (#2 CYLINDER)

DTC	P0303/17	MISFIRE (#3 CYLINDER)

ES

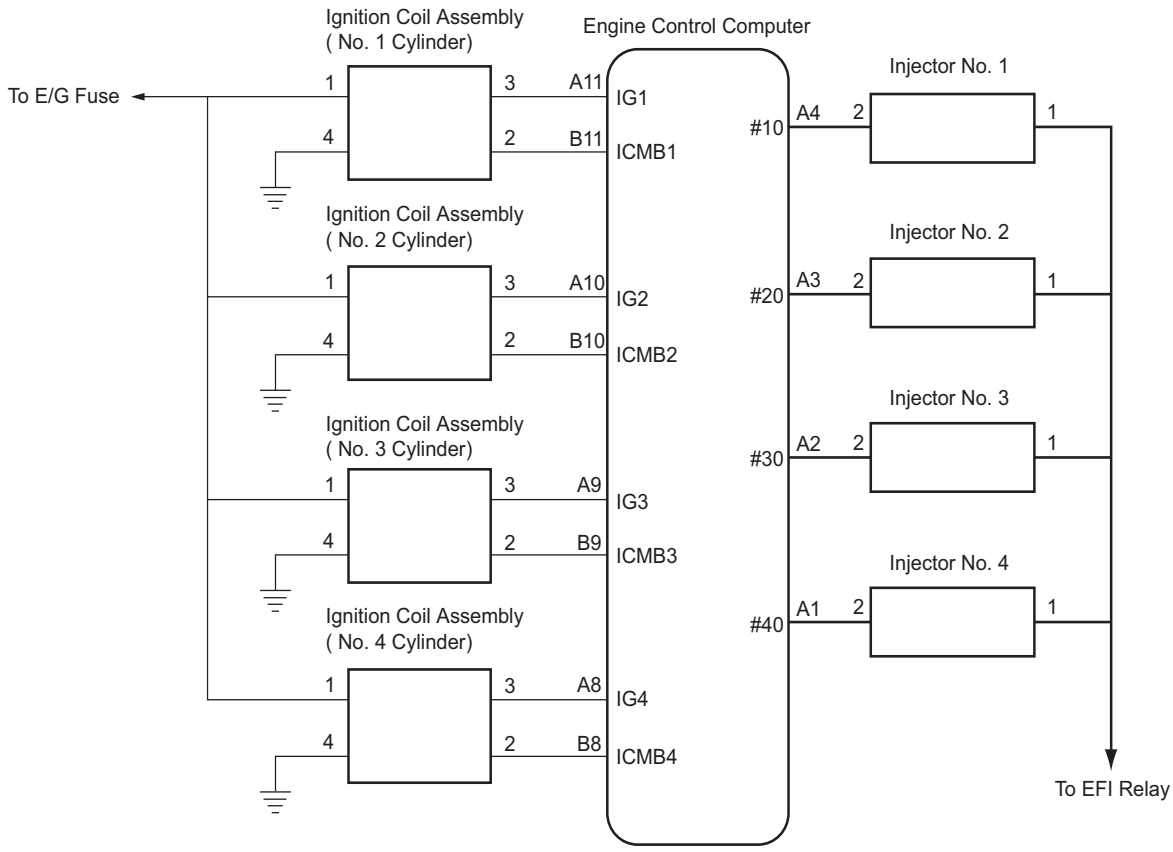
DTC	P0304/17	MISFIRE (#4 CYLINDER)

DESCRIPTION

The igniter detects ionic current that is generated by combustion. This ionic current is represented by ionic voltage and input to the engine control computer.If the voltage is lower than the specified value, the engine control computer determines that there has been a misfire and counts the number of detected misfires. If the number of misfires reaches or exceeds a specified value, the engine check warning light illuminates to indicate a problem. If the number of misfires reaches or exceeds the point at which the catalyst may overheat, the engine check warning light flashes.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0300/17	1. When driving at vehicle speed of 30 to 70 km/h 2. DTCs P0301/17 through P0304/17 are output repeatedly 3. 60 seconds or more 4. 2 trip	• Ignition system • Intake system • Fuel system • Wire harness or connector • Coolant temperature • Engine control computer • Fuel injector
P0301/17	1. When driving at vehicle speed of 30 to 70 km/h 2. Rate of misfires is higher than the set value 3. 60 seconds or more 4. 2 trip	• Ignition system • Intake system • Fuel system • Wire harness or connector • Coolant temperature • Engine control computer • Fuel injector
P0302/17	1. When driving at vehicle speed of 30 to 70 km/h 2. Rate of misfires is higher than the set value 3. 60 seconds or more 4. 2 trip	• Ignition system • Intake system • Fuel system • Wire harness or connector • Coolant temperature • Engine control computer • Fuel injector
P0303/17	1. When driving at vehicle speed of 30 to 70 km/h 2. Rate of misfires is higher than the set value 3. 60 seconds or more 4. 2 trip	• Ignition system • Intake system • Fuel system • Wire harness or connector • Coolant temperature • Engine control computer • Fuel injector
P0304/17	1. When driving at vehicle speed of 30 to 70 km/h 2. Rate of misfires is higher than the set value 3. 60 seconds or more 4. 2 trip	• Ignition system • Intake system • Fuel system • Wire harness or connector • Coolant temperature • Engine control computer • Fuel injector

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

- If any codes are detected other than misfire malfunction, perform troubleshooting for those DTCs first.
- Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.
- To confirm that the repair has been completed, operate the vehicle using one of the driving patterns shown below.

Driving patterns

Engine speed	Time
Idle	3 and a half minutes or more
1000 r/min	3 minutes or more
2000 r/min	1 and a half minutes or more
3000 r/min	1 minute or more

1	**INSPECT THE IGNITION SYSTEM**

(See page IG - 1)

NG → **REPAIR OR REPLACE IGNITION SYSTEM**

OK

2	CHECK FUEL PRESSURE

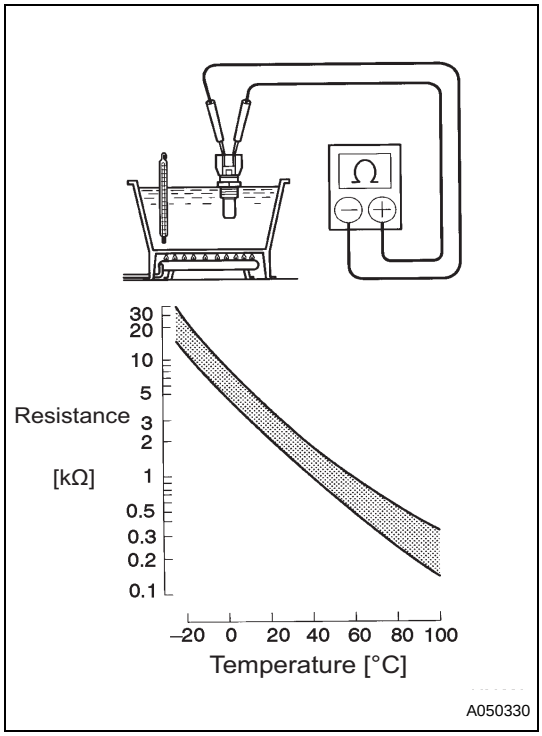
(See page FU - 3)

NG → **REPAIR OR REPLACE FUEL SYSTEM**

OK

3	CHECK COOLANT TEMPERATURE

ES



(a) Check the resistance.

(1) Using the tester, inspect the resistance between the terminals.

Standard:

At approx. 20°C : 2.32 to 2.59 kΩ

At approx. 80°C : 0.310 to 0.326 kΩ

NOTICE:

Protect the terminal area from getting wet when checking the sensor by applying water. Also, wipe the sensor dry after the check.

NG → **REPLACE COOLANT TEMPERATURE SENSOR**

OK

4	INSPECT FUEL INJECTOR ASSEMBLY

SST 09843-97201, O9268-41047

(a) Check the resistance.

(1) Using the tester, measure the resistance between the injector terminals.

Standard:

12 Ω (20°C)

HINT:

If the value is not within the standard range, replace with known-good parts.

(b) CHECK INJECTION VOLUME

NOTICE:

Work in a location with good air ventilation and watch out for fire.

(1) Connect the SST (injection measuring tool set) to the fuel pipe (vehicle side).

NOTICE:

Be extremely careful when handling the fuel tube connector.

(2) Attach the injector to a graduated cylinder.

HINT:

To prevent fuel from spraying, install the correct-sized vinyl tube, etc.

(3) Connect the DS-II to the DLC and operate the fuel pump.

(4) Connect the injector to the SST (EFI inspection wire).

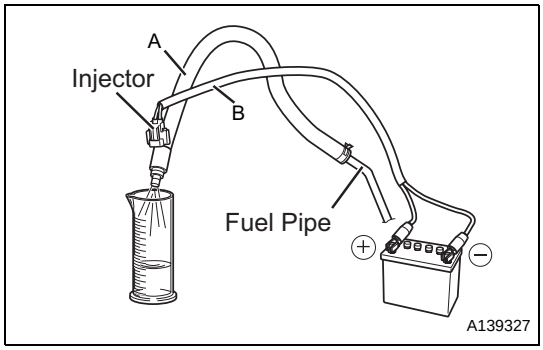
(5) Connect the SST (EFI inspection wire) to the battery, perform fuel injection (15 seconds each) 2 or 3 times, and calculate the average value.

Standard

Injection Volume	Difference Between Individual Injectors
60 to 73 ml	13ml or less

HINT:

If the value is not within the standard range, replace with known-good parts.

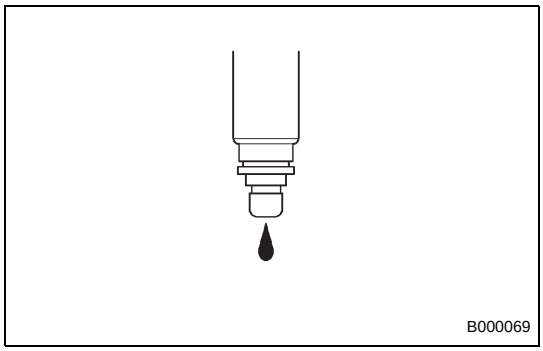


(c) Check for leakage.

(1) When removing the SST from the battery under the conditions described above, check that there is no leakage from the injector.

Standard:

1 drop or less per 12 minutes



NG → **REPLACE FUEL INJECTOR ASSEMBLY**

OK

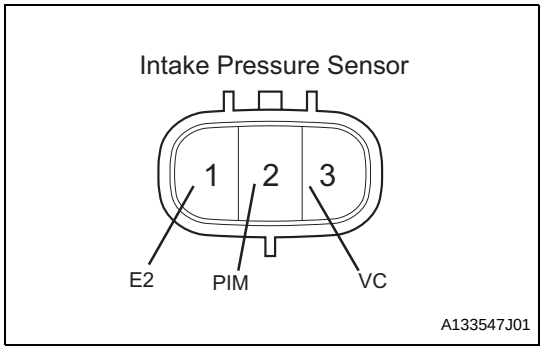
5 CHECK VACUUM SENSOR

(a) Turn the ignition switch to the ON position.

(b) Measure the voltage between the terminals of the vacuum sensor connecter using the tester.

Standard

Tester Connection (Terminal Symbol)	Standard
3 (VC) ⟷ 1 (E2)	4.5 to 5.5 V
2 (PIM) ⟷ 1 (E2)	3.1 to 4.1V



(c) Remove the fuel pump relay and crank the engine, then measure the voltage between the terminals of the vacuum sensor connector.

Standard

Tester Connection (Terminal Symbol)	Standard
2 (PIM) ⟷ 1 (E2)	Voltage value fluctuates

NG → **REPLACE THE VACUUM SENSOR**

OK

6	CHECK WIRE HARNESS AND CONNECTOR

(a) Disconnect connector A of the engine control computer and disconnect the connectors of each fuel injector.

(b) Using a tester, check whether there is continuity or a short between the engine control computer vehicle side connector and the fuel injector vehicle side connector.

Standard

Installed position	Terminal Connection (Terminal Symbol)	Standard
#1 Cylinder	2←→24(#10)	There is continuity and no short between other terminals and body ground
#2 Cylinder	2←→23(#20)	There is continuity and no short between other terminals and body ground
#3 Cylinder	2←→22(#30)	There is continuity and no short between other terminals and body ground
#4 Cylinder	2←→21(#40)	There is continuity and no short between other terminals and body ground

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

OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

DTC P0325/18 KNOCK SENSOR SIGNAL SYSTEM

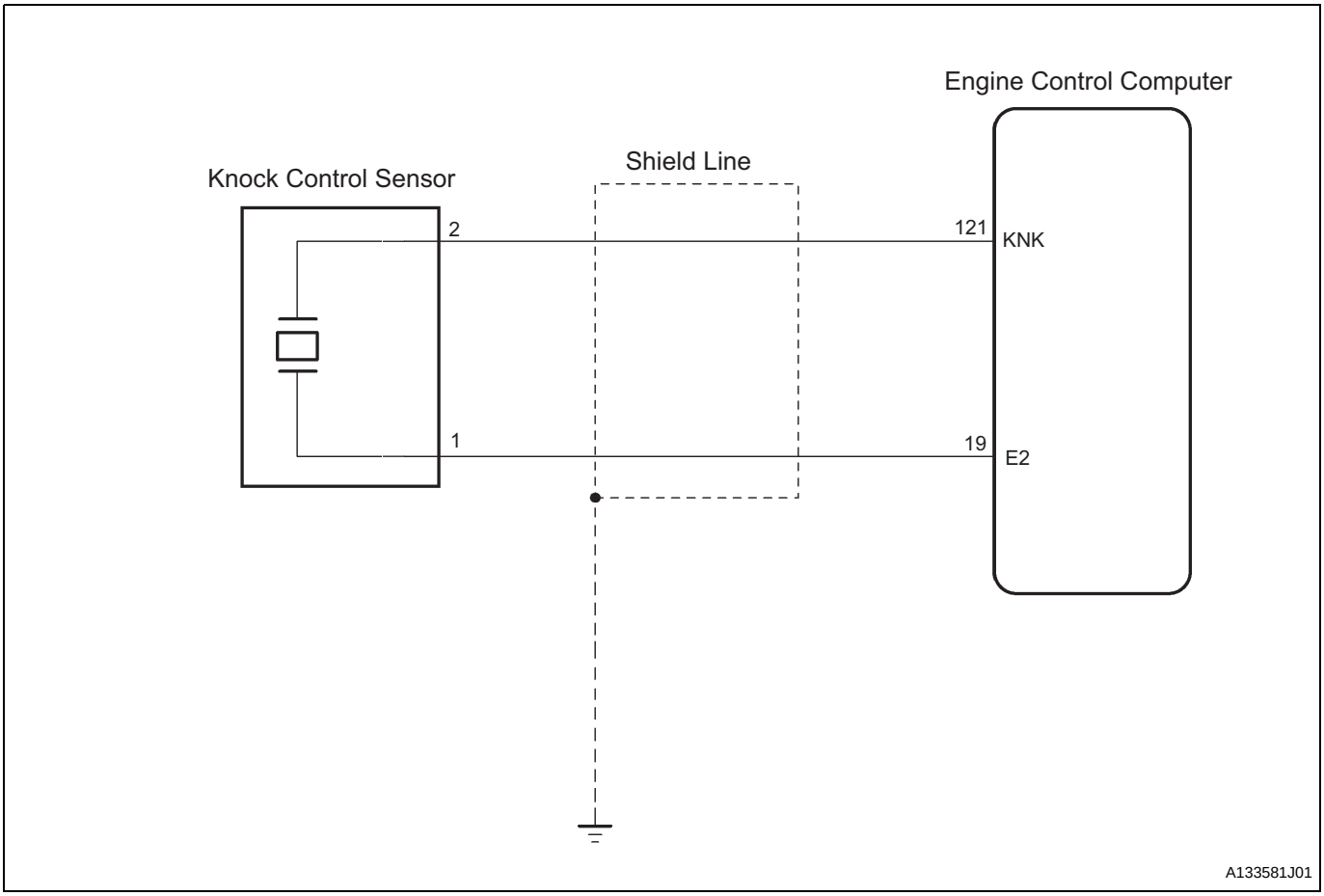
DESCRIPTION

The knock control sensor is mounted to the cylinder block to detect engine knocking.Inside the knock control sensor, there is a sensing element. When the sensing element is deformed due to the cylinder block vibration caused by knocking, it generates electricity. When the engine computer senses this voltage, it retards the ignition timing to control the knocking.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0325/52	1. IG ON 2. Open or short in knock control sensor circuit 3. 0.9 seconds or more 4. 1 trip	• Wire harness or connector • Knock control sensor • Installation tightness of knock control sensor • Engine control computer

ES

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

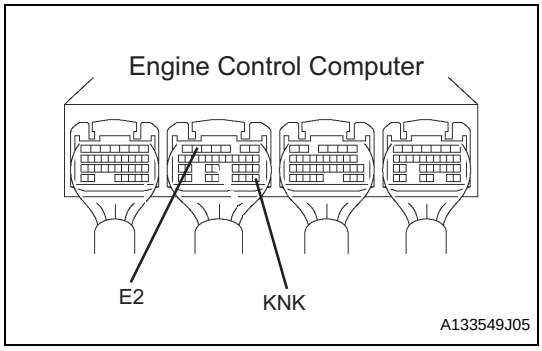
HINT:

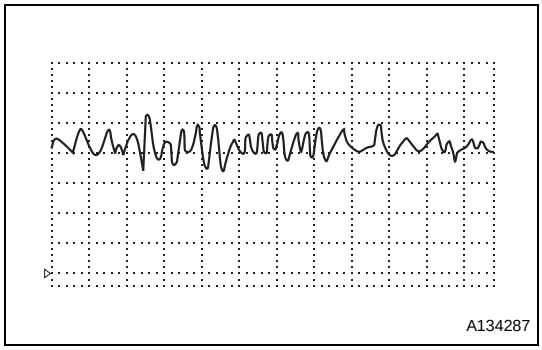
Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1	INSPECT ENGINE CONTROL COMPUTER

HINT:
The communication between the engine control computer and the knock control sensors can be checked using the oscilloscope function of the DS-II.

(a) Connect the DS-II to terminals 121(KNK) and 19 (E2) of the engine control computer connectors.(For terminal layout, see page ES - 16.)





(b) Set the DS-II to the oscilloscope function.(See the DS-II instruction manual for the setting procedures.)

Item	Condition
Tester Connection	KNK ←→ E2
Tool setting	1 V/DIV, 1 ms/DIV
Measurement condition	Engine is warmed up and an engine speed of 4000 r/min is maintained

HINT:
- The oscilloscope waveform shown as an example does not include noise or chattering waveforms.
- The waveform amplitudes differ slightly depending on the vehicle.

OK → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

NG

2	INSPECT SENSOR INSTALLATION PART

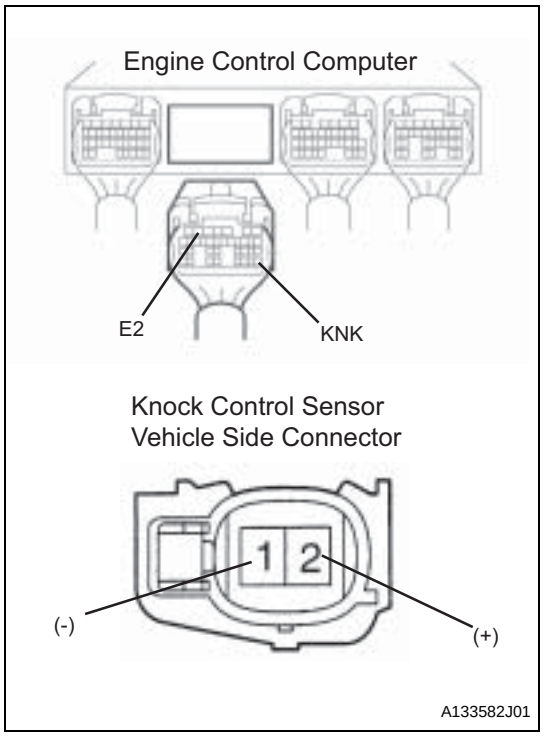
(a) Check the condition of the knock control sensor installation.

NG → **REPAIR OR REPLACE SENSOR INSTALLATION PART**

OK

3	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER KNOCK CONTROL SENSOR)

(a) Disconnect the engine control computer connector B and the knock control sensor connector.



(b) Using a tester, check whether there is continuity or a short between the engine control computer and the knock control sensor(For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine Control Computer ⟷ Knock Control Sensor	Standard
121 (KNK) ⟷ 2 (+)	There is continuity and no short between other terminals and body ground
19(E2) ⟷ 1(-)	There is continuity and no short between other terminals and body ground

ES

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

OK

4 **REPLACE KNOCK CONTROL SENSOR**

(a) Replace the knock control sensor.(See page ES - 133, ES - 134.)
(b) Connect the DS-II to the DLC.
(c) Turn the ignition switch to the ON position, and delete the DTC memory by following the prompts on the DS-II screen.
(d) Perform a road test.

GO

5 **READ DTCs**

(a) Connect the DS-II to the DLC.
(b) Turn the ignition switch to the ON position, and read the DTCs by following the prompts on the DS-II screen.
(1) Check if DTC P0325/52 is detected.

Result

A	B
Indicates P0325/52	Does not indicate P0325/52

B → **SYSTEM NORMAL**

A

CHECK AND REPLACE ENGINE CONTROL COMPUTER

DTC	P0335/13	ENGINE REVOLUTION SENSOR SIGNAL SYSTEM

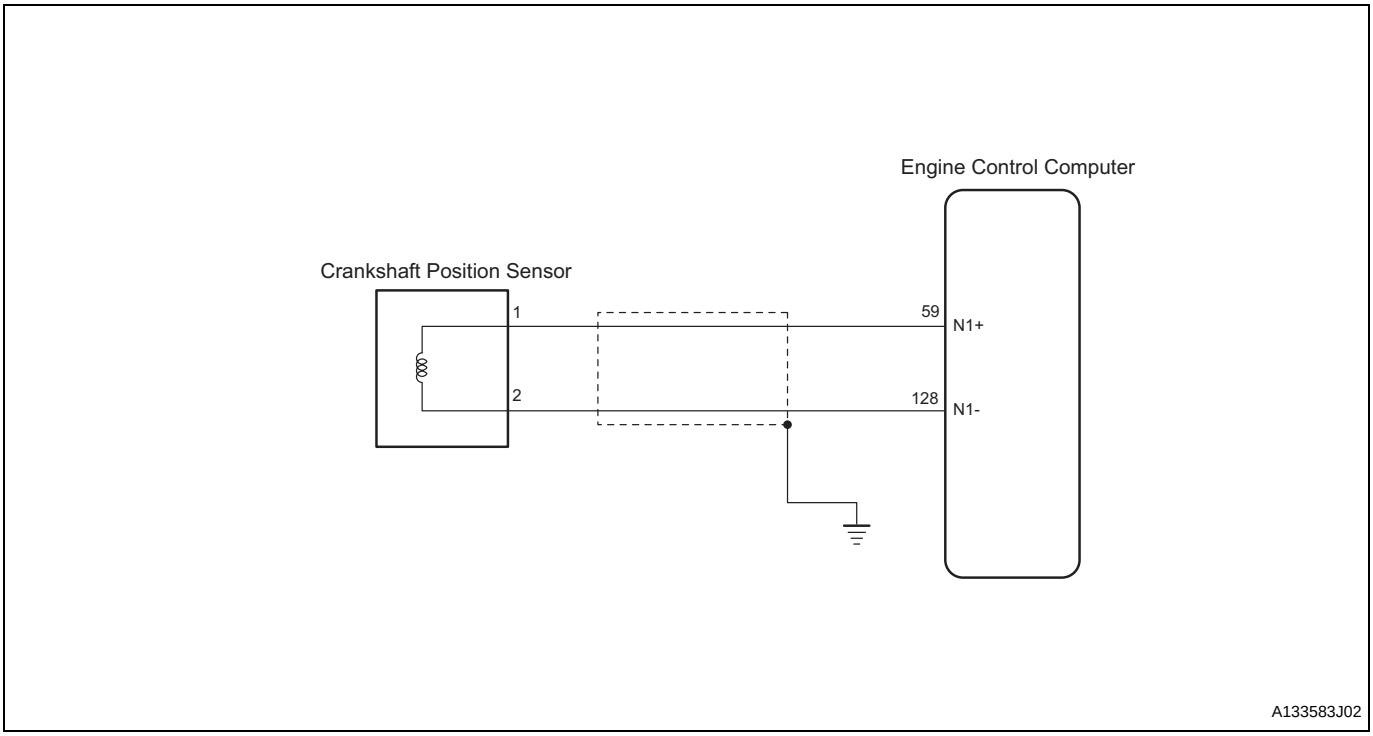
DESCRIPTION

The crank position sensor system consists of the crank angle sensor plate No.1 and the pickup coil. The crank angle sensor is installed on the crankshaft. It has 30 teeth with 6 missing teeth to allow top dead center to be detected. The NE signal sensor outputs 30 signals per engine revolution.The engine control computer detects the cylinder number and the relative position of the camshaft and angle based on the N2 signal. It detects crankshaft angle and engine speed based on the N1 signal.

ES

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0335/13	1. Cranking 2. N1 signal is not input 3. 2 seconds or more 4. 1 trip	• Wire harness or connector • Crank position sensor • Crank angle sensor plate No.1 • Engine control computer

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

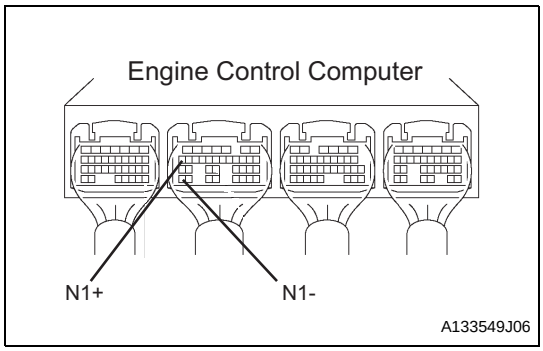
- Read the freeze frame data using the DS-II. Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.
- If the problem is not detected after first troubleshooting DTC P0335/13, this may indicate a mechanical system problem.

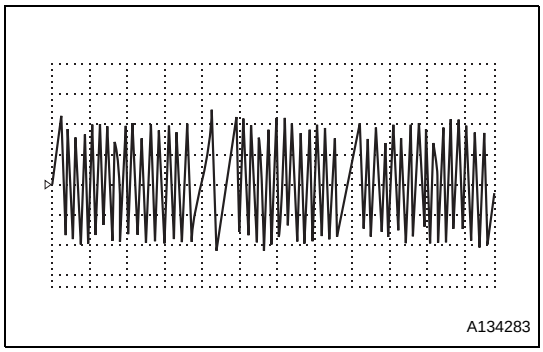
1	CHECK ENGINE CONTROL COMPUTER

HINT:

The function of the engine control computer crank position sensor can be checked using the oscilloscope function of the DS-II.

(a) Connect the DS-II to terminals 59 (N1+) and 128 (N1-) of the engine control computer connectors.(For terminal layout, see page ES - 16.)





(b) Set the DS-II to the oscilloscope function.

Item	Condition
Tester connection	N1+ ⟷ N1-
Tool setting	2 V/DIV, 20 ms/DIV
Measurement condition	While engine is idling

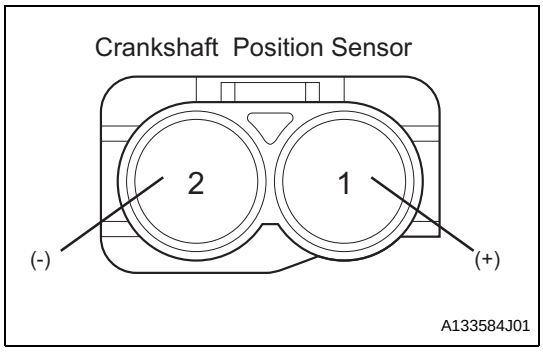
HINT:

- As engine speed increases, the amplitudes become larger.
- As engine speed increases, the cycles become shorter.
- DTCs may be recorded due to noise.

OK → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

NG

2	CHECK CRANK POSITION SENSOR



(a) Check the resistance.

(1) Using a tester, measure the resistance between the connector terminals.

Standard:

1630 to 2740 Ω (when cold)

2065 to 3225Ω (when warm)

NOTICE:

The terms, cold and warm, refer to the temperature of the parts inspected.Cold is designated as a temperature between -10 and 50°C. Warm is designated as a temperature between 50 to 100 °C.

NG → **REPLACE CRANK POSITION SENSOR**

OK

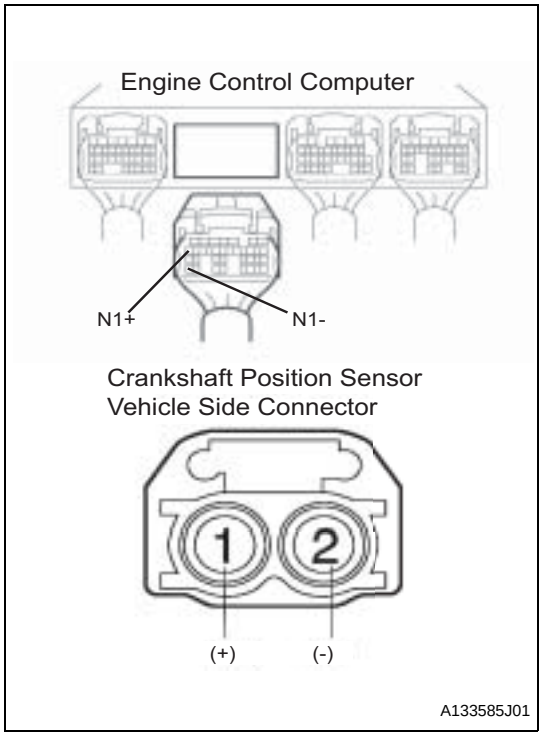
3	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER CRANK POSITION SENSOR)

(a) Disconnect the engine control computer connector B and the crank position sensor connector.

(b) Using a tester, check whether there is continuity or a short between the engine control computer and the crank position sensor.(For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine Control Computer ⟷ Crank Position Sensor	Standard
59 (N1+) ⟷ 1 (+)	There is continuity and no short between other terminals and body ground
128 (N1-) ⟷ 2 (-)	There is continuity and no short between other terminals and body ground



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

OK

4	INSPECT SENSOR INSTALLATION PART

(a) Check the tightness and installation condition of the crank position sensor bolt.

NG → **REPAIR OR REPLACE SENSOR INSTALLATION PART**

OK

5	CHECK CRANK ANGLE SENSOR PLATE NO.1

(a) Check the concave and protruding parts of crank angle sensor plate No.1 and check the installation condition.

NG → **REPAIR OR REPLACE CRANK ANGLE SENSOR PLATE NO.1**

OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

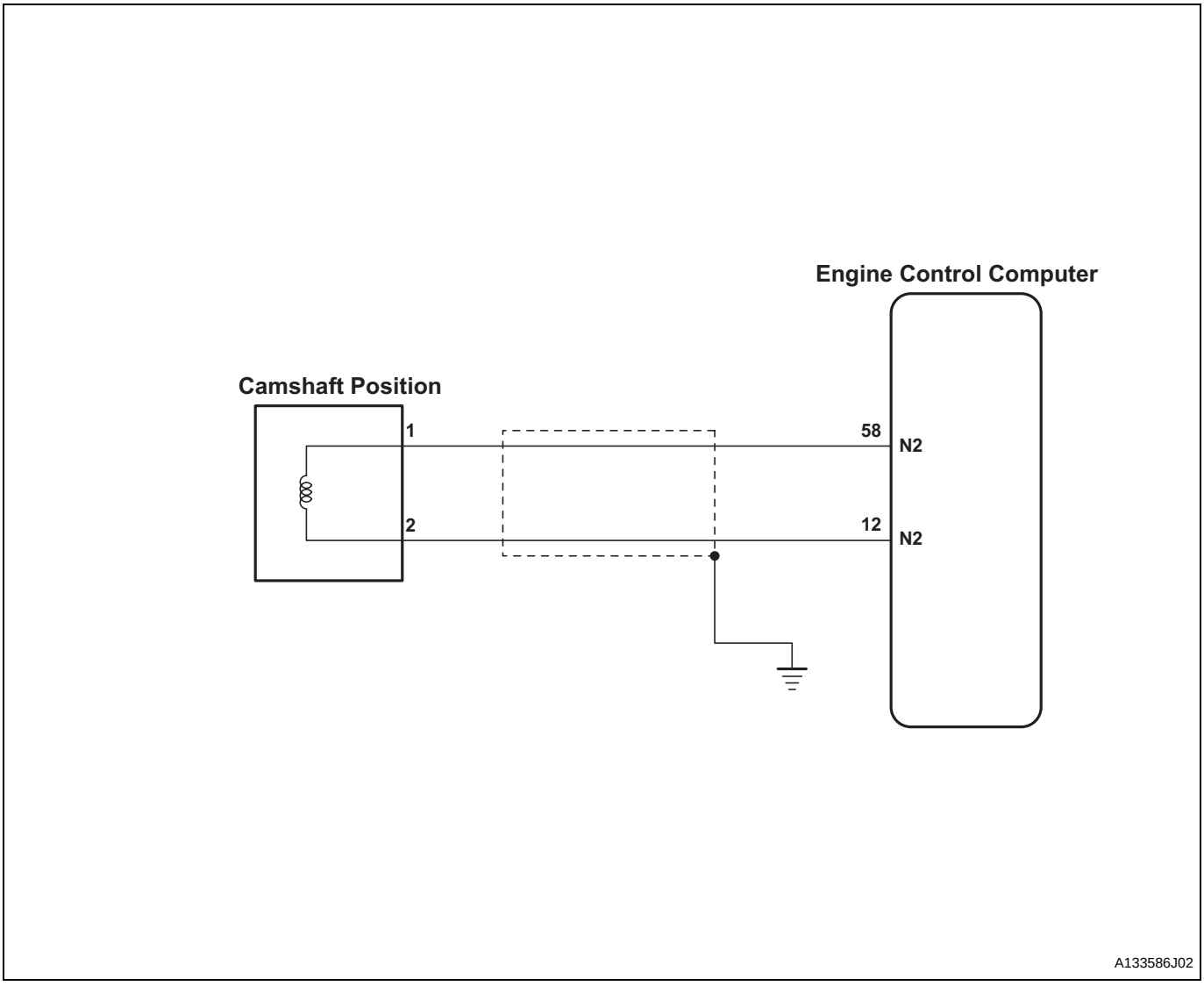
DTC P0340/14 CAM ANGLE SENSOR SIGNAL SYSTEM

DESCRIPTION

The cam position sensor (N2 signal) consists of the pickup coil and the timing rotor that is mounted on the camshaft. When the camshaft rotates, the relative positions of the protruding part of the timing rotor and the air gap on the top of the pickup coil changes. This causes the magnetic field to change, generating electromotive force in the pickup coil.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0340/14	1. When cranking 2. No input of a certain number of cam position sensor 3. - 4. 1 trip	• Wire harness or connector • Cam position sensor • Camshaft • Engine control computer

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

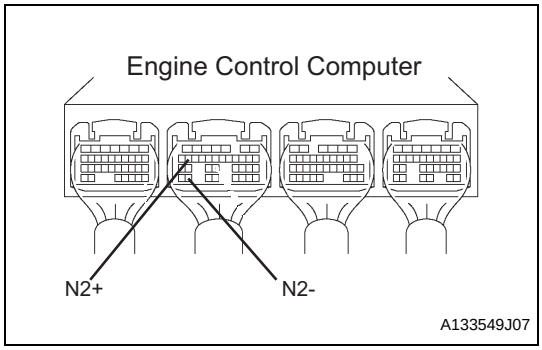
- Read the freeze frame data using the DS-II. Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.
- If the problem is not detected after first troubleshooting DTC P0340/14, this may indicate a mechanical system problem.

1 CHECK ENGINE CONTROL COMPUTER

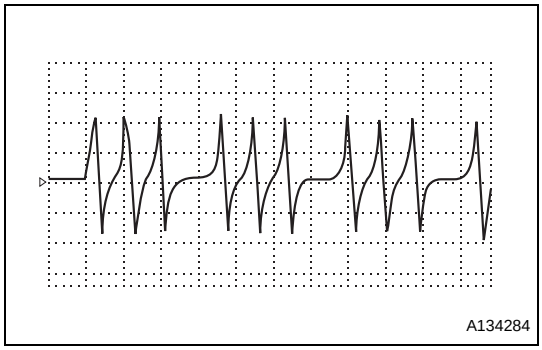
HINT:

The function of the engine control computer cam position sensors can be checked using the oscilloscope function of the DS-II.

(a) Connect the DS-II to terminals 58(N2+) and 127 (N2-) of the engine control computer connectors. (For terminal layout, see page ES - 16.)



(b) Set the DS-II to the oscilloscope function.



Item	Condition
Tester Connection	:N2+ ←→ N2-
Tool setting	2 V/DIV, 20 ms/DIV
Measurement condition	While engine is idling

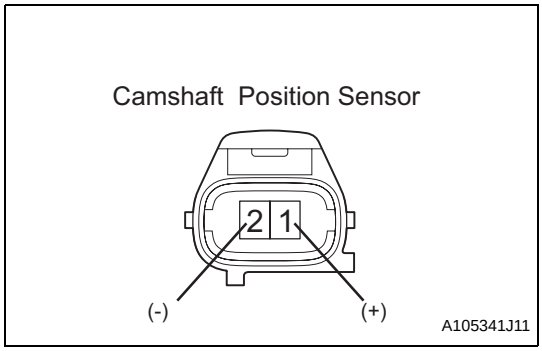
HINT:

- As engine speed increases, the amplitudes become larger.
- As engine speed increases, the cycles become shorter.
- DTCs may be recorded due to noise.

OK → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

NG

2 CHECK CAM POSITION SENSOR



(a) Check the resistance.

(1) Using a tester, measure the resistance between the connector terminals.

Standard:

835 to 1400 (when cold)

1060 to 1645 (when warm)

NOTICE:

The terms, cold and warm, refer to the temperature of the parts inspected.Cold is designated as a temperature between -10 and 50°C. Warm is designated as a temperature between 50 to 100 °C.

NG → **REPLACE CAM POSITION SENSOR**

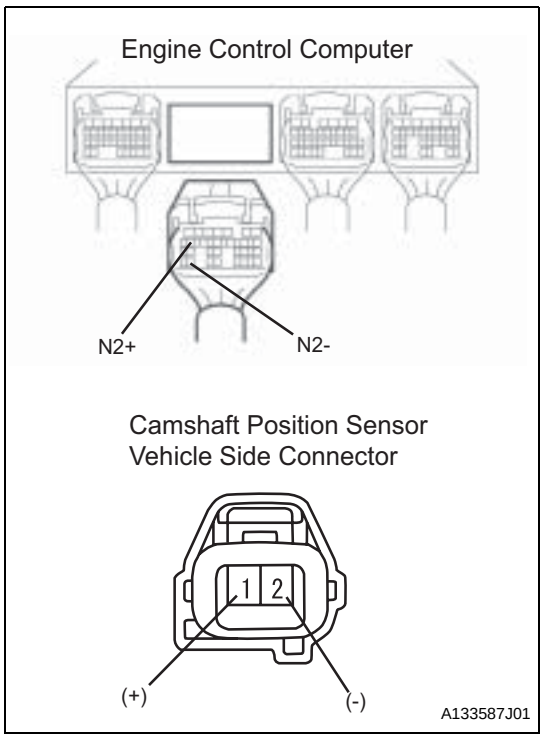
OK

3	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER CAM POSITION SENSOR)

(a) Disconnect the engine control computer connector B and the cam position sensor connector.

(b) Using a tester, check whether there is continuity or a short between the engine control computer and the cam position sensor.(For terminal layout, see page ES - 16.)

Standard:



Tester Connection (Terminal Symbol) Engine Control Computer ⟷ Crank Position Sensor	Standard
58 (N2+) ⟷ 1 (+)	There is continuity and no short between other terminals and body ground
127 (N2-) ⟷ 2 (-)	There is continuity and no short between other terminals and body ground

NG → REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

OK

4	INSPECT SENSOR INSTALLATION PART

(a) Check the tightness and installation condition of the cam position sensor bolt.

NG → REPAIR OR REPLACE SENSOR INSTALLATION PART

OK

5	Inspect camshaft

(a) Check the concave and protruding parts of the camshaft and check the installation condition.

NG → REPAIR OR REPLACE CAMSHAFT

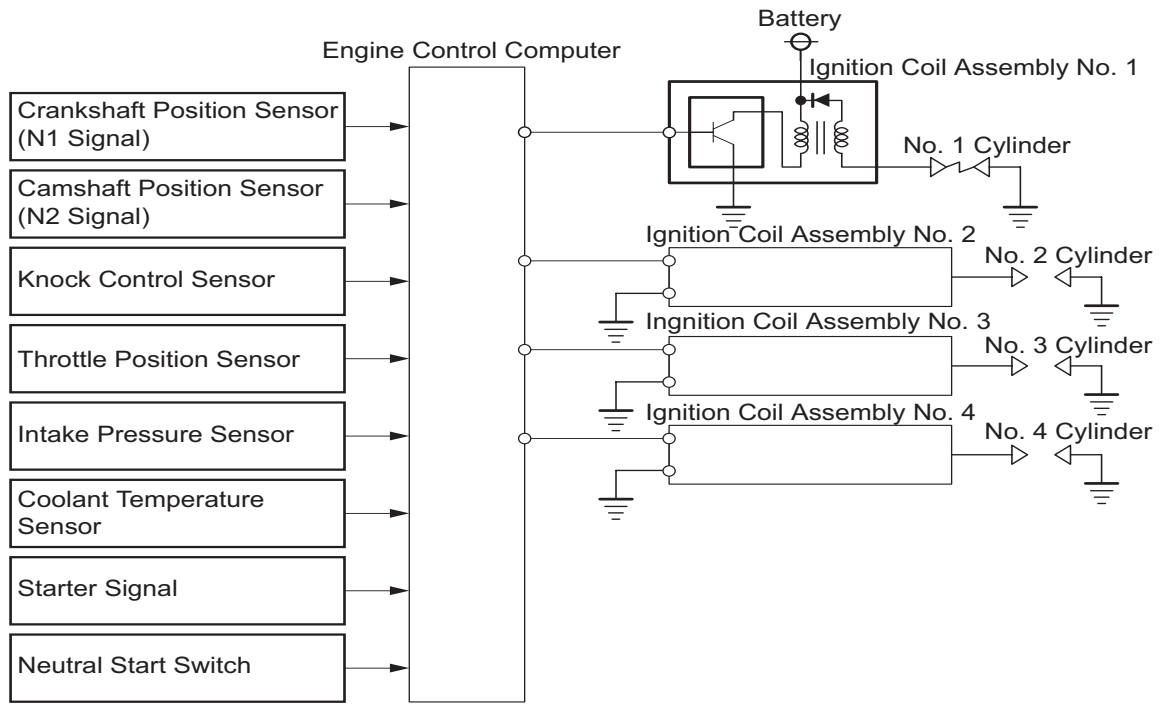
OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

DTC P0350/16 IGNITION PRIMARY SYSTEM

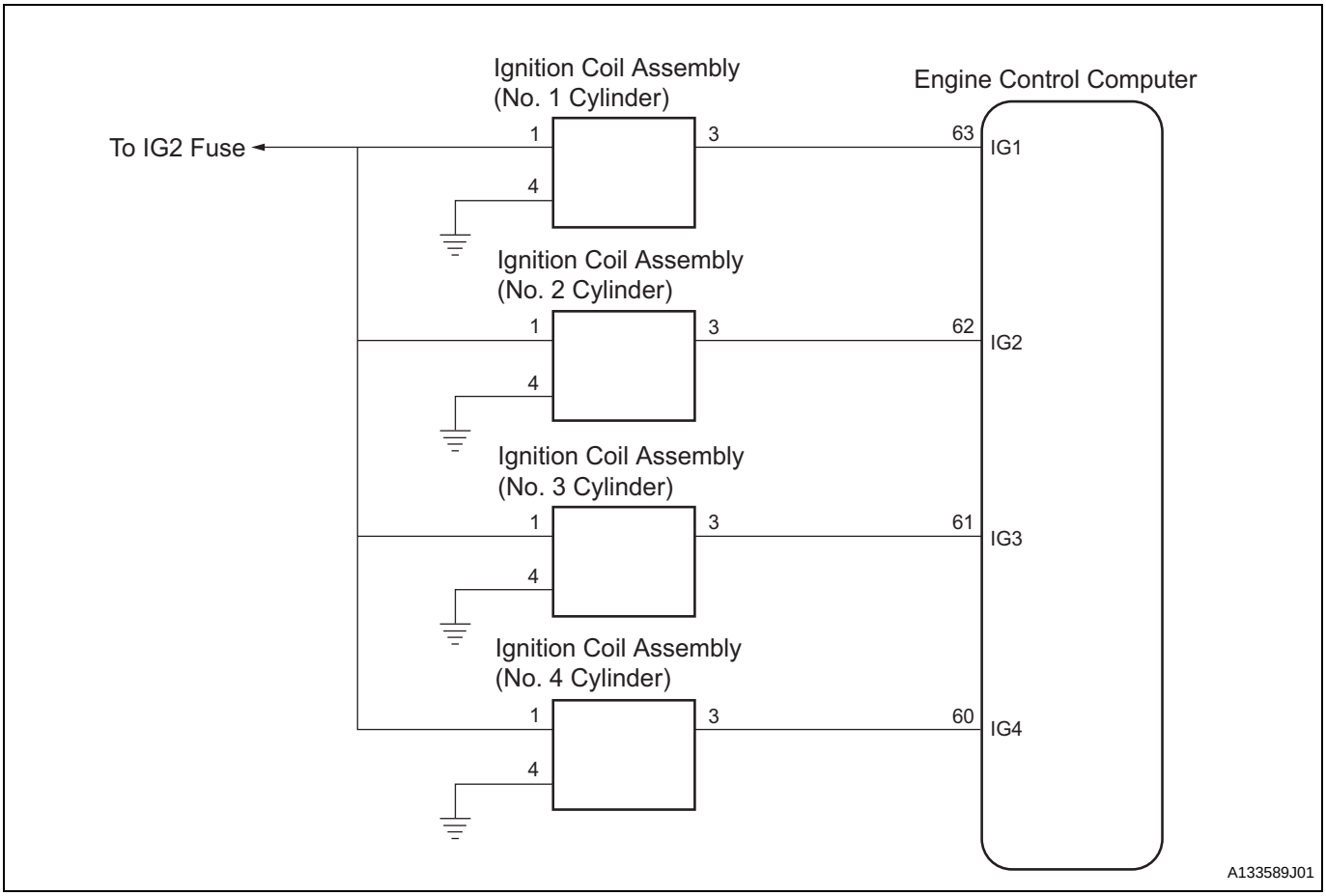
DESCRIPTION

A direct ignition system has been adopted. Along with increasing ignition accuracy, the direct ignition system reduces high voltage loss and enhances the overall reliability of the ignition system.The direct ignition system performs ignition, using 1 ignition coil for each cylinder.The engine control computer determines the ignition timing and transmits ignition signals (IG) to each cylinder.Based on the IG signals, the power transistor in the igniter cuts off the current in the primary coil. This generates electromotive force in the secondary coil. The electromotive force in the secondary coil ignites the spark plug.



DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0350/16	1. At time of engine start and when engine is operating at 1500 r/min or less 2. No IG signals continuously 3. Approx. 30 seconds 4. 1 trip	• Wire harness or connector • IGNITION COIL ASSEMBLY • Engine control computer

CIRCUIT DIAGRAM

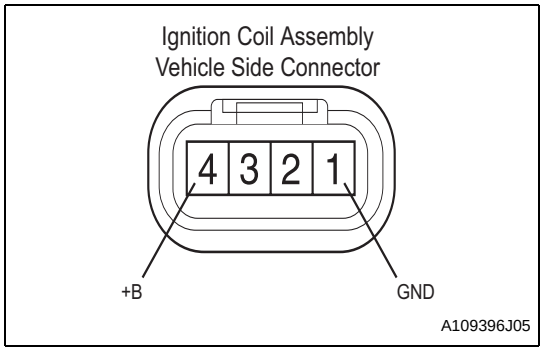


INSPECTION PROCEDURE

HINT:

- Read the freeze frame data using the DS-II. Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.
- The inspection method for the No.1 cylinder circuit is shown below. If the DTC P0350/16 is still shown after the test, check the circuit of each cylinder.

1	CHECK WIRE HARNESS AND CONNECTOR (POWER SOURCE CIRCUIT CHECK)



(a) Disconnect the ignition coil assembly connector.
(b) Turn the ignition switch to the ON position.
(c) Using a tester, check the voltage between terminals in the ignition coil assembly vehicle side connector.

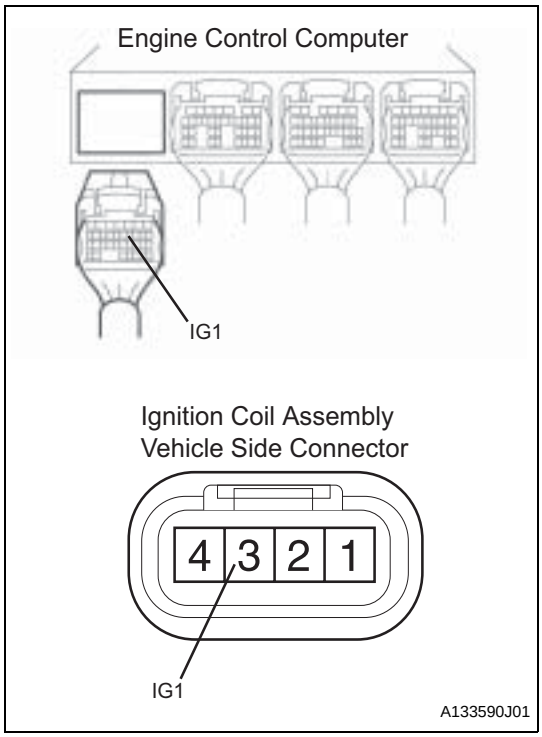
Standard

Tester Connection (Terminal Symbol)	Standard
1 (+B) ⟷ 4 (GND)	9 to 14 V

NG → **CHECK POWER SOURCE CIRCUIT**

OK

2	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER IGNITION COIL ASSEMBLY)



(a) Disconnect the engine control computer connector A and ignition coil assembly connector.

(b) Using a tester, check whether there is continuity or a short between the engine control computer vehicle side connector and the ignition coil assembly vehicle side connector. (For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine Control Computer ←→ Ignition Coil Assembly	Standard
63 (IG1) ←→ 3 (IG1)	There is continuity and no short between other terminals and body ground

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

OK

3	REPLACE IGNITION COIL ASSEMBLY

GO

4	CHECK FOR DTCs

(a) Connect the DS-II to the DLC.

(b) Read the DTCs by following the prompts on the screen.

Result

A	B
P0350/16	Indicates a normal code

B → **SYSTEM RETURNS TO NORMAL**

A

REPLACE ENGINE CONTROL COMPUTER

DTC P0420/27 CATALYST DETERIORATION

DESCRIPTION

The rear O2 sensor detects oxygen levels after the catalyst. If the catalyst has deteriorated, the rear O2 sensor signal looks like that of the front O2 sensor, repeating lean/rich signals in short cycles.Therefore, the timing of the voltage of the lean/rich signal from the rear O2 sensor is calculated and compared to the lean/rich signal from the front 02 sensor. If this voltage exceeds a set value, and the response of the rear O2 sensor from the front O2 sensor signal becomes more rapid than the set value, this indicates that the catalyst has deteriorated. In this case, the DTC shown below will be recorded.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0420/27	1. The vehicle is driven at a speed of 50 km/h, after the engine is completely warmed-up 2. The voltage of the rear O2 sensor signal is large, and the response is rapid 3. 40 seconds or more 4. 2 trip	• Exhaust system • Ignition system • Fuel system • Engine control computer • Wire harness or connector

ES

CIRCUIT DIAGRAM

(See Page ES - 44)

INSPECTION PROCEDURE

1 **INSPECT EMISSION CONTROL SYSTEM**

HINT:
For inspection procedures, See page EC - 1.

NG → **REPAIR OR REPLACE EMISSION CONTROL SYSTEM**

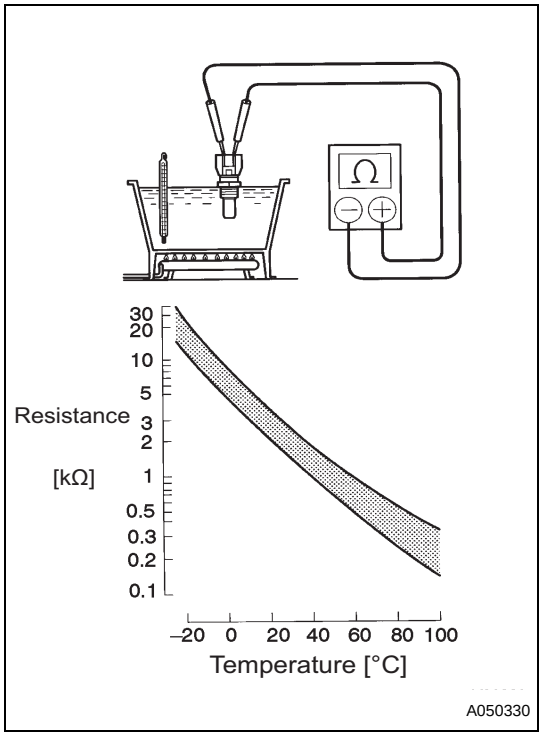
OK

2 **INSPECT FUEL INJECTOR ASSEMBLY (See page ES - 54)**

NG → **REPLACE FUEL INJECTOR ASSEMBLY**

OK

3	CHECK COOLANT TEMPERATURE



(a) Check the resistance.

(1) Using the tester, inspect the resistance between the terminals.

Standard

Measurement Condition	Standard
When approx. 20°C	2.32 to 2.59 kΩ
When approx. 80°C	0.310 to 0.326 kΩ

NOTICE:

Protect the terminal area from getting wet when checking the sensor by applying water. Also, wipe the sensor dry after the check.

NG → **REPLACE COOLANT TEMPERATURE SENSOR**

OK

4	INSPECT THE IGNITION SYSTEM

HINT:

For inspection procedures, see page IG - 1.

NG → **REPAIR OR REPLACE IGNITION SYSTEM**

OK

5	CHECK FUEL SYSTEM

HINT:

For inspection procedures, see page FU - 3.

NG → **REPAIR OR REPLACE FUEL SYSTEM**

OK

6	CHECK FOR EXHAUST GAS LEAKS

NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE AREA**

OK

7	READ DS-II DATA (RrO2 SENSOR OUTPUT VOLTAGE)

(a) Connect the DS-II to the DLC.
(b) Following the prompts on the DS-II screen, select ECU DATA MONITOR, then RrO2 SENSOR OUTPUT VOLTAGE. Then select MODE CHANGE and LINE GRAPH.
(c) Warm up oxygen sensor No.2 for approximately 90 seconds at an engine speed of 2500 r/min.
(d) Read the voltage of the RrO2 sensor output while racing the engine at a speed of 4000 r/min several times.

Result:

Voltage output is 0.4 V or less and 0.5 V or more

OK → **GO TO STEP 9**

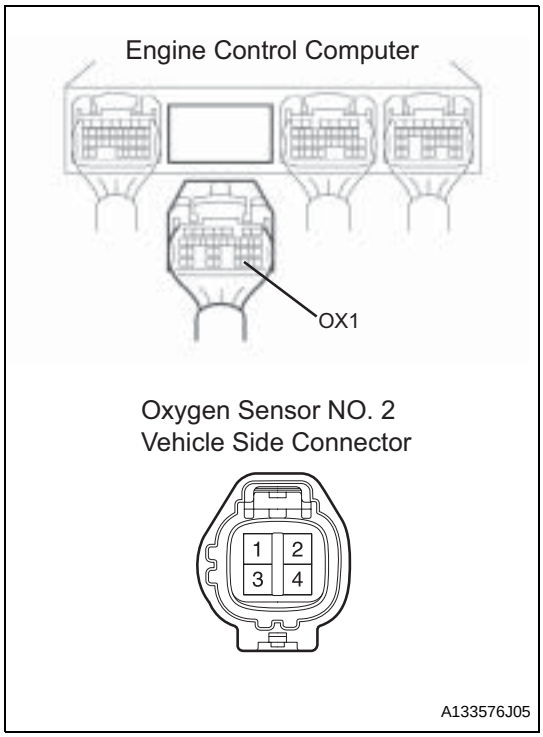
NG

8	CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER OXYGEN SENSOR NO.2)

(a) Disconnect the engine control computer connector B and the connector of oxygen sensor No.2.
(b) Using a tester, check whether there is continuity or a short between the engine control computer and oxygen sensor No.2. (For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine Control Computer ⟷ Oxygen Sensor	Standard
18 (OX2) ⟷ 3 (OX2)	There is continuity and no short between the other terminals and body ground
19 (E2) ⟷ 4 (E2)	There is continuity and no short between the other terminals and body ground



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

OK

REPLACE OXYGEN SENSOR NO.2

9	ROAD TEST TO CHECK OPERATION

(a) Connect the DS-II to the DLC.

(b) Turn the ignition switch to the ON position, and delete the DTCs by following the prompts on the DS-II screen.

(c) To check the system, warm up the oxygen sensor No.2 by performing a road test.

HINT:

Refer to the procedure for the oxygen sensor No.2 output voltage inspection.

GO

ES

10	READ DTCs

(a) Connect the DS-II to the DLC.

(b) Turn the ignition switch to the ON position, and read the DTCs by following the prompts on the DS-II screen.

(1) Check if DTC P0420/27 is indicated.

Result

A	B
P0420/27 is output again	P0420/27 is not output again

B → CHECK FOR INTERMITTENT PROBLEMS

A

CHECK AND REPLACE ENGINE CONTROL COMPUTER

DTC P0443/76 EVAP PURGE VSV

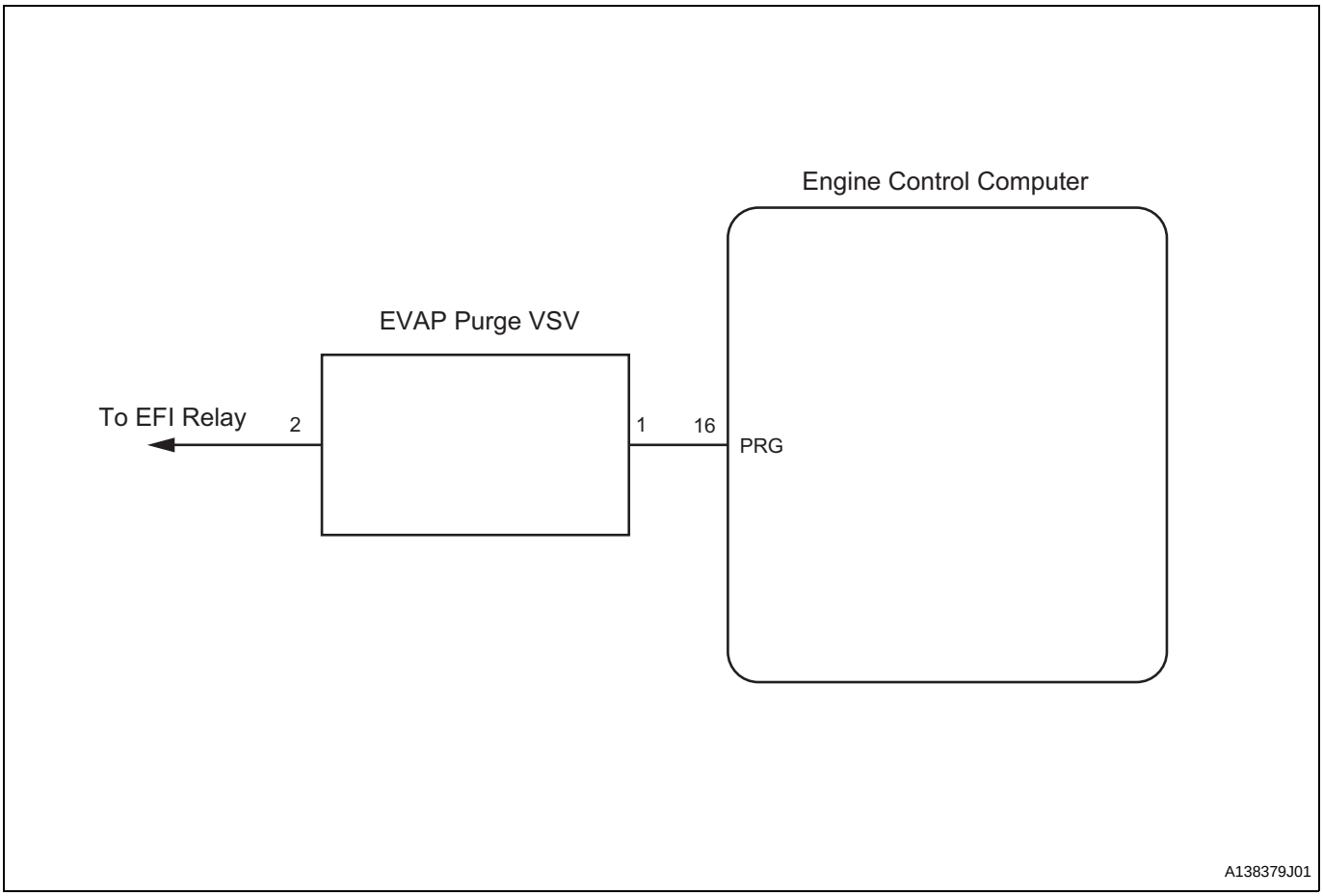
DESCRIPTION

Evap purge VSV controls evaporation purge volume based on a signal (duty signal) from the engine control computer.Purge volume is determined based on the ON/OFF time ratio (duty ratio).

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0443/76	1. After engine start 2. Evap purge control signal malfunction 3. VSV operates more than 3 times 4. 2 trip	• Evap purge VSV • Wire harness or connector • Engine control computer

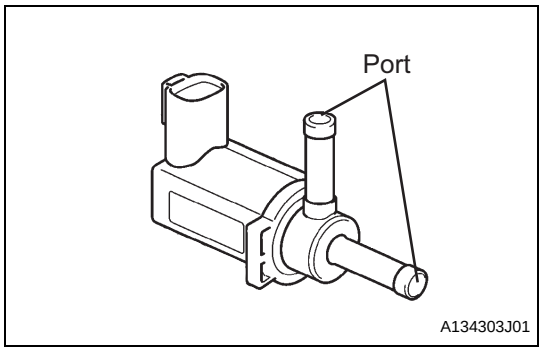
ES

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

1 **INSPECT EVAP PURGE VSV**



(a) Check the air-flow.
(1) Check for air-flow between the ports when voltage is applied to the connector terminals.
Standard

Inspection Condition	Air-flow
No current	No air-flow
Current	Air-flow

(b) Check the resistance.
(1) Using the tester, inspect the resistance between the terminals.
Standard:
30 to 34 Ω (20°C)

NG → **REPLACE EVAP PURGE VSV**

OK

2 **CHECK WIRE HARNESS AND CONNECTOR (POWER SOURCE VOLTAGE CHECK)**

(a) Disconnect the connector of the evap purge VSV connector.
(b) Turn the ignition switch to the ON position.
(c) Using a tester, measure the voltage between evap purge VSV vehicle side connector terminal 2 (+) and the body ground.
Standard:
9 to 14 V

NG → **CHECK POWER SOURCE CIRCUIT**

OK

3 **CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER EVAP PURGE VSV)**

(a) Disconnect connector A of the engine control computer and the connector of the evap purge VSV.
(b) Using a tester, check whether there is continuity or a short between the engine control computer vehicle side connector terminal 16 (PRG) and evap purge VSV vehicle side connector terminal 1 (-). (For terminal layout, see page ES - 16.)
Standard:
There is continuity and no short between the other terminals and body ground

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

OK

REPLACE ENGINE CONTROL COMPUTER

DTC P0500/52 VEHICLE SPEED SIGNAL SYSTEM

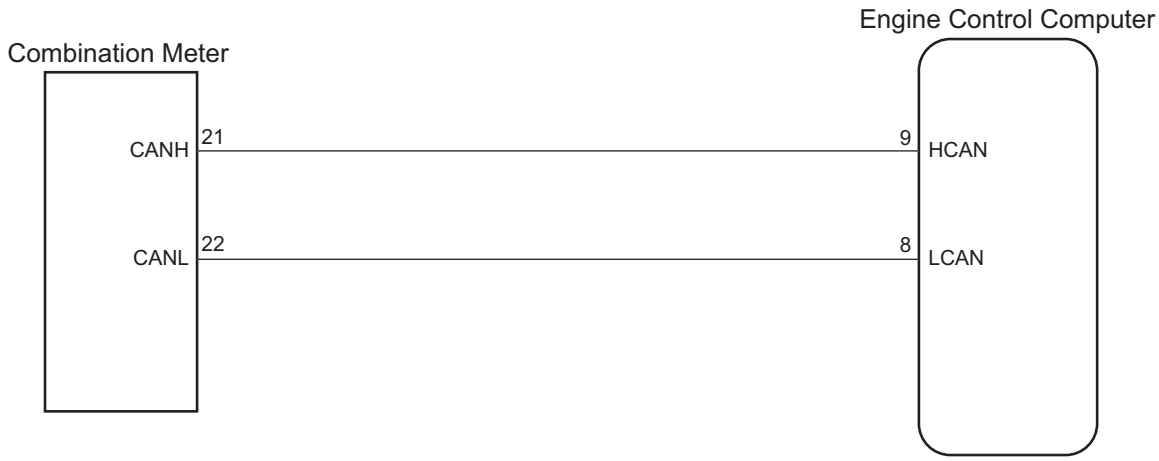
DESCRIPTION

The vehicle speed signal is transmitted to the engine control computer via CAN communication.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0500/52	1. While driving (when slowing down and during fuel-cut) 2. Vehicle speed signal is not input 3. 3 seconds or more 4. 2 trip	• Combination meter • Speed sensor • Wire harness or connector • Engine control computer

ES

CIRCUIT DIAGRAM



A134898J01

INSPECTION PROCEDURE

1	READ DS-II DATA (VEHICLE SPEED)

(a) Make sure that the speedometer operates normally.
(b) Connect the DS-II to the DLC.
(c) Read the vehicle speed displayed on the DS-II.

Standard:

The DS-II and speedometer displays are identical.

OK → **CHECK FOR INTERMITTENT PROBLEMS**

NG

2	GO TO METER AND GAUGE SYSTEM

3	READ DTCs

(a) Connect the DS-II to the DLC.
(b) Turn the ignition switch to the ON position, and read the DTCs by following the prompts on the DS-II screen.
(1) Check if DTC P0500/52 is detected.

Standard

Tester Display	Proceed to
DTC P0500/52 is detected	A
DTC P0500/52 is not detected	B

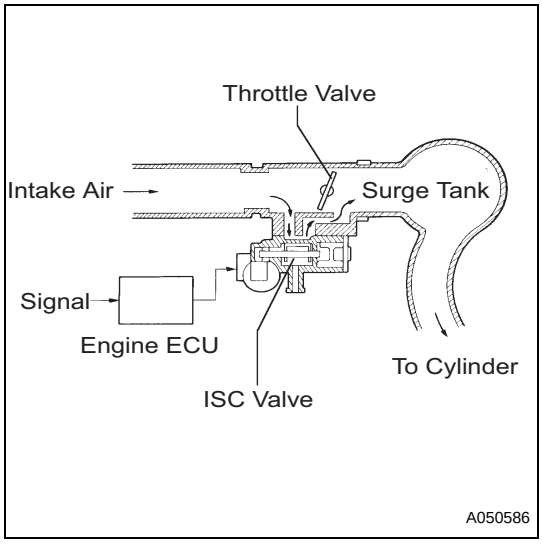
B → SYSTEM RETURNS TO NORMAL

A → REPAIR OR REPLACE ENGINE CONTROL COMPUTER

DTC P0505/71 ISC VALVE SYSTEM

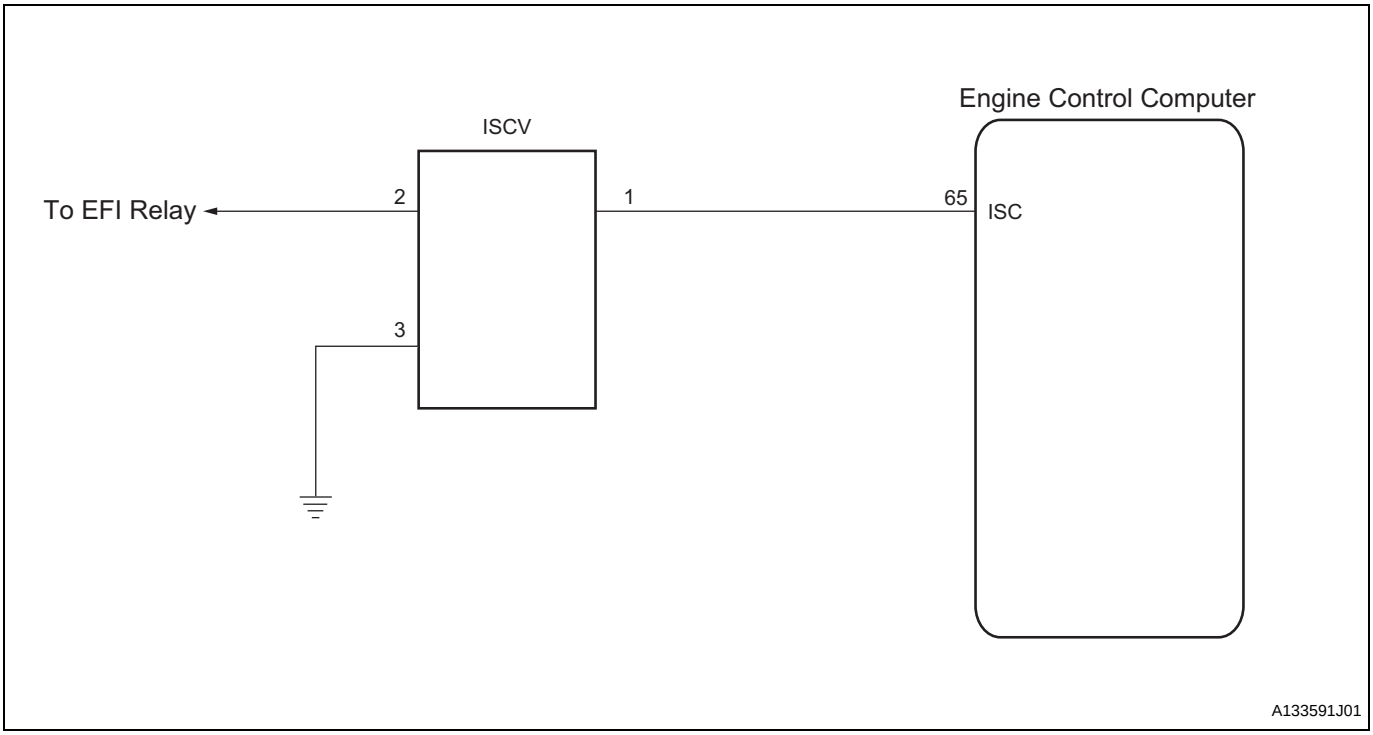
DESCRIPTION

The throttle body idle speed control valve assembly (ISCV) of the rotary solenoid type is installed on the throttle body. The intake air that by-passes the throttle valve passes through the passage to the ISCV.
To control the idle speed, the engine control computer controls the intake air passage of the ISC valve and sends a signal to allow the idle speed to be adjusted towards the target idling speed.



DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0505/33	1. While engine is idling 2. Short or open in ISCV circuit 3. 3 seconds or more 4. 1 trip	• ISCV • Wire harness or connector • Engine control computer

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1	PERFORM DS-II ACTIVE TEST (ISC DUTY RATIO)

(a) Following the prompts on the DS-II screen , select ACTIVE TEST.

(b) Check that the engine speed changes when the ISC duty ratio is changed.

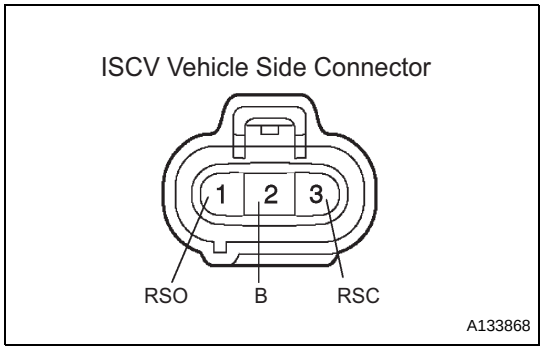
Standard:

The engine speed increases or decreases in response to changes in the ISC duty ratio.

OK → **CHECK FOR INTERMITTENT PROBLEMS**

NG

2 **CHECK THROTTLE BODY IDLE SPEED CONTROL VALVE ASSEMBLY (POWER SOURCE CIRCUIT)**



(a) Disconnect the ISCV connector.
(b) Turn the ignition switch to the ON position.
(c) Using a tester, measure the voltage of the ISCV vehicle side connecter terminals.

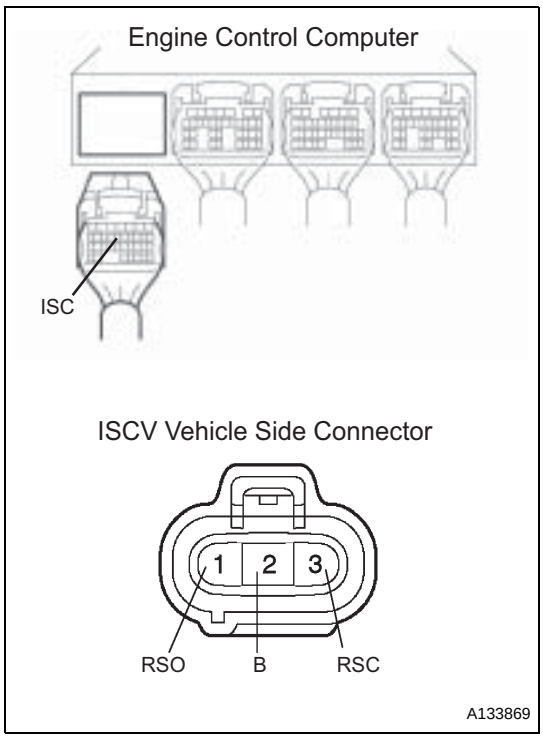
Standard

Tester Connection (Terminal Symbol)	Standard
2 (B) ⟷ 3 (RSC)	9 to 14 V

NG → **CHECK POWER SOURCE CIRCUIT**

OK

3 **CHECK WIRE HARNESS OR CONNECTOR (ISC CIRCUIT)**



(a) Disconnect the engine control computer connector A and ISCV connector.
(b) Using a tester, check whether there is continuity or a short between the engine control computer and the ISCV.(For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine Control Computer ⟷ ISCV	Standard
65 (ISC) ⟷ 1 (RSO)	There is continuity and no short between the other terminals and body ground

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

OK

4 **CHECK THROTTLE BODY IDLE SPEED CONTROL VALVE ASSEMBLY**

NOTICE:

- **Delete the DTCs after the inspection.**

(a) Remove the ISCV.
(b) CHECK OPERATION
  (1) Connect the wire harness to the removed ISCV.

(2) With the ignition in the ON position, check the operation of the valve.

Standard:

Neutral (50% open) → Fully closed → Fully open → Neutral (50% open)

HINT:

Operation should start within 0.5 seconds.

NG → **REPLACE THROTTLE BODY IDLE SPEED CONTROL VALVE ASSEMBLY**

OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

DTC	P0535/44	A/C EVAPORATOR TEMPERATURE SENSOR SIGNAL SYSTEM

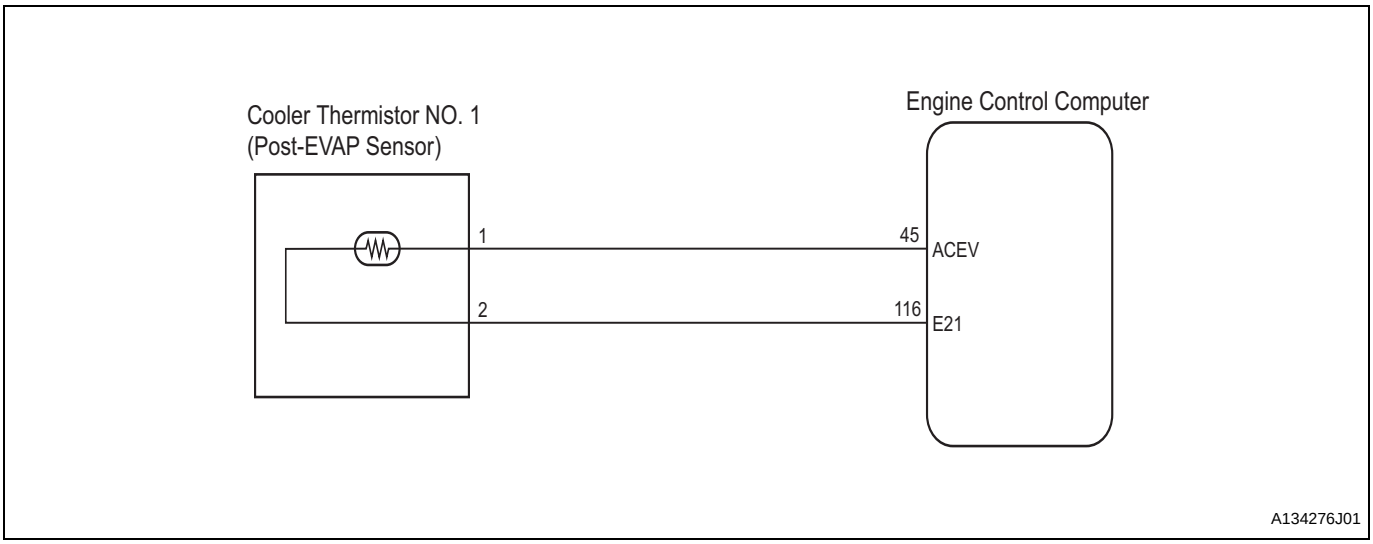
DESCRIPTION

Cooler thermistor No.1 (evaporator rear sensor) is installed in the evaporator of the air conditioner unit. Cooler thermistor No.1 senses the temperature of the cooled air that has passed through the evaporator as a change in resistance. It outputs this change in resistance to the engine control computer.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P0535/44	1. IG ON 2. Open or short in cooler thermistor No.1 (evaporator rear sensor) circuit 3. Continuously for 0.5 seconds or more 4. 1 trip	• Cooler thermistor No.1 (evaporator rear sensor) • Wire harness or connector • Engine control computer

ES

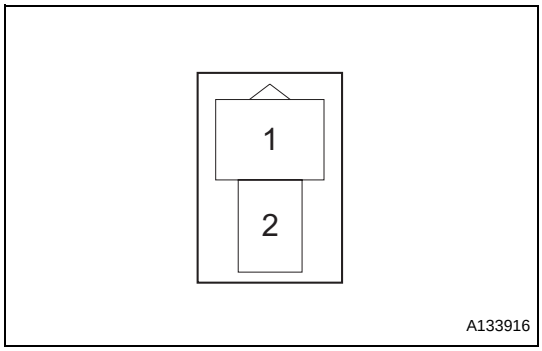
CIRCUIT DIAGRAM



INSPECTION PROCEDURE

1	CHECK COOLER THERMISTOR NO.1 (EVAPORATOR REAR SENSOR)

(a) Disconnect the connector of cooler thermistor No.1 (evaporator rear sensor).



(b) Using a tester, check the resistance between terminals 1 and 2 of the connector of cooler thermistor No.1 (evaporator rear sensor).

Standard

Temperature	Standard
0°C	4.6 to 5.1 kΩ
15 °C	2.1 to 2.6 kΩ

NOTICE:

- **If you touch the temperature sensor with your hand, you body temperature will confuse the measurement.Therefore, make sure to hold the connector side when performing the measurements.**
- **Wait until the sensor adjusts to a stable ambient temperature before performing the inspection.**

NG → **REPLACE COOLER THERMISTOR NO.1 (EVAPORATOR REAR SENSOR)**

OK

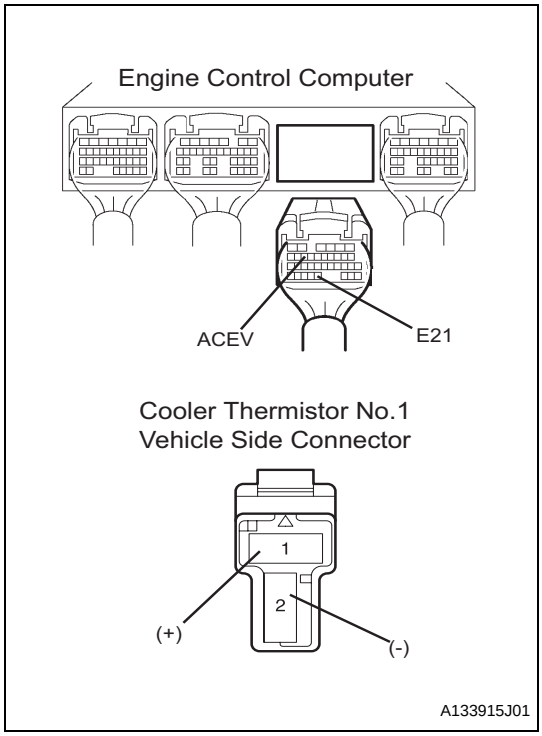
2	INSPECT WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER COOLER THERMISTOR NO.1 [EVAPORATOR REAR SENSOR])

(a) Disconnect the engine control computer connector C and the connector of cooler thermistor No.1.

(b) Using a tester, check whether there is continuity or a short between the engine control computer vehicle side connector C and the connector terminals of cooler thermistor No.1.(For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine Control Computer ←→ Cooler Thermistor No.1 (Evaporator Rear Sensor)	Standard
45 (ACEV) ←→ 1 (+)	There is continuity and no short between the other terminals and body ground
116 (E21) ←→ 2 (-)	There is continuity and no short between the other terminals and body ground



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

OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

DTC	P1105/32	ATMOSPHERIC PRESSURE SENSOR SIGNAL SYSTEM

DESCRIPTION

The atmospheric pressure sensor is built into the EFI ECU.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P1105/32	1. After engine start 2. No signals from atmospheric pressure sensor 3. 1 second or more 4. 1 trip	• Engine control computer

INSPECTION PROCEDURE

1 **CLEAR DTCs.**

(a) Connect the DS-II to the DLC.
(b) Delete the DTCs using the DS-II.

2 **READ DTCs**

(a) Connect the DS-II to the DLC.
(b) Read the DTCs using the DS-II.

Standard

Result	Proceed to
DTC P1105/32 is detected	A
DTC P1105/32 is not detected	B

B → **CHECK FOR INTERMITTENT PROBLEMS**

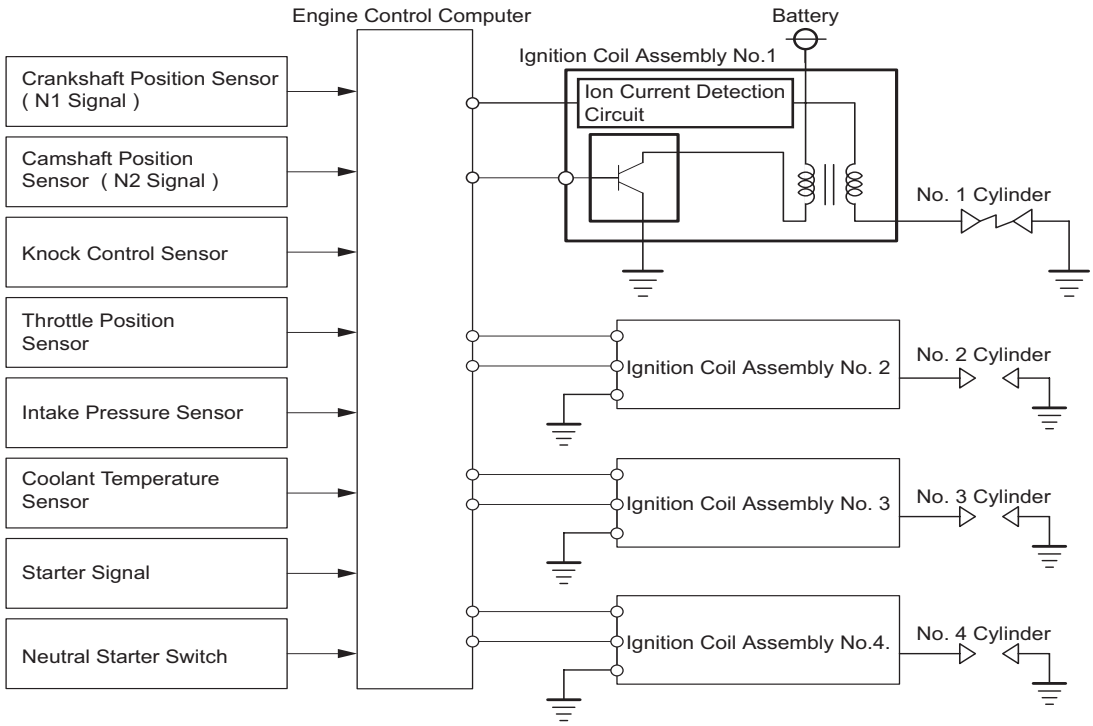
A →

REPAIR OR REPLACE ENGINE CONTROL COMPUTER

DTC P1300/36 IONIC CURRENT SYSTEM

DESCRIPTION

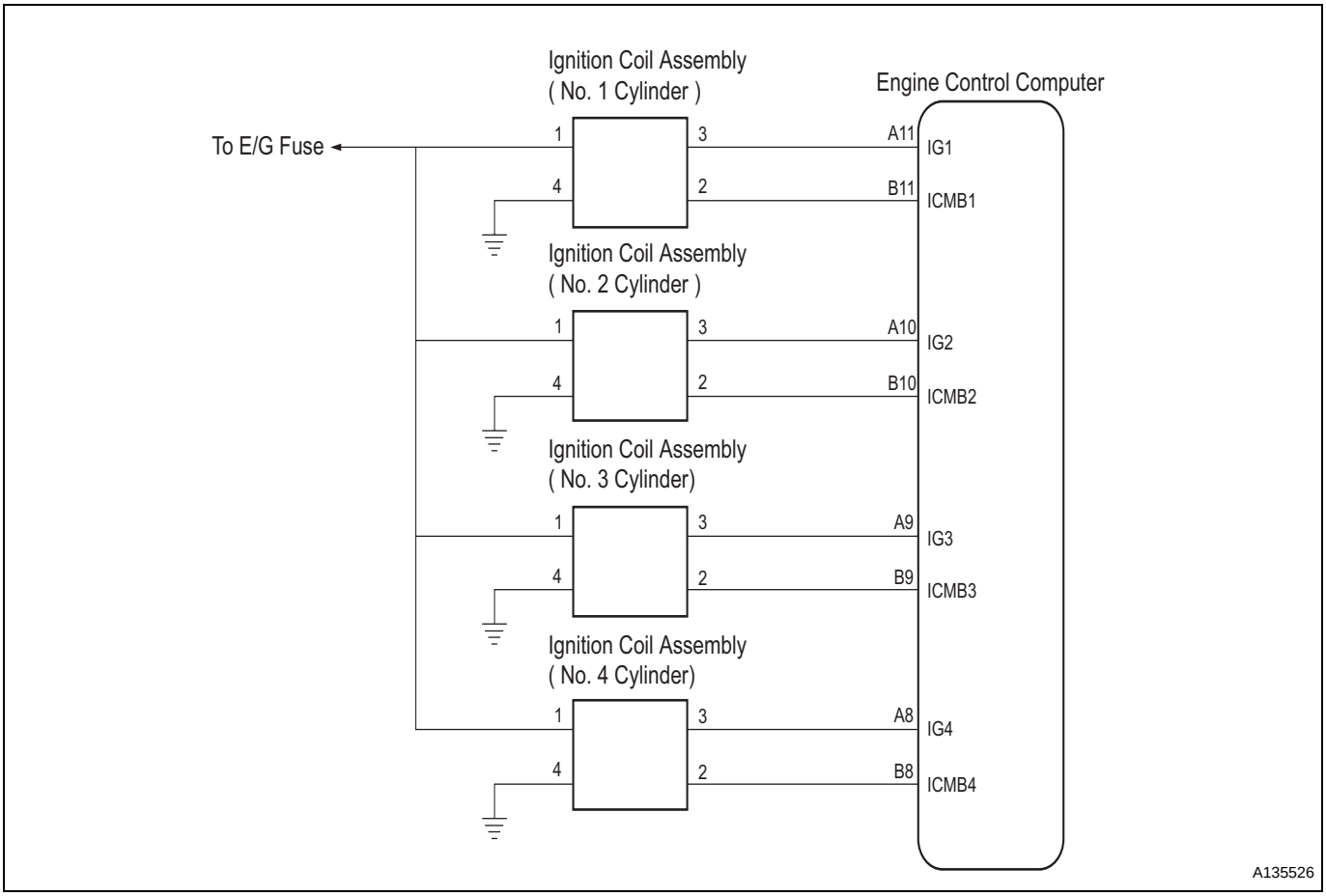
This system detects engine misfires by using the fact that the ionic current generated by combustion pressure has an identical waveform.If a misfire occurs, ionic current is not generated. Therefore, when the voltage transmitted to the engine control computer is lower than specified, the engine control computer detects a misfire.If the detected ionic current is extremely weak it is amplified by the igniter.



A135529

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P1300/36	1. Engine is warmed up and running 2. ICMB signal is not input (continuously input) 3. Approx.30 seconds 4. 2 trip	• IGNITION COIL ASSEMBLY • Fuel system • Ignition system • Wire harness or connector • Engine control computer

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.
- The inspection method for the No.1 cylinder circuit is shown below. If the DTC P1300/36 is still shown after the test, check the circuit of each cylinder.

1	**INSPECT IGNITION SYSTEM**

(See page IG - 1)

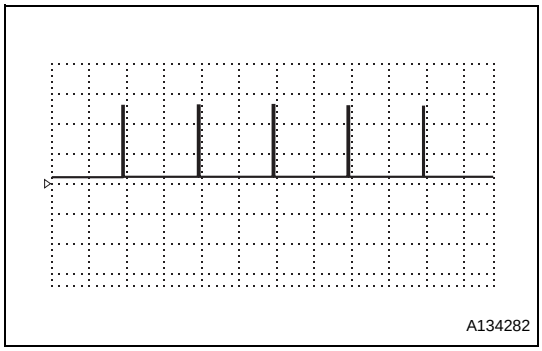
NG → **REPAIR OR REPLACE IGNITION SYSTEM**

OK

2	**CHECK ENGINE CONTROL COMPUTER (IG SYSTEM)**

HINT:

The communication between the engine control computer and the ignition coil assembly can be checked using the oscilloscope function of the DS-II.


A134282

(a) CHECK OUTPUT WAVEFORM
(1) Connect the DS-II between the terminals of the engine control computer and set the DS-II to the oscilloscope function.

Tester Connection	IG1, IG2, IG3, IG4 ⟷ E1
Tool setting	5 V/DIV, 10 ms/DIV
Measurement Condition	Engine is warmed up and idling

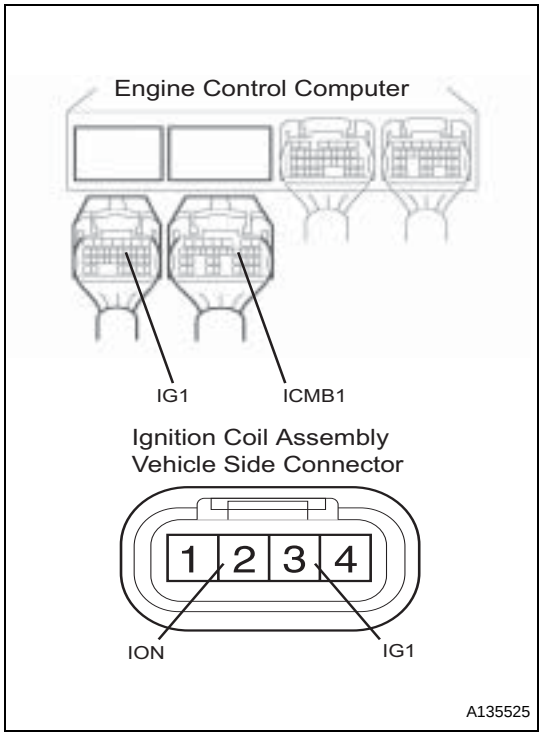
HINT:
- As the engine speed increases, the waveform cycle becomes shorter.
- The oscilloscope waveform shown as an example does not include noise or chattering waveforms.

ES

NG → **REPLACE ENGINE CONTROL COMPUTER**

OK

3 CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER IGNITION COIL)



A135525

(a) Disconnect engine control computer connectors A and B and the ignition coil assembly connector.
(b) Using a tester, check whether there is continuity or a short between the engine control computer vehicle side connector and the ignition coil assembly vehicle side connector.(For terminal layout, See page ES - 16)

Standard

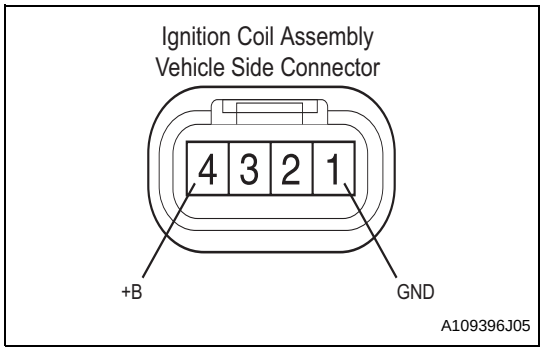
Tester Connection (Terminal Symbol) Engine Control Computer ⟷ Ignition Coil Assembly	Standard
63 (IG1) ⟷ 3 (IG1)	There is continuity and no short between the other terminals and body ground
51 (ICMB1) ⟷ 2 (ION)	There is continuity and no short between the other terminals and body ground

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

OK

4 CHECK WIRE HARNESS AND CONNECTOR (POWER SOURCE CIRCUIT CHECK)

(a) Disconnect the ignition coil assembly connector.
(b) Turn the ignition switch to the ON position.



(c) Using a tester, check the voltage between the terminals in the ignition coil assembly vehicle side connector.

Standard

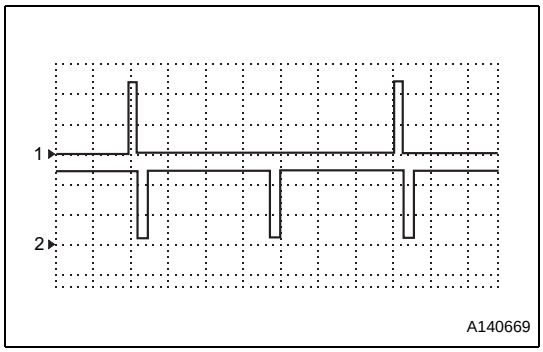
Tester Connection (Terminal Symbol)	Standard
1 (+B) ⟷ 4 (GND)	9 to 14 V

NG → **REPAIR OR REPLACE POWER SOURCE SYSTEM**

OK

ES

5 CHECK ENGINE CONTROL COMPUTER (ICBM)



HINT:

The communication between the engine control computer and the ignition coil assembly can be checked using the oscilloscope function of the DS-II.

(a) CHECK OUTPUT WAVEFORM

(1) Connect the DS-II between the terminals of the engine control computer and set the DS-II to the oscilloscope function.

Tester Connection	CH1: IG1, IG2, IG3, IG4 ⟷ E1 CH2: ICMB1, ICMB2, ICMB3, ICMB4
Tool setting	2 V/DIV, 20 ms/DIV
Measurement Condition	Engine is warmed up and idling, coolant temperature is 80°C or higher, air conditioner is ON

HINT:

- The output waveform (CH2) of the ionic current combustion control signal generated between the output waveform of the ignition signal is the ionic current combustion control signal of cylinder #4 when cylinder #1 is inspected. (When cylinder #2 is inspected, cylinder #3).
- The oscilloscope waveform shown as an example does not include noise or chattering waveforms.

NG → **REPLACE IGNITION COIL**

OK

TO FUEL SYSTEM

DTC P01346/75 VVT CONTROL SYSTEM (VALVE TIMING FAIL)

DESCRIPTION

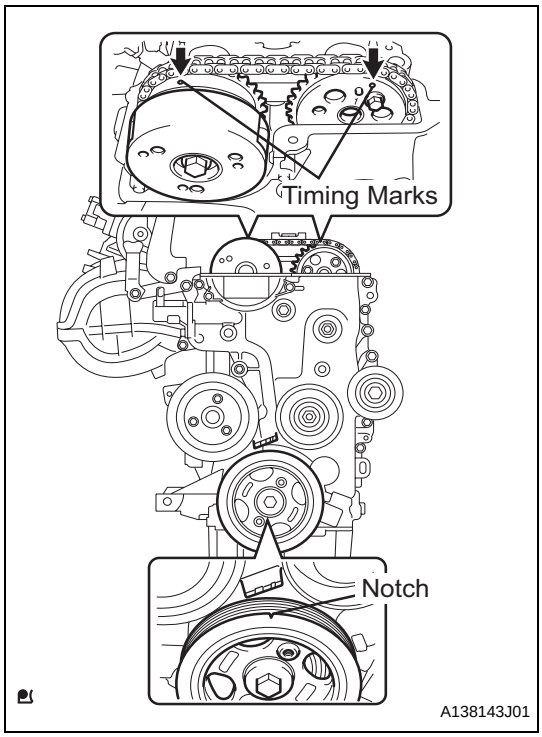
The VVT system controls the open/close timing of the air intake valve to achieve the appropriate timing in accordance with vehicle operating conditions.The engine control computer controls the camshaft and camshaft oil control valves in order to properly adjust the open/close timing of the air intake valve, and changes the relative position between the camshaft and crankshaft by operating the camshaft timing gear assembly.

ES

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P1346/18	1. While engine is running 2. Valve timing deviation (cannot achieve targeted valve timing) 3. 5 seconds or more 4. 2 trip	• Mechanical system malfunction (timing chain jumped a tooth or chain stretched) • VALVE TIMING • ENGINE CONTROL COMPUTER

INSPECTION PROCEDURE

1 **CHECK VALVE TIMING**



Standard:

See the illustration.

NG → **ADJUST VALVE TIMING**

OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

DTC	P1349/73	VVT CONTROL (ADVANCE ANGLE AND RETARD ANGLE FAIL)

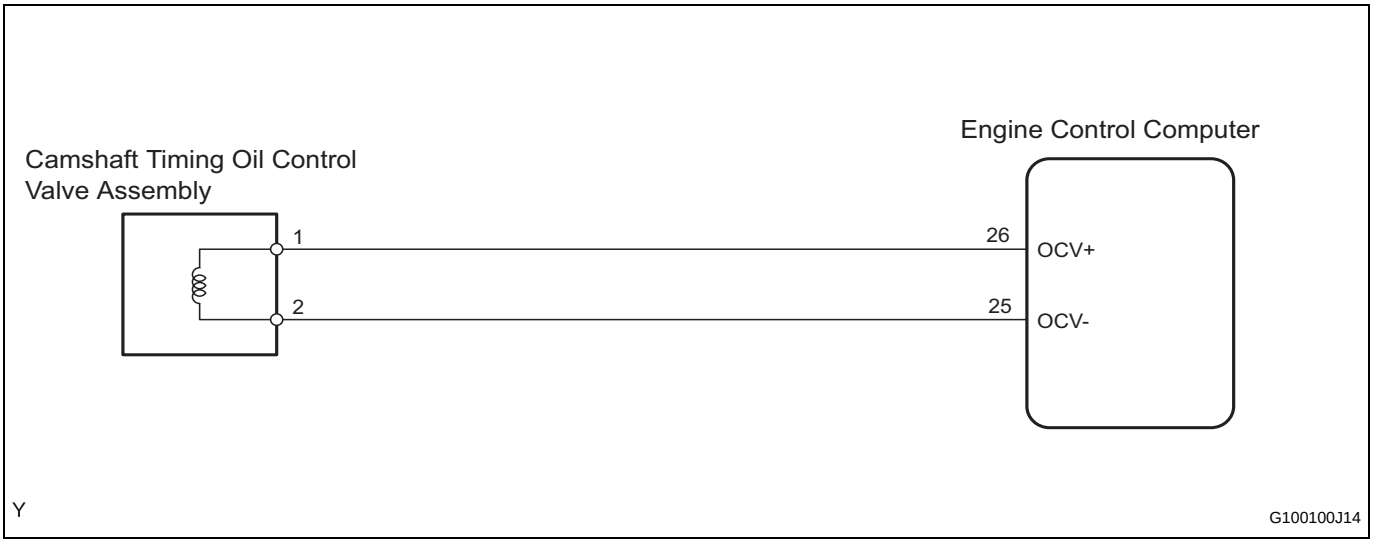
DESCRIPTION

The VVT system controls the open/close timing of the air intake valve to achieve the appropriate timing in accordance with vehicle operating conditions.The engine control computer controls the camshaft and camshaft oil control valve assembly in order to properly adjust the open/close timing of the air intake valve, and changes the relative position between the camshaft and crankshaft by operating the camshaft timing gear assembly.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P1349/59	1. Engine speed of 500 to 4000 r/min, and coolant temperature between 80 to 110°C 2. Cannot achieve valve timing within ±5°of target, or valve timing is fixed, does not vary 3. 5 seconds or more 4. 2 trip	• VALVE TIMING • CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY • CAMSHAFT TIMING GEAR ASSEMBLY • VVT SYSTEM OIL PATH • Engine control computer

ES

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the DS-II. Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1	READ DTCs

(a) Connect the DS-II to the DLC.

(b) Turn the ignition switch to the ON position, and delete the DTCs by following the prompts on the DS-II screen.

(c) Perform a road test.

(d) Check for DTCs following the prompts on the DS-II screen.

(1) Check if DTC P1349/73 is output.

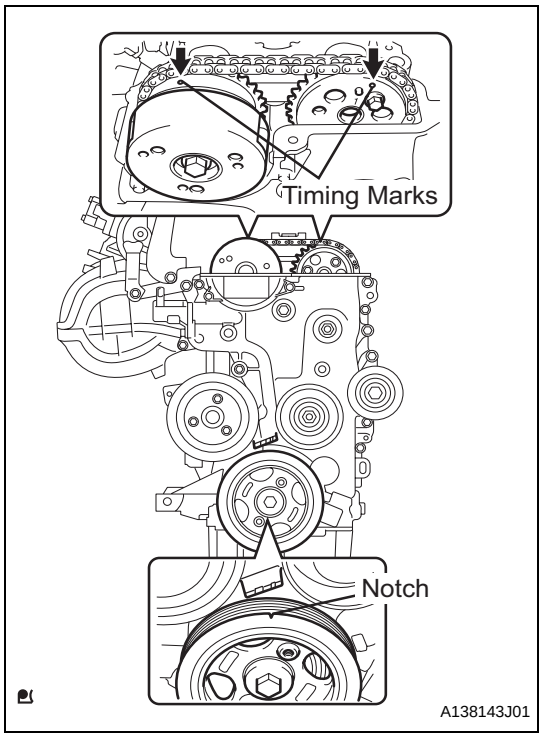
Result:

A	B
Indicates P1349/73	Does not indicate P1349/73

B → CHECK FOR INTERMITTENT PROBLEMS

A

2 CHECK VALVE TIMING



Standard:

See the illustration.

NG → ADJUST VALVE TIMING

OK

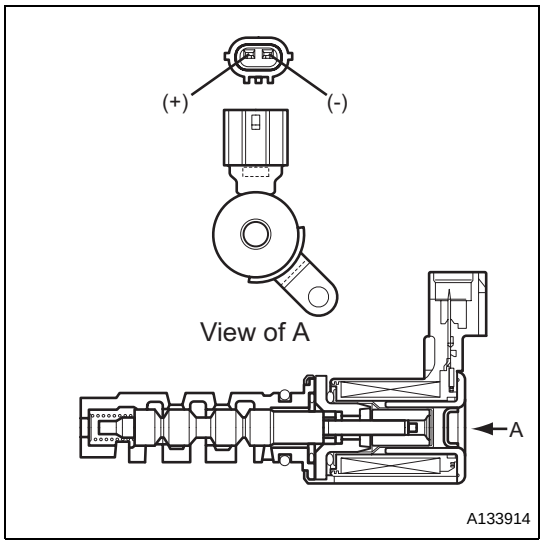
3 CHECK CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Check the resistance.

(1) Using a tester, measure the resistance between the terminals.

Standard:

6.9 to 7.9 (20°C)



(b) CHECK OPERATION

(1) Apply battery voltage across the terminals, then check that the spool valve operates.

NOTICE:

Make sure the spool valve is not stuck.

HINT:

If the spool valve does not return due to foreign matter like sludge, the pressure may leak slightly toward the advanced side. This leakage may cause DTCs to be recorded.

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

OK

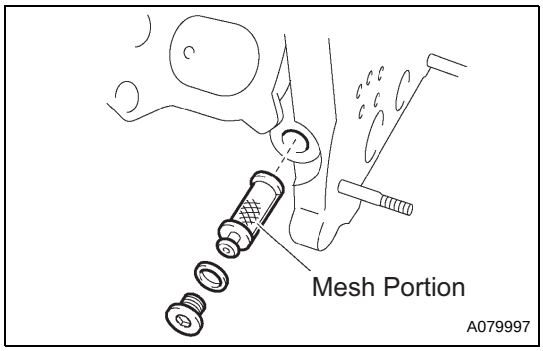
4	CHECK CAMSHAFT TIMING GEAR ASSEMBLY

(a) Make sure that the camshaft timing gear assembly is not damaged.

NG → **REPLACE CAMSHAFT TIMING GEAR ASSEMBLY**

OK

5	CHECK OIL CONTROL VALVE FILTER



(a) Check that the oil control valve filter is not blocked.

Standard:

There is no blockage or foreign matter.

NG → **REPLACE OIL CONTROL VALVE FILTER**

OK

6	READ DTCs

(a) Connect the DS-II to the DLC.

(b) Turn the ignition switch to the ON position, and delete the DTCs by following the prompts on the DS-II screen.

(c) Perform a road test.

(d) Check for DTCs following the prompts on the DS-II screen.
(1) Check if DTC P1349/73 is output.
Result:

A	B
Indicates P1349/73	Does not indicate P1349/73

B → CHECK FOR INTERMITTENT PROBLEMS

A → CHECK AND REPLACE ENGINE CONTROL COMPUTER

DTC P1351/62 TIMING CHAIN CONTROL SYSTEM

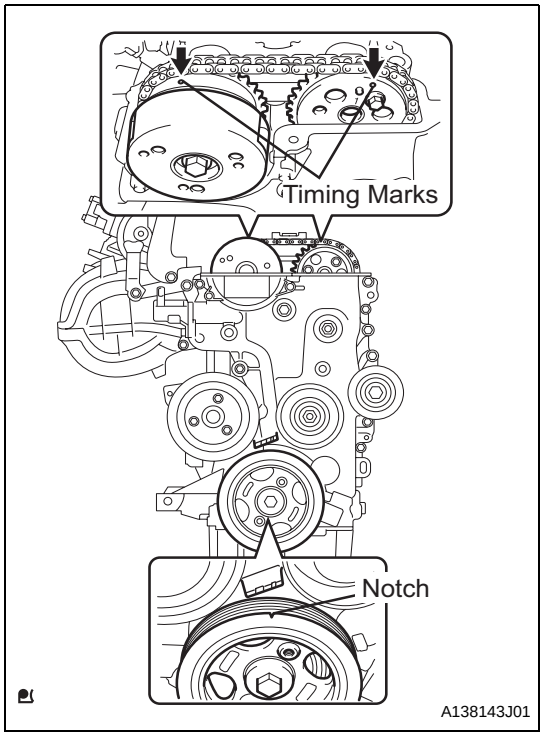
DESCRIPTION

The VVT system controls the open/close timing of the air intake valve to achieve the appropriate timing in accordance with vehicle operating conditions. The engine control computer controls the camshaft and the camshaft timing oil control valve in order to properly adjust the open/close timing of the air intake valve, and changes the relative position between the camshaft and crankshaft by operating the camshaft timing gear assembly.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P1351/62	1. While engine is running 2. Valve timing deviation 3. 5 seconds or more 4. 5 trip	• Mechanical system malfunction (timing chain jumped a tooth or chain stretched) • VALVE TIMING • Engine control computer

INSPECTION PROCEDURE

1 **CHECK VALVE TIMING**



Standard:

See the illustration.

NG → **ADJUST VALVE TIMING**

OK

REPLACE CHAIN

DTC P1510/54 STARTER SIGNAL SYSTEM

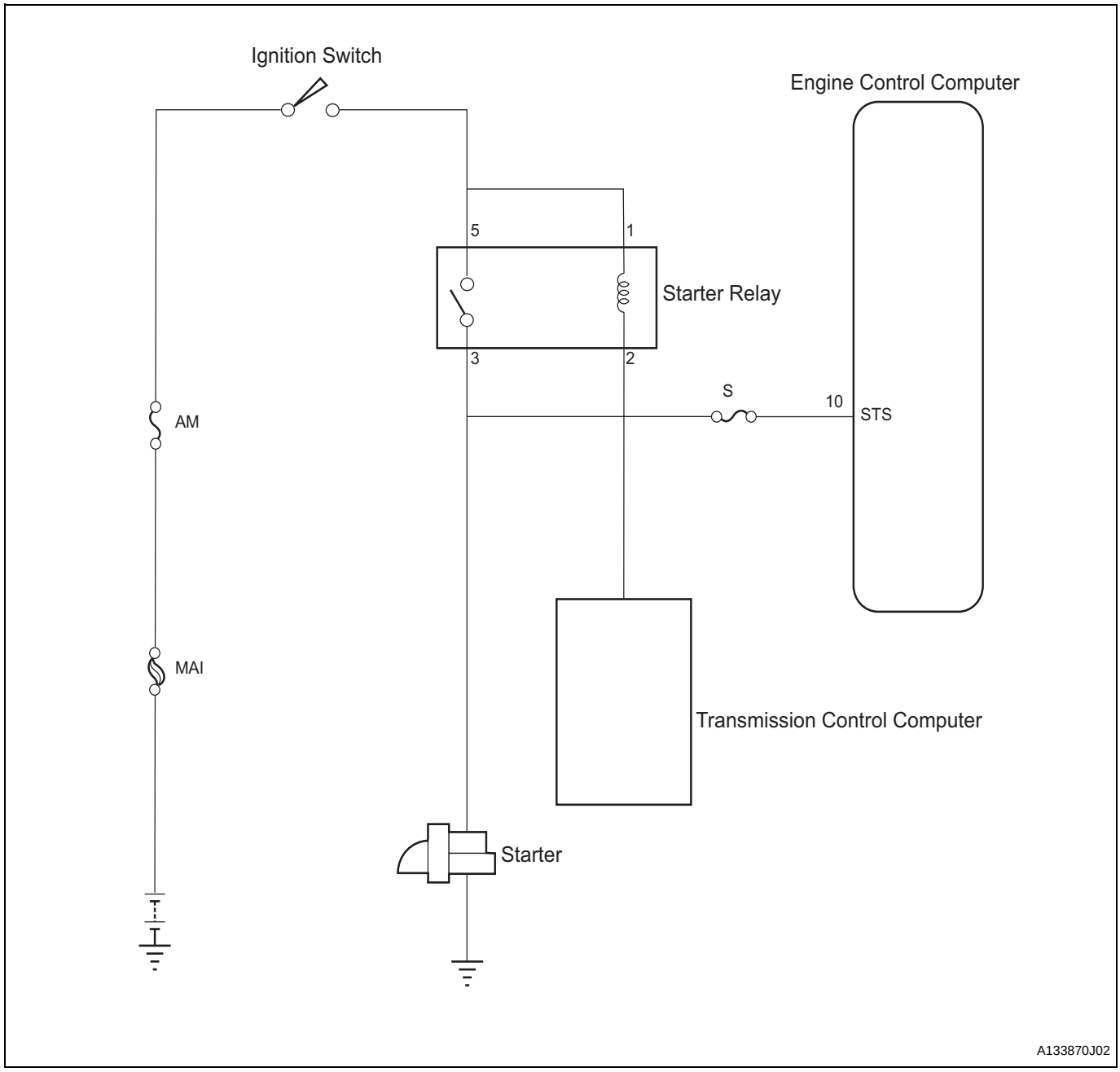
DESCRIPTION

The starter operation signal is transmitted to the STSW terminal of the engine control computer while the engine cranks.The starter operating signal is used primarily for increasing fuel injection volume when the engine starts.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P1510/54	1. After engine start 2. There are no ON signals even when engine speed reaches a set value at a vehicle speed of 0 km/h 3. - 4. 1 trip *	• Wire harness or connector • Engine control computer

* : 2 trip for EU specifications.

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

HINT:

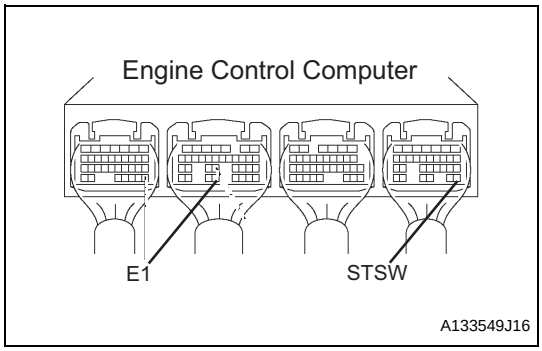
This diagnosis procedure assumes that the engine is not malfunctioning and can be cranked with the starter. If the engine cannot be cranked, determine the suspected area using a problem symptoms table. (See page ES - 4)

1	**INSPECT ENGINE CONTROL COMPUTER**

SST 09842-97209

(a) Connect the SST (sub harness, EFI computer check) to the engine control computer.

(b) Turn the ignition switch to the ON position.



(c) Using a tester, measure the voltage between terminals D26 (STSW) and B32 (E1) of the engine control computer connector. (For terminal layout, see page ES - 16.)

Standard:

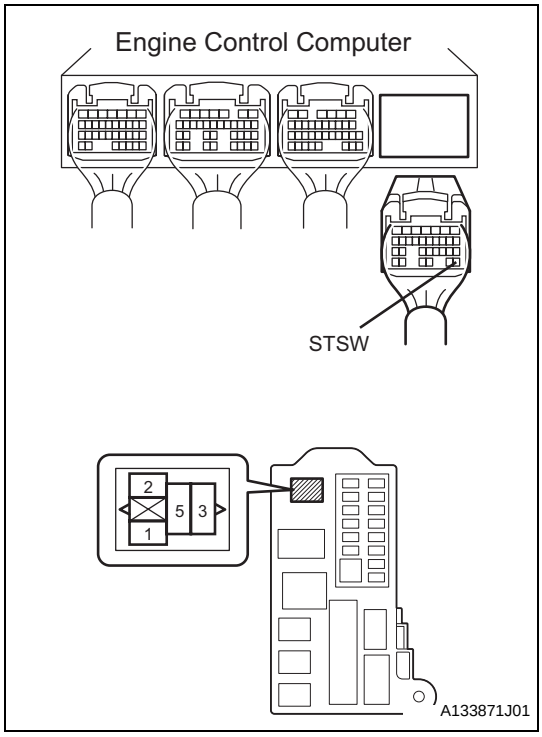
10 to 14 V

OK → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

NG

ES

2 **CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER STARTER RELAY)**



(a) Disconnect the engine control computer connector D.

(b) Remove the starter relay.

(c) Using a tester, check whether there is continuity or a short between the engine control computer and the starter relay block holder terminal. (For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol) Engine Control Computer ←→ Relay Block Holder For Installing Starter Relay	Standard
107 (STSW) ←→ 4	There is continuity and no short between the other terminals and body ground

NOTICE:

When applying the tester probe to the holder during inspection, be careful not to damage the holder part by pressing it too hard.

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

OK

CHECK AND REPAIR POWER SOURCE SYSTEM

DTC P1560/61 SHORT TO BACK UP POWER SOURCE

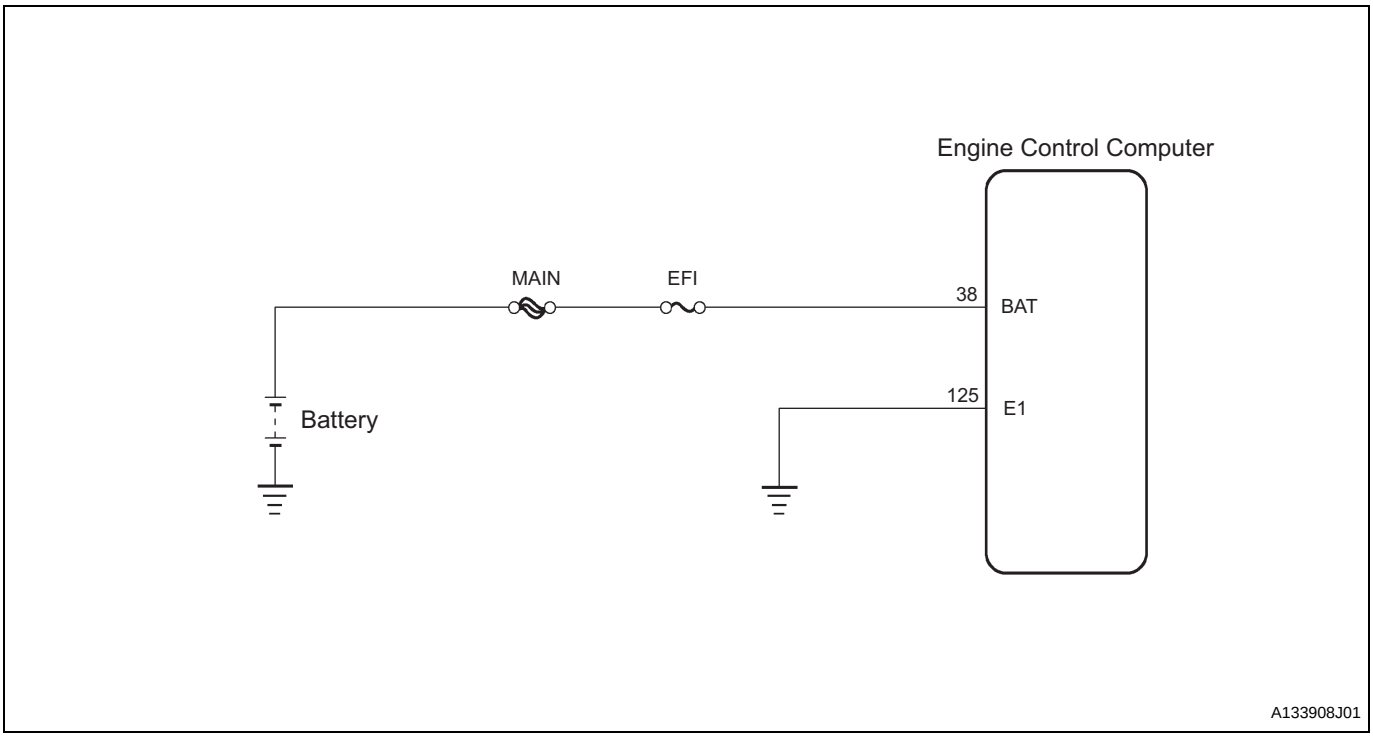
DESCRIPTION

Even when the ignition switch is turned off, battery power is supplied to the BAT terminal of the engine control computer. This power is used for recording DTC or data when malfunctions occur.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P1560/61	1. Ignition is in ON position (battery voltage exceeds 10 V) 2. Open to back-up power source circuit 3. - 4. 3 trip	• Engine control computer • Wire harness or connector • EFI fuse

ES

CIRCUIT DIAGRAM

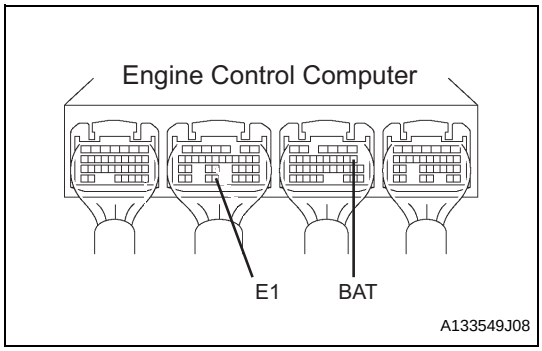


INSPECTION PROCEDURE

1	CHECK ENGINE CONTROL COMPUTER

SST 09842-97209

(a) Connect the SST (sub harness, EFI computer check) to the engine control computer.



(b) Measure the voltage between the engine control computer terminals using a tester. (For terminal layout, see page ES - 16.)

Standard

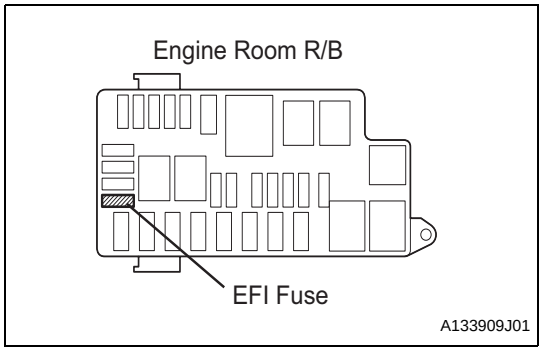
Tester Connection (Terminal Symbol)	Standard
38 (BATT) ⟷ 125 (E1)	10 to 14 V

OK → **CHECK FOR INTERMITTENT PROBLEMS**

ES

NG

2 **CHECK FUSE (EFI FUSE)**



(a) Remove the EFI fuse from the inside of the engine room R/B.
(b) Using a tester, check the EFI fuse for continuity.

Standard:

Continuity

NG → **REPLACE FUSES**

OK

CHECK OR REPLACE ENGINE ECU POWER CIRCUIT

DTC	P1600/83	KEYLESS SYSTEM / IMMOBILISER SYSTEM COMMUNICATION SYSTEM (MALFUNCTION IN ECU)

DESCRIPTION

The transponder key computer assembly (immobiliser ECU) ensures security by controlling the START/END of the communication of matching codes with the engine control computer. It does so in accordance with ignition ON/OFF status and the immobiliser SET/UNSET status. If the communication cannot be matched due to a malfunction in the engine control computer, a DTC is recorded.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P1600/83	1. IG ON 2. Communication stopped with immobiliser ECU 3. 1 second or more 4. 1 trip	• Engine control computer

INSPECTION PROCEDURE

1	READ DTCs

(a) Connect the DS-II to the DLC.

(b) Turn the ignition switch to the ON position, and read the DTCs by following the prompts on the DS-II screen.

HINT:

If P1600/83 is detected, this indicates that the engine computer is malfunctioning. Replace the engine control computer.

REPLACE ENGINE CONTROL COMPUTER

DTC	P1601/81	KEYLESS / IMMOBILISER SYSTEM COMMUNICATION SYSTEM (CODE DOES NOT MATCH, COMMUNICATION ERROR)

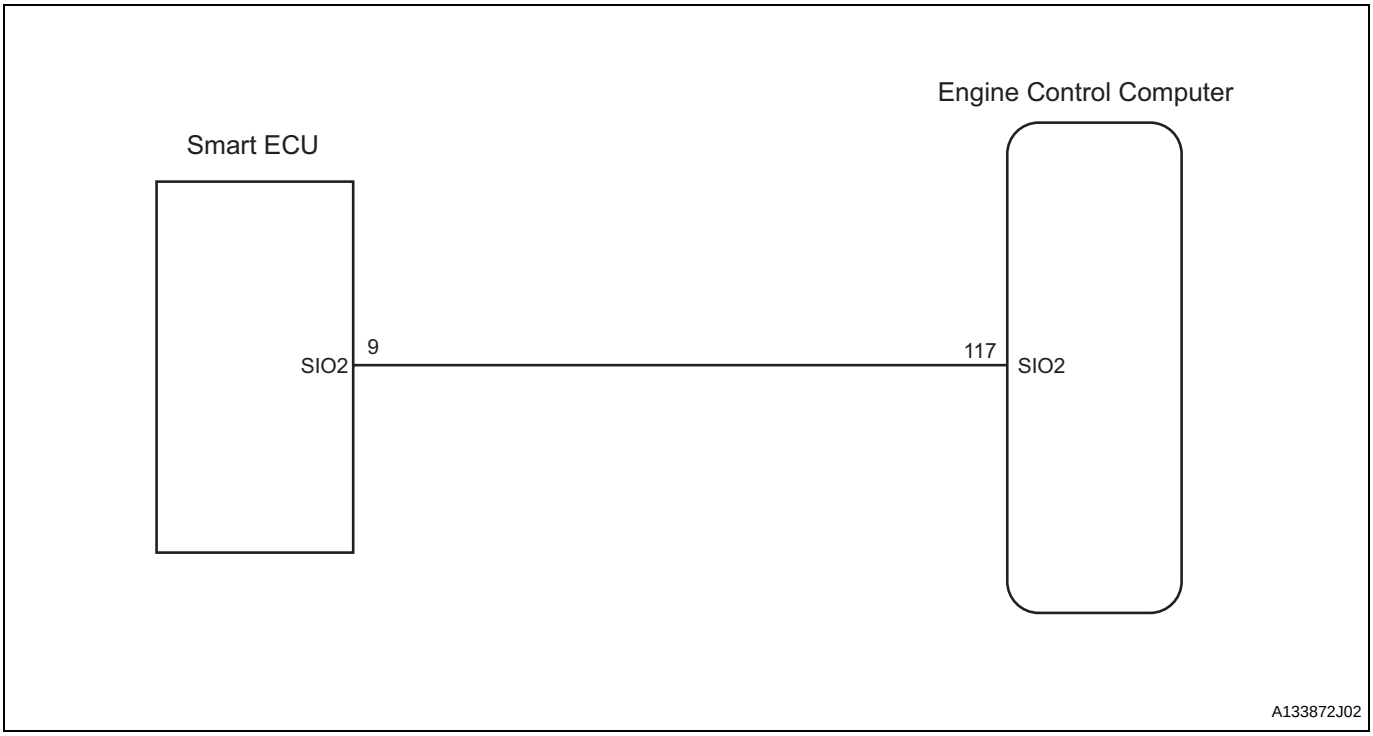
DESCRIPTION

The transponder key computer assembly (immobiliser ECU) ensures security by controlling the START/END of the communication of matching codes with the engine control computer. It does so in accordance with the ignition ON/OFF status and the immobiliser SET/UNSET status.

ES

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
P1601/81	1. IG ON 2. Communication problem with transponder key computer assembly (immobiliser ECU) or code mismatch 3. 1 second or more 4. 1 trip	• TRANSPONDER KEY COMPUTER ASSEMBLY (IMMOBILISER ECU) • Engine control computer • Wire harness or connector

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

1	READ DTCs

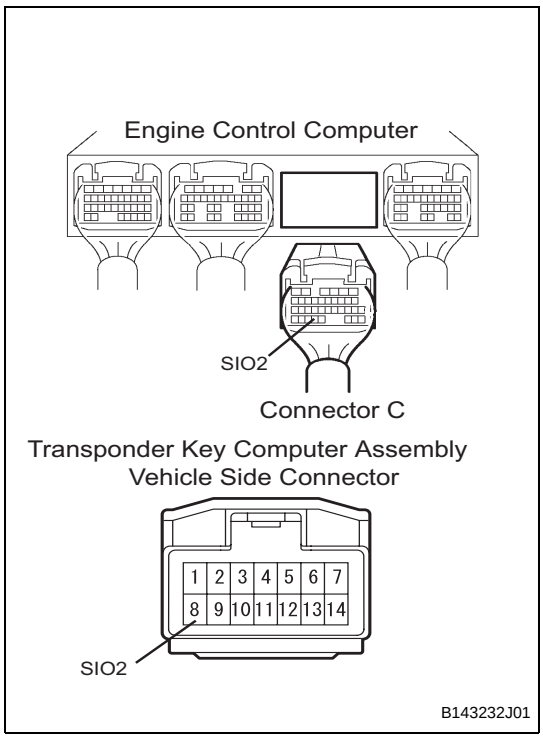
(a) Connect the DS-II to the DLC.
(b) Turn the ignition switch to the ON position, and read the DTCs by following the prompts on the DS-II screen.

Standard:
DTC P1601/81 is not output

OK → **CHECK FOR INTERMITTENT PROBLEMS**

NG

2 **CHECK WIRE HARNESS AND CONNECTOR**



(a) Disconnect the engine control computer connector C and the immobiliser ECU connector.
(b) Using a tester, check whether there is continuity or a short between the engine control computer vehicle side connector and the immobiliser ECU vehicle side connector. (For terminal layout, see page ES - 16.)
Standard

Inspection Terminal (Terminal Name) Engine Control Computer ←→ Smart ECU	Standard
117 (SIO2) ←→ 8 (SIO2)	There is continuity and no shorts between other terminals and body ground

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

OK

3 **RE-REGISTRATION (ENGINE CONTROL COMPUTER IMMOBILISER ECU**

(a) Connect the DS-II to the DLC.
(b) Delete the DTCs using the DS-II.
(c) Register the matching codes for the engine control computer and immobiliser ECU.
(d) Turn the ignition switch to the ON position, and read the DTCs by following the prompts on the DS-II screen.
Standard:
DTC P1601/81 is not output

OK → **SYSTEM RETURNS TO NORMAL**

NG

4 **REPLACE ENGINE CONTROL COMPUTER**

(a) Replace with a new or a known-good engine control computer.

(b) After replacing the engine control computer, register the keys, turn the ignition switch to the ON position, then read the DTCs.

Standard:

DTC P1601/81 is not output

OK → **SYSTEM RETURNS TO NORMAL**

NG

REPLACE TRANSPONDER KEY COMPUTER ASSEMBLY

DTC P1656/74 OCV CONTROL SYSTEM

DESCRIPTION

(See ES - 95)

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Trouble Area
P1656/39	1. IG ON 2. Short or open to camshaft timing oil control valve assembly and circuit 3. 1 second or more 4. 1 trip	• Wire harness or connector • Camshaft timing oil control valve assembly • Engine control computer

ES

CIRCUIT DIAGRAM

(See ES - 95)

INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the DS-II.Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1 **CHECK CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**

(a) Check the resistance.

(1) Using a tester, measure the resistance between the terminals.

Standard:

6.9 to 7.9 (20°C)

(b) Check operation.

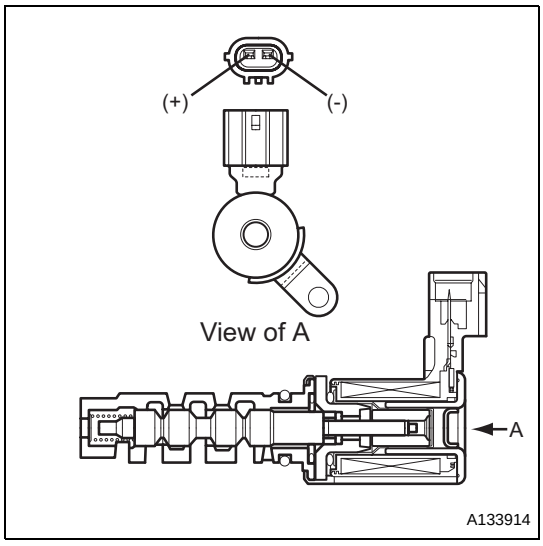
(1) Apply battery voltage across the terminals, then check that the spool valve operates.

NOTICE:

Make sure the spool valve is not stuck.

HINT:

If the spool valve does not return due to foreign matter like sludge, the pressure may leak slightly toward the advanced side. This leakage may cause DTCs to be recorded.

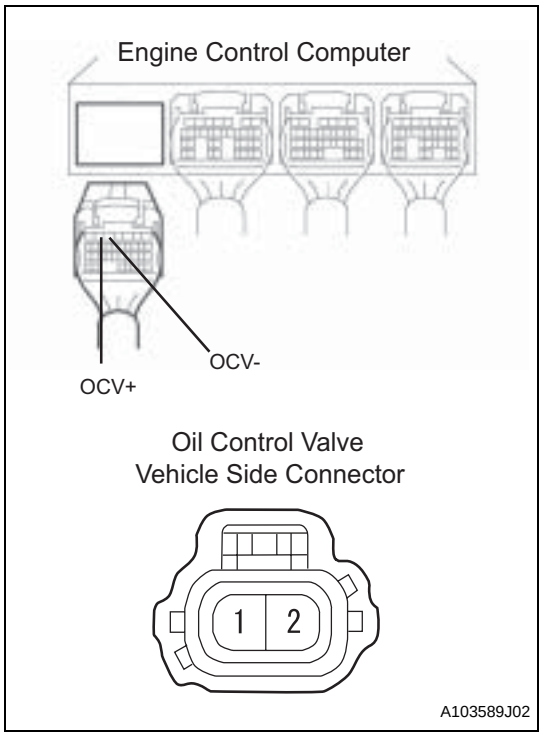


NG → **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**

OK

2 **CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY)**

(a) Disconnect the engine control computer connector A and the connector of the camshaft timing oil control valve assembly.



(b) Using a tester, check whether there is continuity or a short between the engine control computer and the camshaft timing oil control valve assembly.(For terminal layout, see page ES - 16.)

Standard

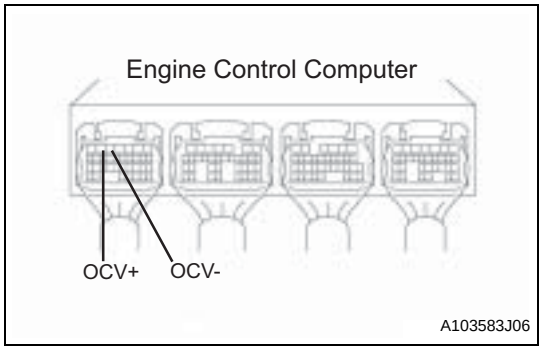
Tester Connection (Terminal Symbol) Engine Control Computer ⟷ Camshaft Timing Oil Control Valve Assembly	Standard
26 (OCV+) ⟷ 1 (+)	There is continuity and no short between the other terminals and body ground
25 (OCV-) ⟷ 2 (-)	There is continuity and no short between the other terminals and body ground

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

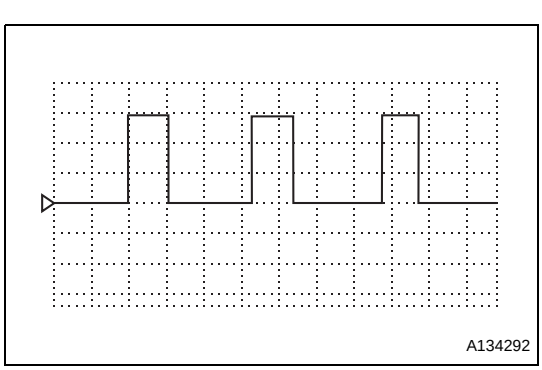
OK

3 CHECK ENGINE CONTROL COMPUTER

HINT:
The communication between the engine control computer and the cam shaft oil control valves can be checked using the oscilloscope function of the DS-II.



(a) Connect the DS-II between terminals 26 (OCV+) and 25 (OCV-) of the engine control computer connector. (For terminal layout, see page ES - 16.)



(b) Set the DS-II to the oscilloscope function. (See the DS-II instruction manual for the setting procedures.)

Item	Condition
Tester Connection	OCV+ ⟷ OCV-
Tool setting	5 V/DIV, 20 ms/DIV
Measurement Condition	While engine is idling

HINT:
As the engine speed increases, the waveform cycle becomes shorter.

NG → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

OK

CHECK FOR INTERMITTENT PROBLEMS

DTC	U0101/82	EAT / CVT COMMUNICATION (RECEPTION)

DTC	U0121/86	ABC COMMUNICATION (RECEPTION)

DTC	U0156/87	METER COMMUNICATION (RECEPTION)

DTC	U1000/85	EAT COMMUNICATION (TRANSMISSION)

ES

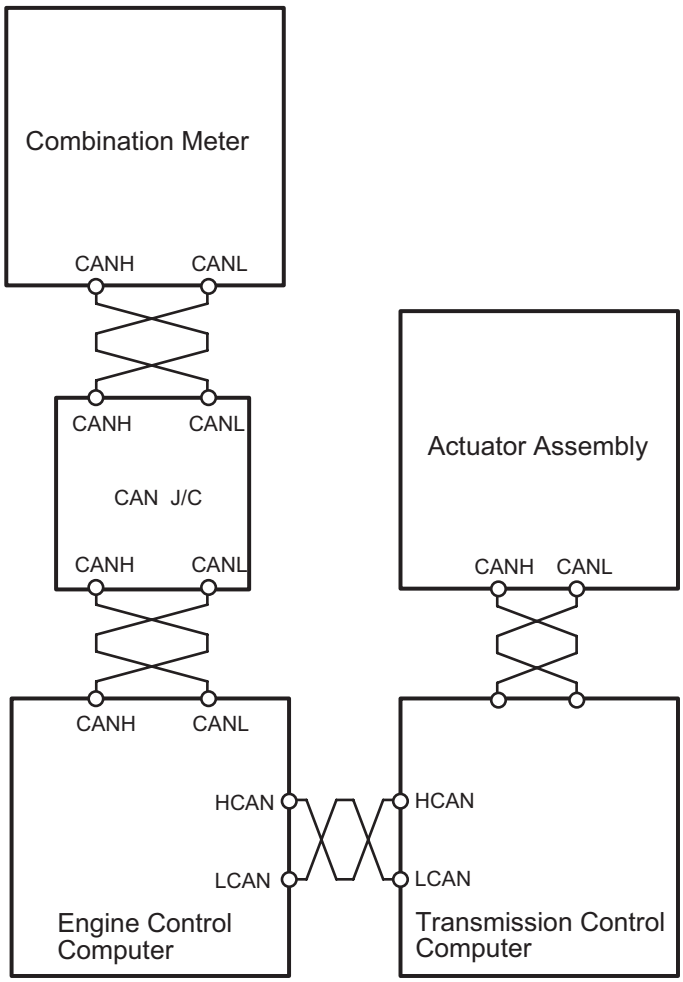
DTC	U1002/88	CAN COMMUNICATION

DESCRIPTION

Via CAN communication. the engine control computer sends and receives signals to and from the transmission control computer, the skid control computer and the combination meter.

DTC No.	DTC Detection Condition 1.Diagnosis Condition 2.Malfunction Condition 3.Malfunction Time 4.Other	Suspected Area
U0101/82	1. IG ON 2. CANH, CANL open or transmission control computer malfunction 3. 1 second 4. 1 trip	• Wire harness or connector • Transmission control computer
U0121/86	1. IG ON 2. CANH, CANL open 3. 1 second 4. 1 trip	• Wire harness or connector
U0156/87	1. IG ON 2. HCAN, LCAN open 3. 1 second 4. 1 trip	• Wire harness or connector
U1000/85	1. IG ON 2. CANH, CANL open or transmission control computer malfunction 3. 1 second 4. 1 trip	• Wire harness or connector
U1002/88	1. IG ON 2. CANH, CANL open or short 3. 1 second 4. 1 trip	• Wire harness or connector

CIRCUIT DIAGRAM



A138315J01

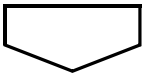
INSPECTION PROCEDURE

1	**READ DTCs**

(a) Record the output DTCs.

HINT:

When CAN communication DTCs and related sensor DTCs are detected at the same time, troubleshoot the sensor DTCs after CAN communication has returned to its normal status.



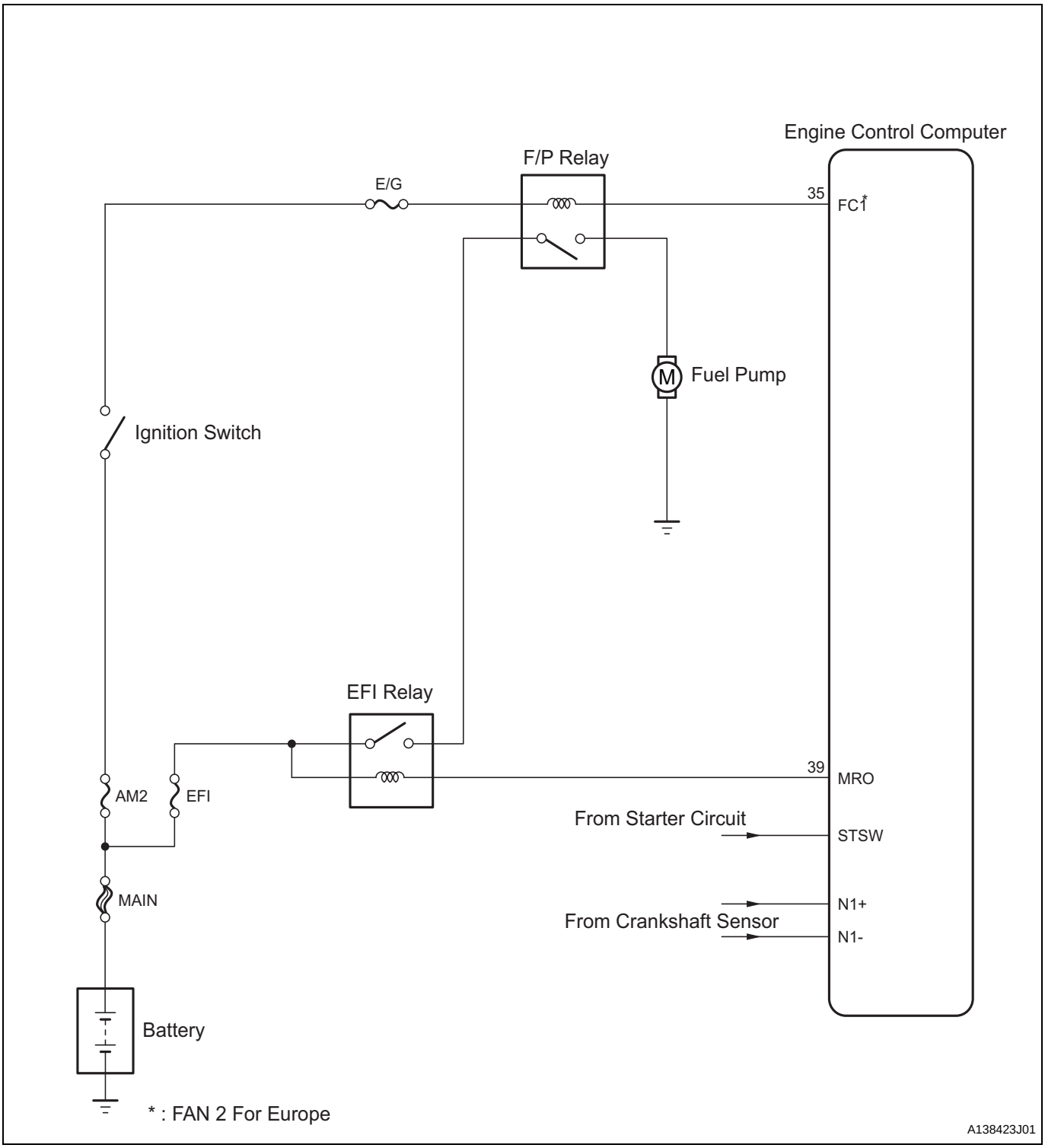
GO TO TROUBLESHOOTING FOR CAN COMMUNICATION SYSTEM

FUEL PUMP CONTROL SYSTEM

DESCRIPTION

While the engine cranks, current flows from the ST terminal of the ignition switch to the starter relay coil, and from the ST terminal to the STSW terminal (STSW signal) of the engine control computer. When the STSW signal and N1 signal are input to the engine control computer, current flows to the fuel pump relay coil via an internal transistor. This turns the relay switch turns ON. The fuel pump receives current and operates. While N1 is input (with the engine running), the fuel pump continues to operate because the transistor switch inside the engine control computer remains ON (F/P relay ON).

CIRCUIT DIAGRAM



INSPECTION PROCEDURE

1	PERFORM DS-II ACTIVE TEST (FUEL PUMP)

(a) Following the prompts on the DS-II screen, select the active test mode .

(b) Turn the ignition switch to the ON position, and perform the active test with the engine stopped.

Standard:

Fuel pump operates.

NG → **GO TO STEP 7**

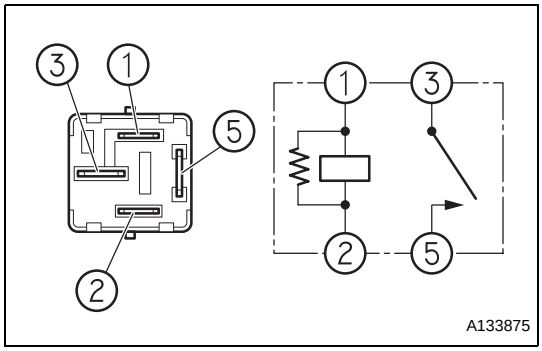
OK

2	CHECK ECU POWER SUPPLY SYSTEM

NG → **CHECK, REPAIR OR REPLACE ECU POWER SOURCE SYSTEM**

OK

3	CHECK FUEL PUMP RELAY



(a) Check for continuity.

(1) Using a tester, inspect the resistance between the terminals.

Standard

Terminals	Continuity
1←→2	Continuity
3←→5	No continuity

(2) Using a tester, make sure that there is continuity between terminals 3 and 5 when battery voltage is applied between terminals 1 and 2.

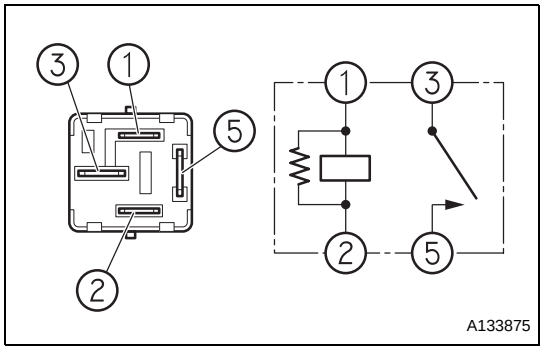
Standard:

Continuity

NG → **REPLACE FUEL PUMP RELAY**

OK

4 **CHECK EFI RELAY**



(a) Check for continuity.

(1) Using a tester, inspect the resistance between the terminals.

Standard

Terminals	Continuity
1←→2	Continuity
3←→5	No continuity

(2) Using a tester, make sure that there is continuity between terminals 3 and 5 when battery voltage is applied between terminals 1 and 2.

Standard:

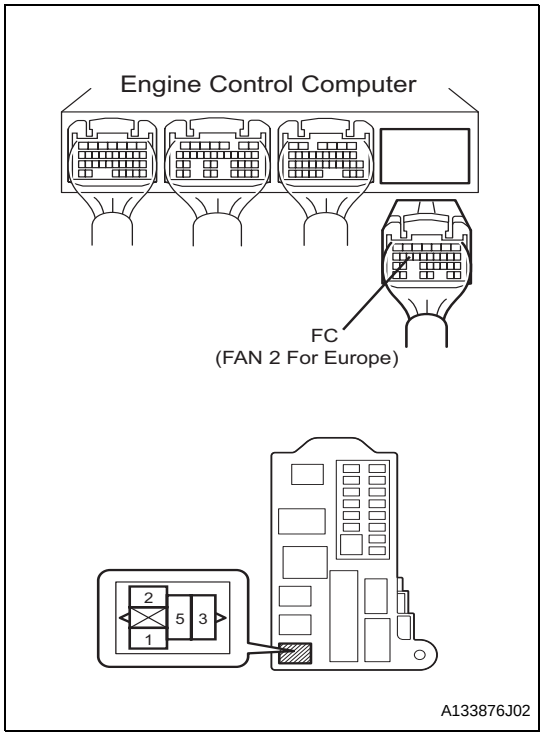
Continuity

ES

NG → **REPLACE EFI RELAY**

OK

5 **CHECK WIRE HARNESS AND CONNECTOR (ENGINE CONTROL COMPUTER F/P RELAY)**



(a) Disconnect the engine control computer connector D.

(b) Remove F/P relay.

(c) Using a tester, check for the continuity and short between the engine control computer and the relay block holder for the fuel pump relay. (For terminal layout, see page ES - 16.)

Standard:

Tester Connection (Terminal Symbol) Engine control computer ←→ Relay block holder for F/P relay	Standard
35 (FC1*) ←→ 3 terminal	Continuity and no short between other terminals and body ground

*: FAN2 for European spec.

NOTICE:

Be careful not to damage the holder part by pressing it too hard, when inspecting by applying the tester probe to the holder.

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

OK

6 **CHECK WIRING HARNESS OR CONNECTOR**

(a) Remove EFI fuse, E/G fuse and relay (fuel pump relay, EFI relay).

(b) Using a tester, check for the continuity and short between terminals of each socket.

Standard:

Tester Connection (Terminal Symbol)	Standard
F/P relay 2 terminal ←→ EFI relay 4 terminal	Continuity and no short between other terminals and body ground
F/P relay 1 terminal ←→ E/G fuse 2 terminal	Continuity and no short between other terminals and body ground
EFI relay 2 terminal ←→ EFI fuse 2 terminal	Continuity and no short between other terminals and body ground
EFI relay 1 terminal ←→ EFI fuse 2 terminal	Continuity and no short between other terminals and body ground

ES

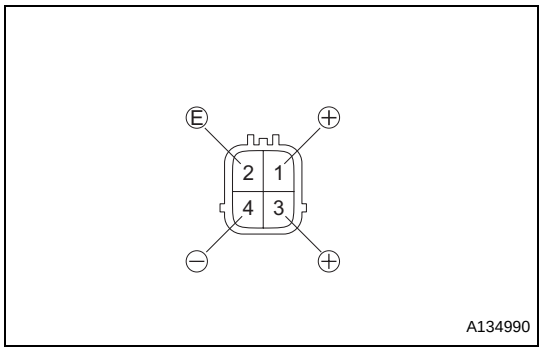
NOTICE:
Be careful not to damage the holder part by pressing it too hard, when inspecting by applying the tester probe to the holder.

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

OK

CHECK AND REPLACE ENGINE CONTROL COMPUTER

7 **CHECK FUEL PUMP**



(a) CHECK RESISTANCE
(1) Using a tester, measure the resistance between terminal 3 (+) and 4 (-) of the fuel pump connector.
Reference Value:
0.2 to 3.0 Ω (20 °C)

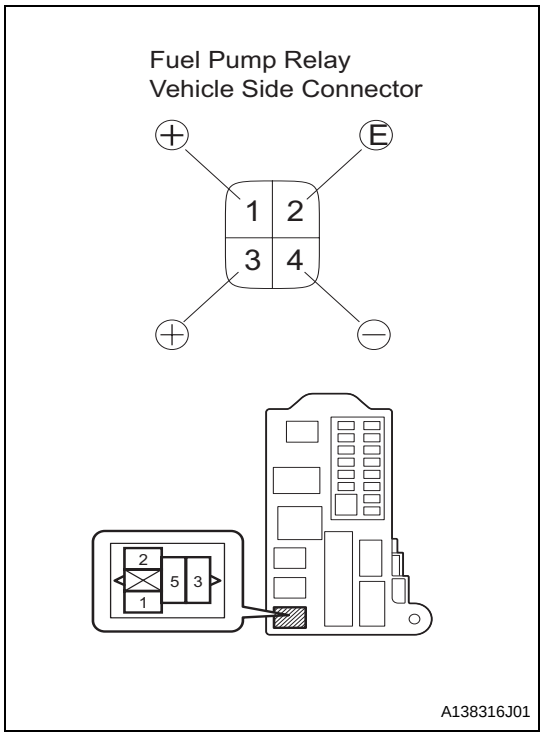
(b) CHECK OPERATION
(1) Apply the battery voltage between terminal 3 (+) and 4 (-) of the fuel pump connector, and check the motor rotates.
NOTICE:
- **Perform the check for a very short time (less than 10 seconds)**
- **Keep the pump as far away from the battery as possible.**
- **Make sure to perform the switching on the battery terminal side.**

NG → **REPLACE FUEL PUMP**

OK

8 **CHECK WIRE HARNESS OR CONNECTOR (BETWEEN EFI CIRCUIT OPENNING RELAY AND FUEL PUMP)**

(a) Disconnect the connector of fuel pump.
(b) Remove F/P relay.



(c) Using a tester, check for the continuity and short between relay block holder for F/P relay and fuel pump, and between fuel pump and body ground.

Standard

Tester Connection Relay Block Holder For EFI Relay ⟷ Fuel Pump	Standard
3⟷3(+)	There is continuity and no short between the other terminals and body ground

Tester Connection Fuel Pump ⟷ Body Ground	Standard
4 (-) ⟷ Body ground	Continuity

NOTICE:

When applying the tester probe to the holder during inspection, be careful not to damage the holder part by pressing it too hard.

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

OK

GO TO RELEVANT CIRCUIT INSPECTION SPECIFIED IN PROBLEM SYMPTOMS TABLE

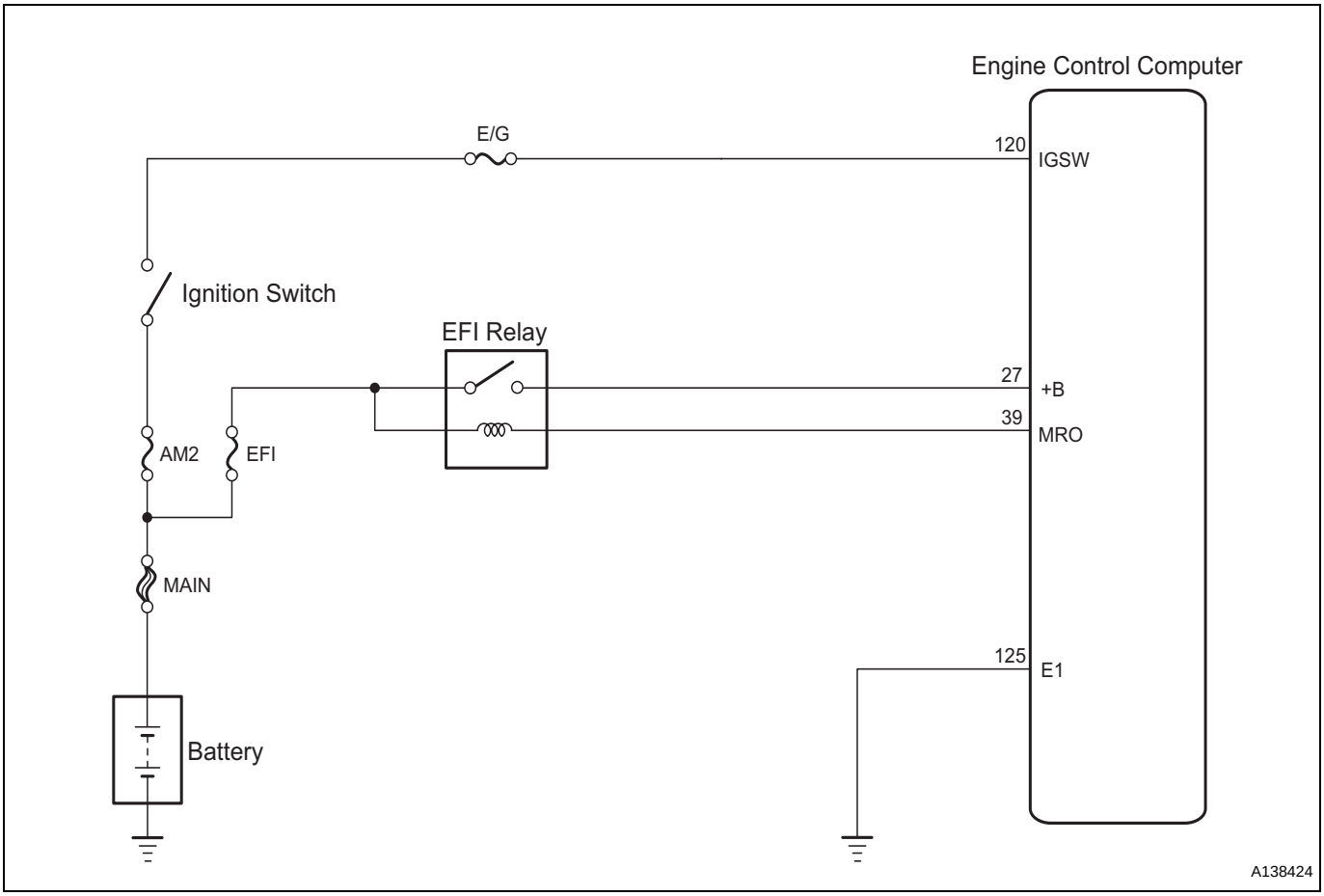
ES

ECU POWER SOURCE SYSTEM

DESCRIPTION

When the ignition switch is ON, current from the battery flows to the EFI relay coil, causing the EFI relay connection to close. Power is then supplied to the +B terminal of the engine control computer.

CIRCUIT DIAGRAM

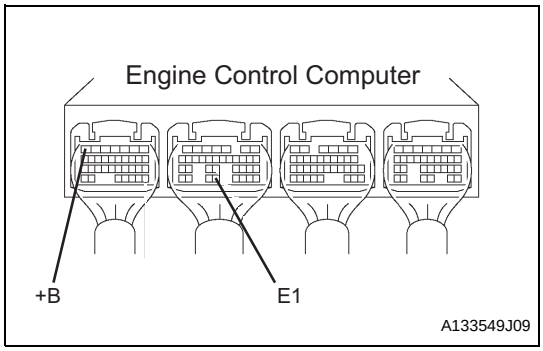


INSPECTION PROCEDURE

1	**CHECK ENGINE CONTROL COMPUTER (CHECK VOLTAGE)**

SST 09842-97209

(a) Connect the SST (sub harness, EFI computer check) to the engine control computer.



(b) Turn the ignition switch to the ON position.
(c) Measure the voltage between the terminals of the engine control computer connector using a tester.(For terminal layout, see page ES - 16.)

Standard

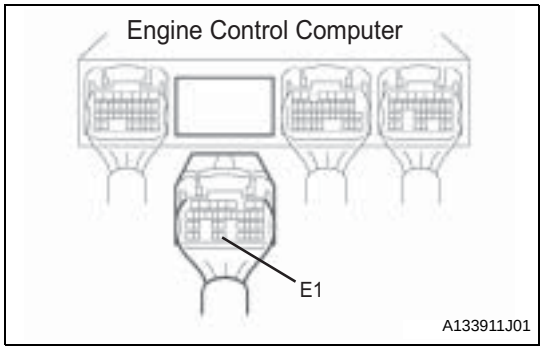
Tester Connection (Terminal Symbol)	Standard
27 (+B) ←→ 125 (E1)	10 to 14V

OK → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

NG

ES

2 CHECK WIRE HARNESS OR CONNECTOR (ECU GROUND)



(a) Disconnect the negative battery terminal.
(b) Disconnect connector B of the engine control computer.
(c) Measure the voltage between the engine control computer and the body ground using the tester. (For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol)	Standard
125 (E1) ←→ Body ground	Continuity

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

OK

3 CHECK ENGINE CONTROL COMPUTER (CHECK VOLTAGE)

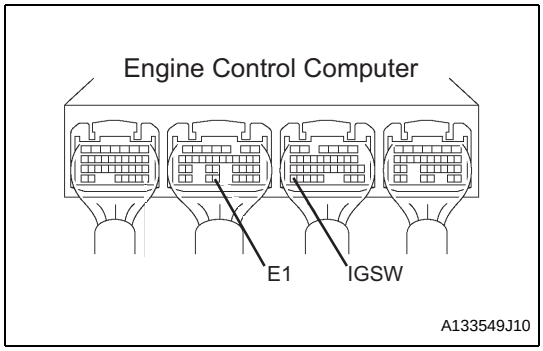
SST 09842-97209

(a) Connect the SST (sub harness, EFI computer check) to the engine control computer.
(b) Turn the ignition switch to the ON position.
(c) Measure the voltage between the terminals of the engine control computer connector using a tester. (For terminal layout, see page ES - 16.)

Standard

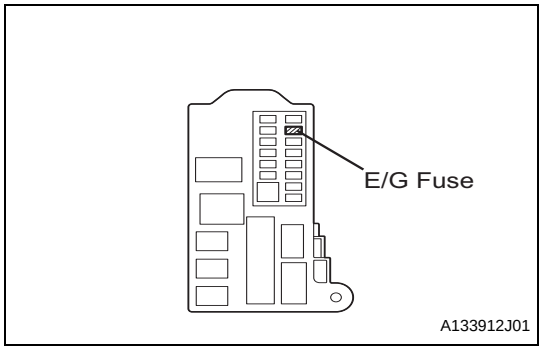
Tester Connection (Terminal Symbol)	Standard
120 (IGSW) ←→ 125 (E1)	9 to 14 V

OK → **GO TO STEP 7**



NG

4	INSPECT FUSE (E/G)

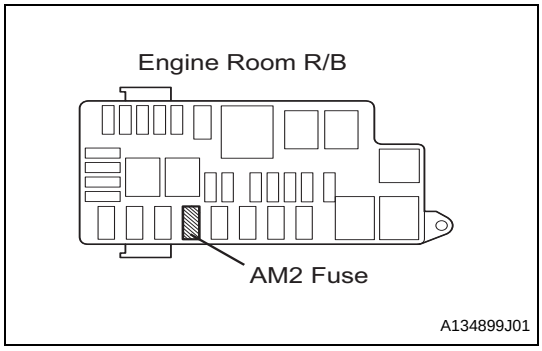


(a) Remove the E/G fuse, and check for continuity using a tester.
Standard:
Continuity

NG → **CHECK ALL WIRE HARNESSES AND DEVICES CONNECTED TO IGN FUSE**

OK

5	INSPECT FUSE (AM2)

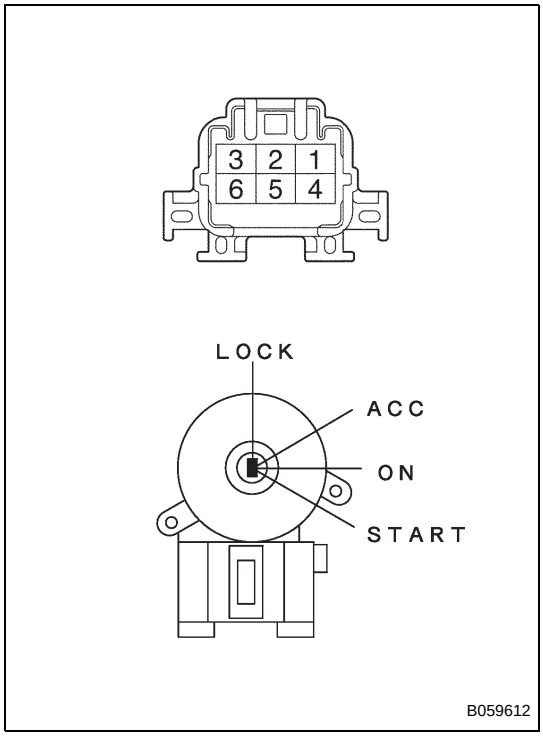


(a) Remove the AM2 fuse, and check for continuity using a tester.
Standard:
Continuity

NG → **CHECK ALL WIRE HARNESSES AND DEVICES CONNECTED TO AM2 FUSE**

OK

6 INSPECTION OF IGNITION (STARTER) SWITCH ASSEMBLY



(a) Check for continuity.

(1) Using the tester, check the continuity between each of the connecter terminals.

Standard

Switch	Terminal No.	Standard
LOCK	-	No continuity
ACC	Terminal 1 ←→ Terminal 3	Continuity
ON	Terminal 1 ←→ terminal 2 ←→ terminal 3, terminal 5 ←→ terminal 6	Continuity
START	Terminal 1 ←→ terminal 2, terminal 4 ←→ terminal 5 ←→ terminal 6	Continuity

ES

NG → **REPLACE IGNITION (STARTER) SWITCH ASSEMBLY**

OK

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

7 CHECK ENGINE CONTROL COMPUTER (CHECK VOLTAGE)

SST 09842-97209

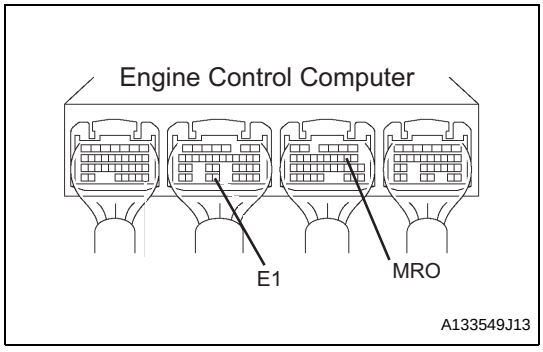
(a) Connect the SST (sub harness, EFI computer check) to the engine control computer.

(b) Turn the ignition switch to the ON position.

(c) Measure the voltage between the terminals of the engine control computer connector using a tester. (For terminal layout, see page ES - 16.)

Standard

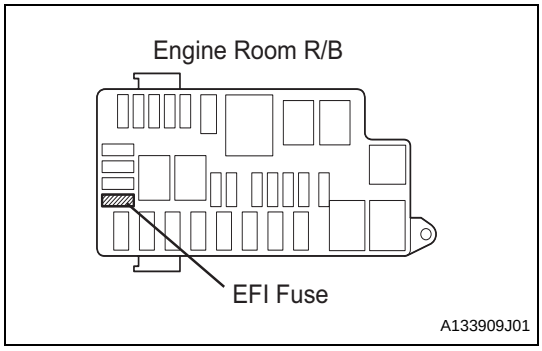
Tester Connection (Terminal Symbol)	Standard
39 (MRO) ←→ 125 (E1)	9 to 14 V



NG → **CHECK AND REPLACE ENGINE CONTROL COMPUTER**

OK

8 **INSPECT FUSE (EFI)**



(a) Remove the EFI fuse from the engine room R/B, and check for continuity using a tester.

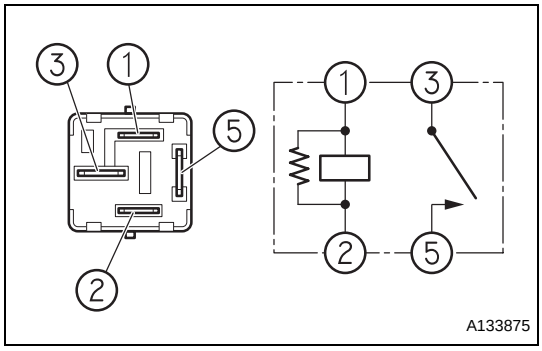
Standard:

Continuity

NG → **CHECK ALL WIRE HARNESSES AND DEVICES CONNECTED TO EFI FUSE**

OK

9 **CHECK EFI COMPUTER RELAY**



(a) Check for continuity.

(1) Using a tester, inspect the resistance between the terminals.

Standard

Terminals	Continuity
1←→2	Continuity
3←→5	No continuity

(2) Using a tester, make sure that there is continuity between terminals 3 and 5 when battery voltage is applied between terminals 1 and 2.

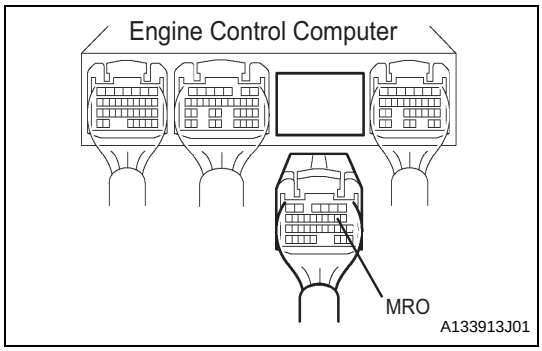
Standard:

Continuity

NG → **REPLACE EFI COMPUTER RELAY**

OK

10 **CHECK WIRE HARNESS OR CONNECTOR (BETWEEN MRO AND GROUND)**



(a) Disconnect the negative battery terminal.

(b) Disconnect connector C of the engine control computer.

(c) Measure the continuity between the engine control computer terminal and the body ground using the tester. (For terminal layout, see page ES - 16.)

Standard

Tester Connection (Terminal Symbol)	Standard
39 (MRO) ←→ Body ground	Continuity

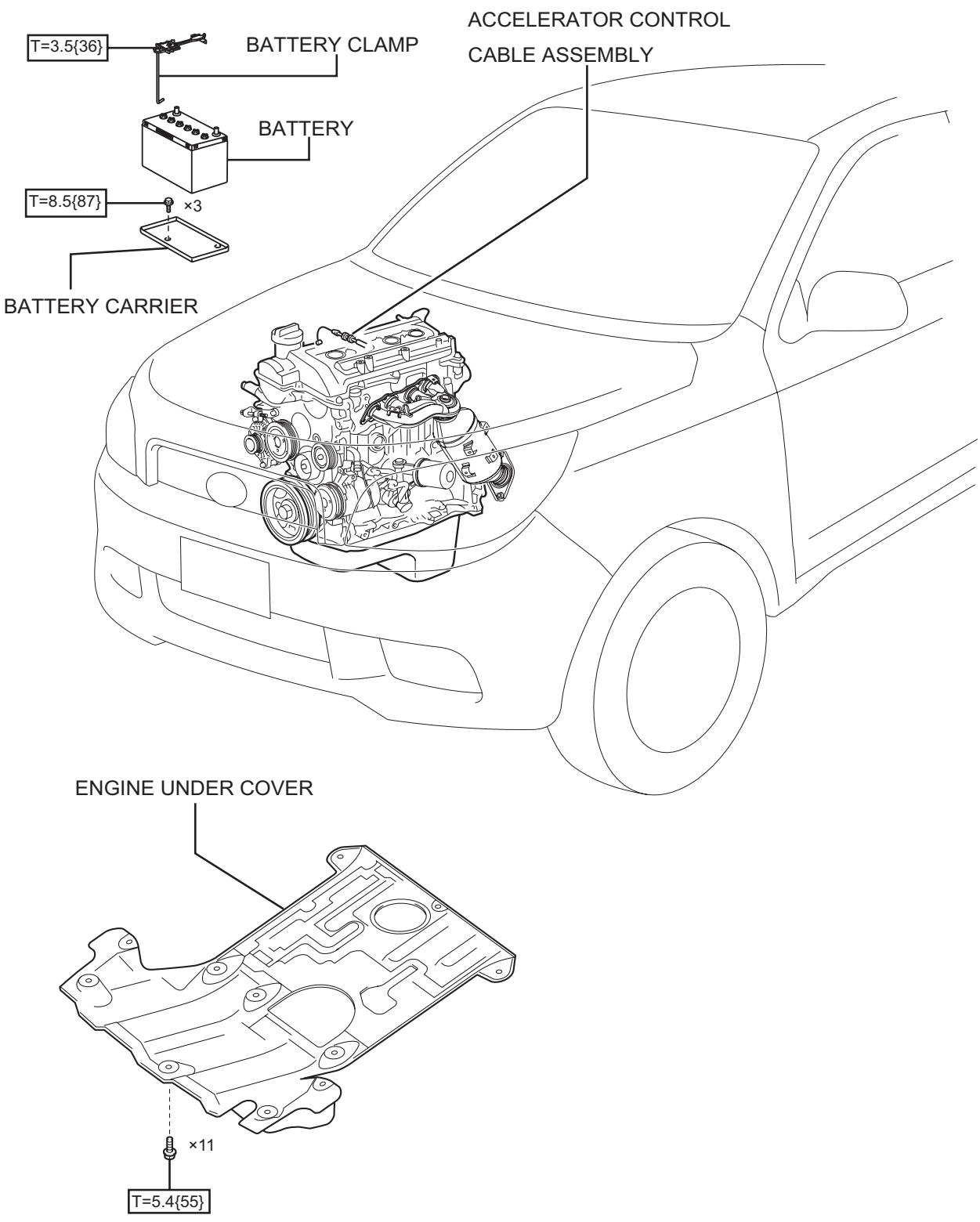
NG → **REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR**

OK

CHECK FOR INTERMITTENT PROBLEMS

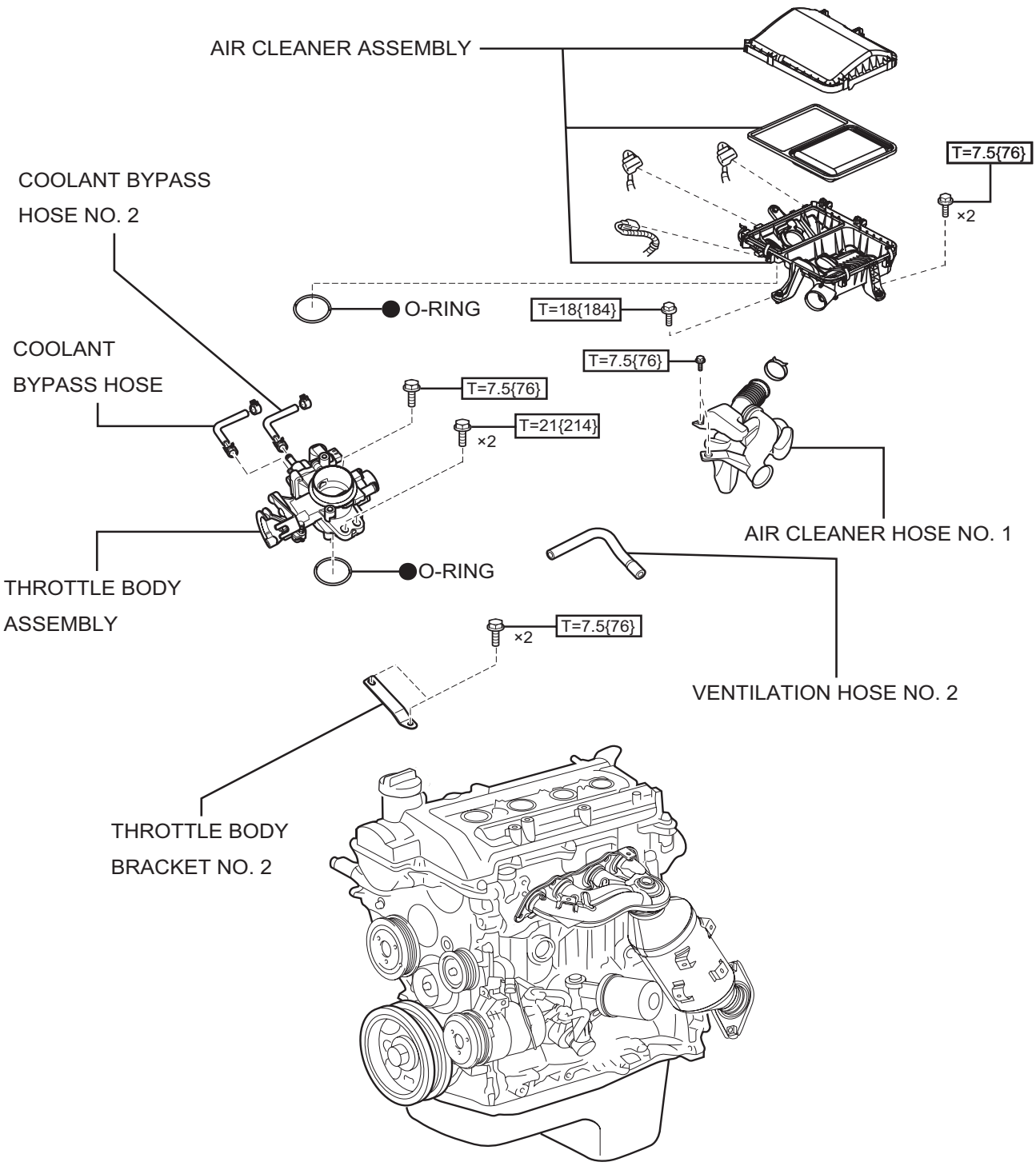
THROTTLE BODY ASSEMBLY (3SZ-VE)

COMPONENTS



A137009J01

ES

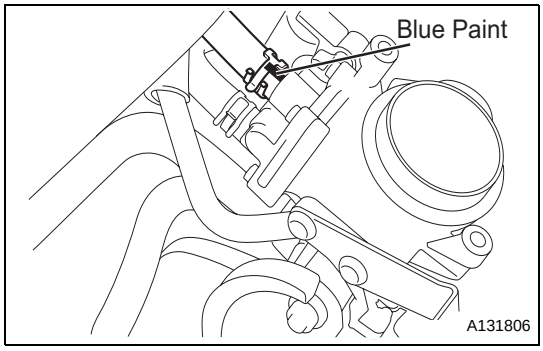


□ ····· TIGHTENING TORQUE [N*m{kgf*cm}] ● ····· NON-REUSEABLE PART

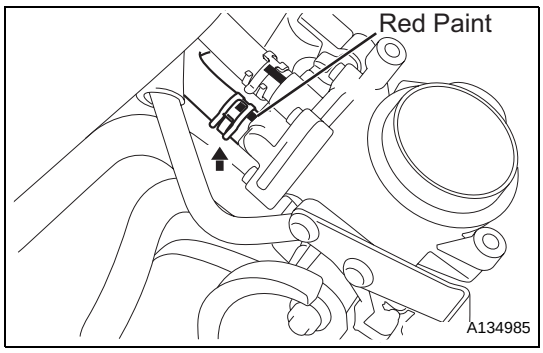
A137008J02

REMOVAL

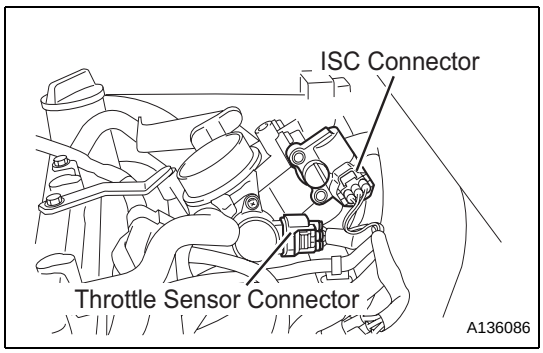
1. **DISCONNECT NEGATIVE BATTERY TERMINAL**
   (See page RS-164.)
2. **REMOVE ENGINE UNDER COVER**
3. **DRAIN ENGINE COOLANT (See page CO-9)**
4. **REMOVE AIR CLEANER HOSE NO.1 (See page CO-15)**
5. **REMOVE AIR CLEANER ASSEMBLY (See page EM-146)**
6. **DISCONNECT ACCELERATOR CONTROL CABLE ASSEMBLY (See page EM-147)**
7. **REMOVE VENTILATION HOSE NO.2 (See page EM-147)**
8. **DISCONNECT WATER BY-PASS HOSE**
   (a) Disengage the clamps and disconnect the water by-pass hose.

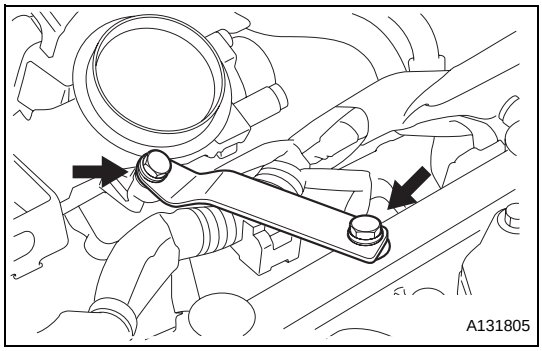


9. **DISCONNECT WATER BY-PASS HOSE NO.2**
   (a) Disengage the clamps and disconnect water by-pass hose No.2.



10. **REMOVE THROTTLE BODY ASSEMBLY**
    (a) Disconnect the connector of the throttle body assembly and the wire harness clamps.





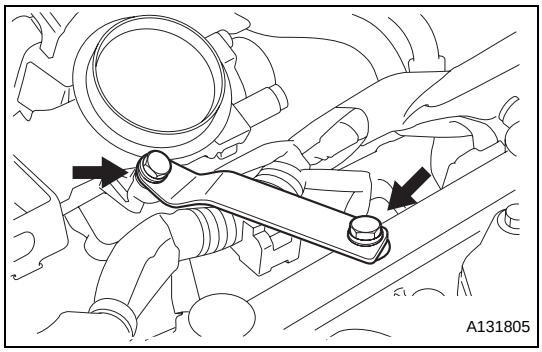
(b) Remove the 2 bolts and throttle body bracket No.2.
(c) Remove the 3 bolts and the throttle body assembly.
(d) Remove the O-rings.

ES

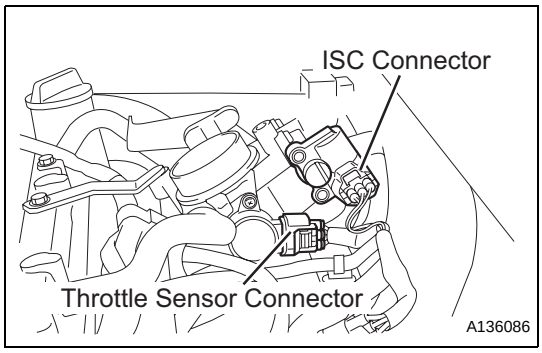
INSTALLATION

1. INSTALL THROTTLE BODY ASSEMBLY

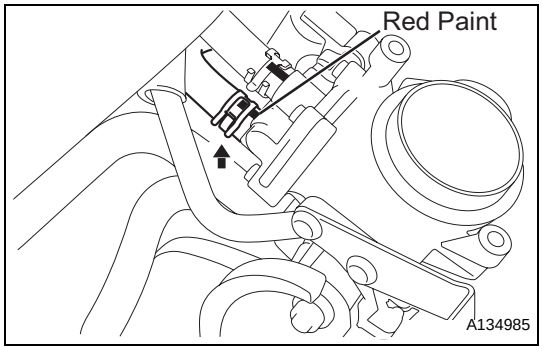
(a) Install a new O-ring.
(b) Install the throttle body assembly with the 3 bolts.
Torque: 21 N*m (214 kgf*cm) Throttle body bracket side
7.5 N*m (77 kgf*cm) Intake manifold side



(c) Install throttle body bracket No.2 with the 2 bolts.
Torque: 7.5 N*m (76 kgf*cm)

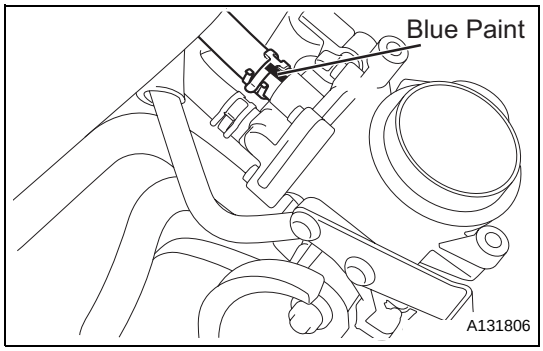


(d) Connect the connectors to the throttle body assembly.



2. CONNECT WATER BY-PASS HOSE

(a) Connect the water by-pass hose and install the clamp.



3. **CONNECT WATER BY-PASS HOSE NO.2**
   (a) Connect water by-pass hose No.2 and install the clamp.
4. **INSTALL VENTILATION HOSE NO.2 (See page EM-166)**
5. **INSTALL ACCELERATOR CONTROL CABLE ASSEMBLY (See page EM-165)**
6. **INSTALL AIR CLEANER ASSEMBLY (See page EM-167)**
7. **INSTALL AIR CLEANER HOSE NO.1 (See page CO-19)**
8. **ADD COOLANT (See page CO-9)**
9. **CHECK FOR COOLANT LEAKS (See page CO-10)**
10. **INSTALL ENGINE UNDER COVER (See page EM-69)**
11. **CONNECT NEGATIVE BATTERY TERMINAL**
    Torque: 5.4 N*m (55 kgf*cm)
12. **PERFORM INTIALIZATION**
    (See page SS-10.)

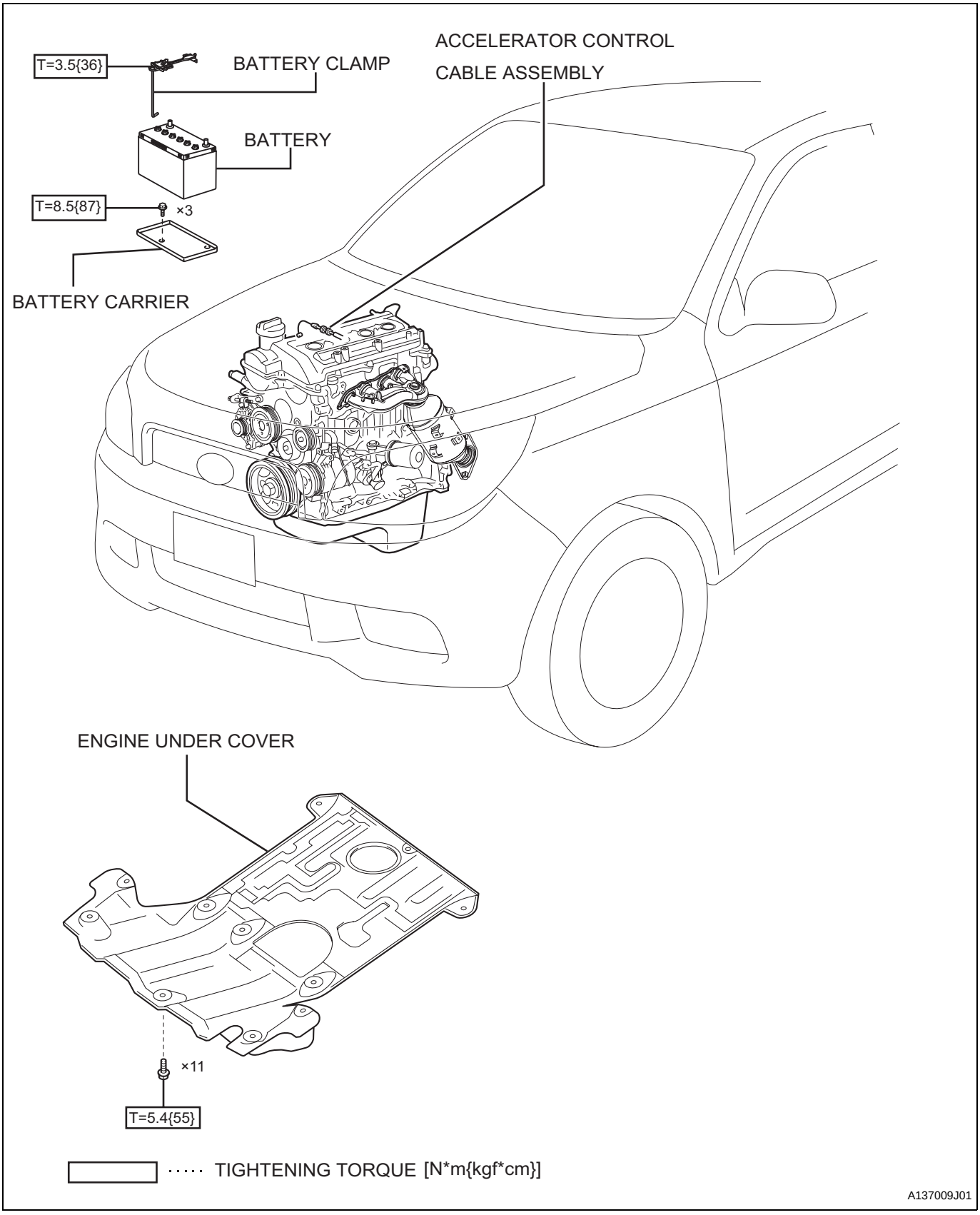
ES

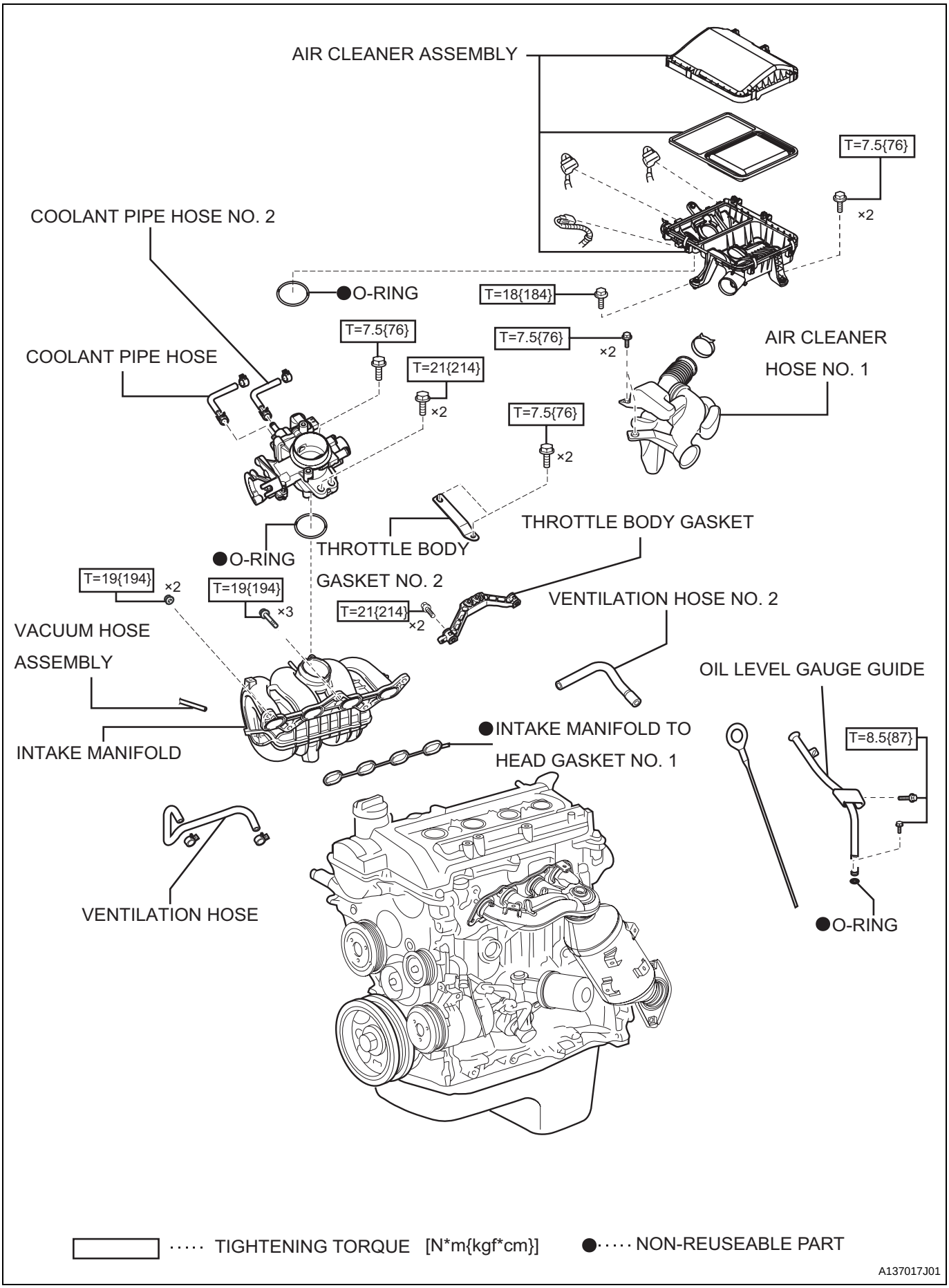
INSPECTION

1. **INSPECT THROTTLE BODY ASSEMBLY**
   (a) Check that the throttle shaft is not loose.
   (b) Check that none of the ports is clogged.
   (c) Check that the throttle valve can open and close smoothly.
   (d) Check that there is no clearance between the throttle stop screw and the lever when the throttle valve is fully open.

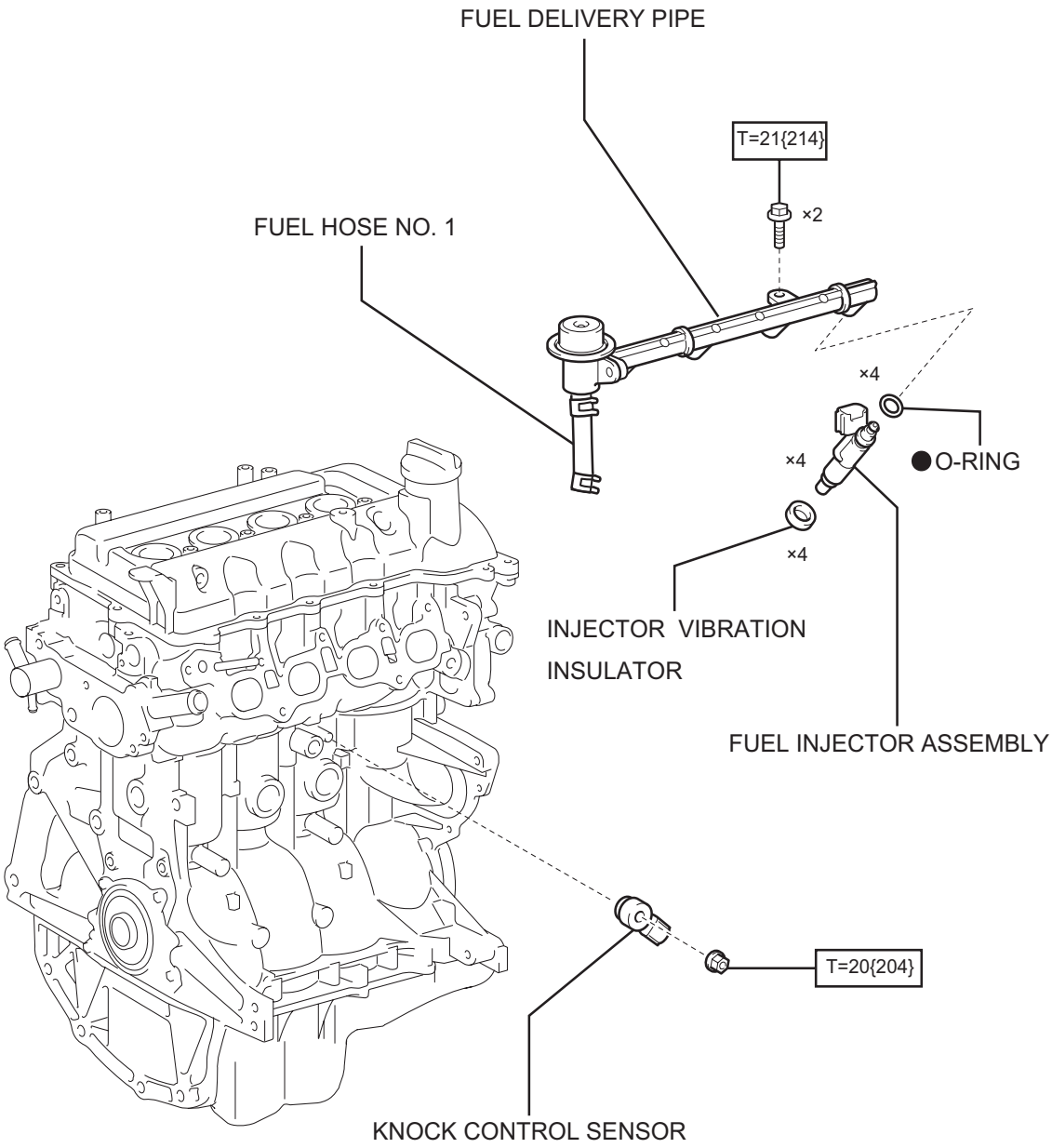
KNOCK CONTROL SENSOR (3SZ-VE)

COMPONENTS




AIR CLEANER ASSEMBLY
T=7.5{76}
×2
COOLANT PIPE HOSE NO. 2
●O-RING
T=18{184}
T=7.5{76}
T=7.5{76}
×2
AIR CLEANER
HOSE NO. 1
COOLANT PIPE HOSE
T=21{214}
×2
T=7.5{76}
×2
THROTTLE BODY GASKET
●O-RING
THROTTLE BODY
GASKET NO. 2
T=19{194}
×2
T=19{194}
×3
T=21{214}
×2
VENTILATION HOSE NO. 2
VACUUM HOSE
ASSEMBLY
OIL LEVEL GAUGE GUIDE
●INTAKE MANIFOLD TO
HEAD GASKET NO. 1
T=8.5{87}
INTAKE MANIFOLD
VENTILATION HOSE
●O-RING
TIGHTENING TORQUE [N*m{kgf*cm}]
●····· NON-REUSEABLE PART
A137017J01

ES

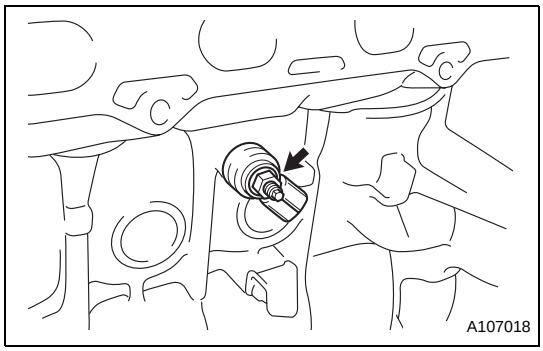


□ ····· TIGHTENING TORQUE [N*m{kgf*cm}] ● ····· NON-REUSEABLE PART

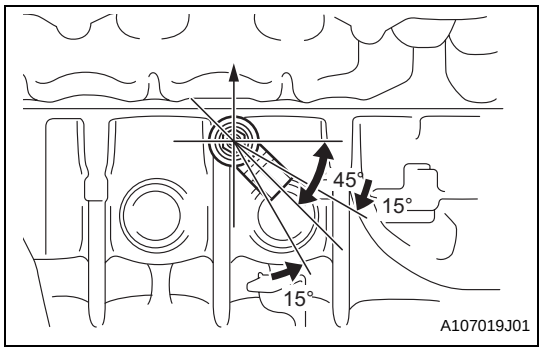
A137018J01

REMOVAL

1. **DISCONNECT NEGATIVE BATTERY TERMINAL**
   (See Page RS-164)
2. **DRAIN ENGINE COOLANT (See page CO-9)**
3. **DISCHARGE FUEL SYSTEM PRESSURE (See page EM-146)**
4. **REMOVE BATTERY**
5. **REMOVE BATTERY CARRIER (See page EM-146)**
6. **REMOVE ENGINE UNDER COVER**
7. **REMOVE AIR CLEANER HOSE NO.1 (See page CO-15)**
8. **REMOVE AIR CLEANER ASSEMBLY (See page EM-146)**
9. **DISCONNECT ACCELERATOR CONTROL CABLE ASSEMBLY (See page EM-147)**
10. **REMOVE VENTILATION HOSE (See page EM-147)**
11. **REMOVE VENTILATION HOSE NO.2 (See page EM-147)**
12. **DISCONNECT FUEL HOSE NO.1 (See page FU-10)**
13. **REMOVE FUEL DELIVERY PIPE (See page FU-10)**
14. **DISCONNECT WATER BY-PASS HOSE NO.2 (See page ES-127)**
15. **DISCONNECT WATER BY-PASS HOSE (See page ES-127)**
16. **REMOVE THROTTLE BODY ASSEMBLY (See page ES-127)**
17. **REMOVE THROTTLE BODY BRACKET (See page EM-149)**
18. **REMOVE OIL LEVEL GAUGE GUIDE (See page EM-148)**
19. **DISCONNECT VACUUM HOSE ASSEMBLY**
20. **REMOVE INTAKE MANIFOLD (See page EM-149)**
21. **REMOVE KNOCK CONTROL SENSOR**
    (a) Disconnect the connector.
    (b) Remove the nut, then remove the knock control sensor.

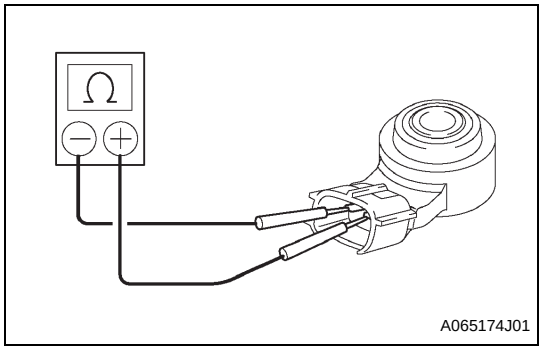


INSTALLATION



1. **INSTALL KNOCK CONTROL SENSOR**
   (a) Install the knock control sensor with the nut in the direction shown in the illustration.
   Torque: 20 N*m (204 kgf*cm)
   (b) Connect the connector.
2. **INSTALL INTAKE MANIFOLD (See page EM-164)**
3. **INSTALL THROTTLE BODY ASSEMBLY (See page EM-164)**
4. **INSTALL FUEL INJECTOR ASSEMBLY (See page FU-11)**
5. **INSTALL FUEL DELIVERY PIPE (See page FU-11)**
6. **INSTALL OIL LEVEL GAUGE GUIDE (See page EM-58)**
7. **CONNECT FUEL HOSE NO.1 (See page FU-12)**
8. **CONNECT ACCELERATOR CONTROL CABLE ASSEMBLY (See page EM-165)**
9. **INSTALL VENTILATION HOSE (See page EM-166)**
10. **INSTALL VENTILATION HOSE NO.2 (See page EM-166)**
11. **INSTALL BATTERY CARRIER (See page EM-167)**
12. **INSTALL BATTERY**
13. **CONNECT NEGATIVE BATTERY TERMINAL (See page EM-167)**
14. **INSTALL AIR CLEANER ASSEMBLY (See page EM-167)**
15. **INSTALL AIR CLEANER HOSE NO.1 (See page CO-19)**
16. **ADD COOLANT (See page CO-9)**
17. **CHECK FOR COOLANT LEAKS (See page CO-10)**
18. **CHECK COOLANT (See page CO-10)**
19. **PERFORM INITIALIZATION**
    (See page SS-10**.)**

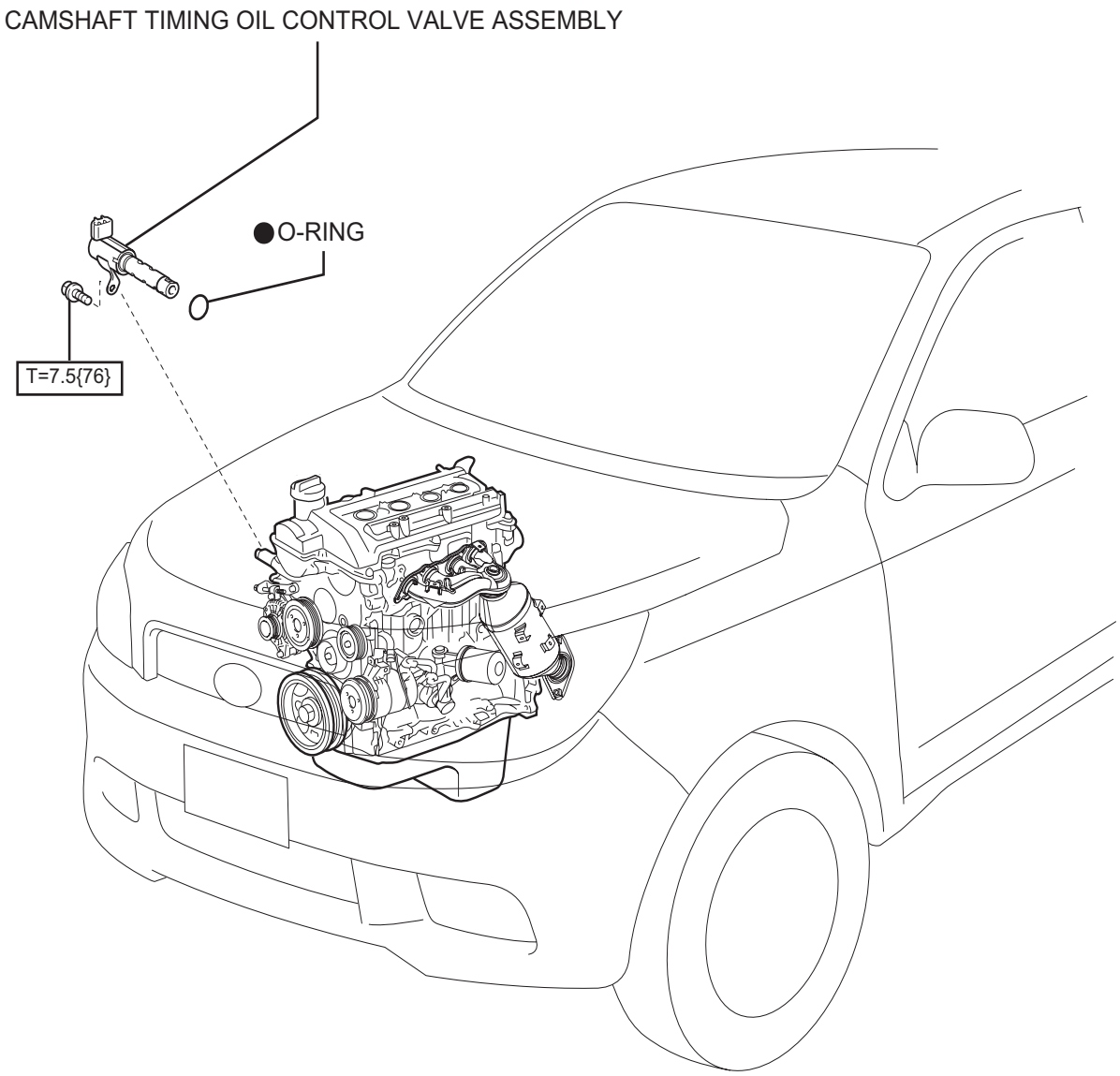
INSPECTION



1. **CHECK KNOCK CONTROL SENSOR**
   (a) Check the resistance.
      (1) Using a tester, measure the resistance between the connector terminals.
      Standard:
      120 to 280 Ω

CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (3SZ-VE)

COMPONENTS

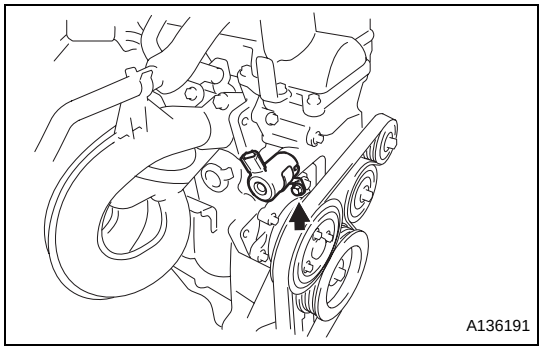


REMOVAL

1. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Disconnect the connector.

(b) Remove the bolt, then remove the camshaft timing oil control valve assembly.



INSTALLATION

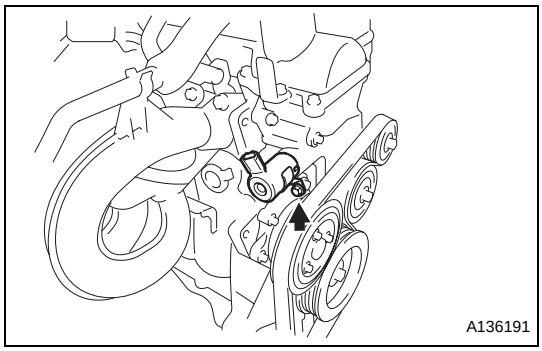
1. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Apply engine oil to a new O-ring.

(b) Install the camshaft timing oil control valve assembly with the bolt.

Torque: 7.5 N*m (76 kgf*cm)

(c) Connect the connector.



ON-VEHICLE INSPECTION

1. CHECK CAMSHAFT OIL CONTROL VALVE ASSEMBLY OPERATION

(a) Connect the DS-II to the DLC.

(b) Warm up the engine.

(c) Following the prompts on the screen, select ACTIVE TEST, then VVT CONTROL and check the idling speed in both the INACTIVE or ACTIVE modes.

Standard

Item	Standard
Inactive (OCV OFF)	**Normal engine speed**
Active (OCV ON)	**Rough idle or engine stop**

(d) Following the prompts on the screen, select ACTIVE TEST, then VVT LINEAR DRIVE BANK 1 and check the idling speed at the max retard angle (-100%).

Standard

Item	Standard
When normal	**Normal engine speed**
Max retard angle (-100%)	**Rough idle or engine stop**

INSPECTION

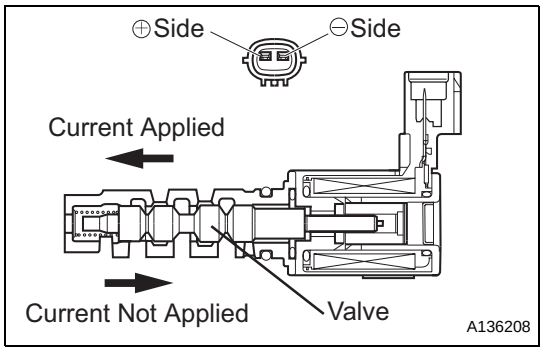
1. CHECK CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Check the resistance.

(1) Using a tester, measure the resistance between the terminals.

Standard:

6.9 to 7.9 Ω (when 20°C)



(b) Check operation.

(1) Apply battery voltage across the terminals, then check that the spool valve operates.

NOTICE:

Make sure the spool valve is not stuck.

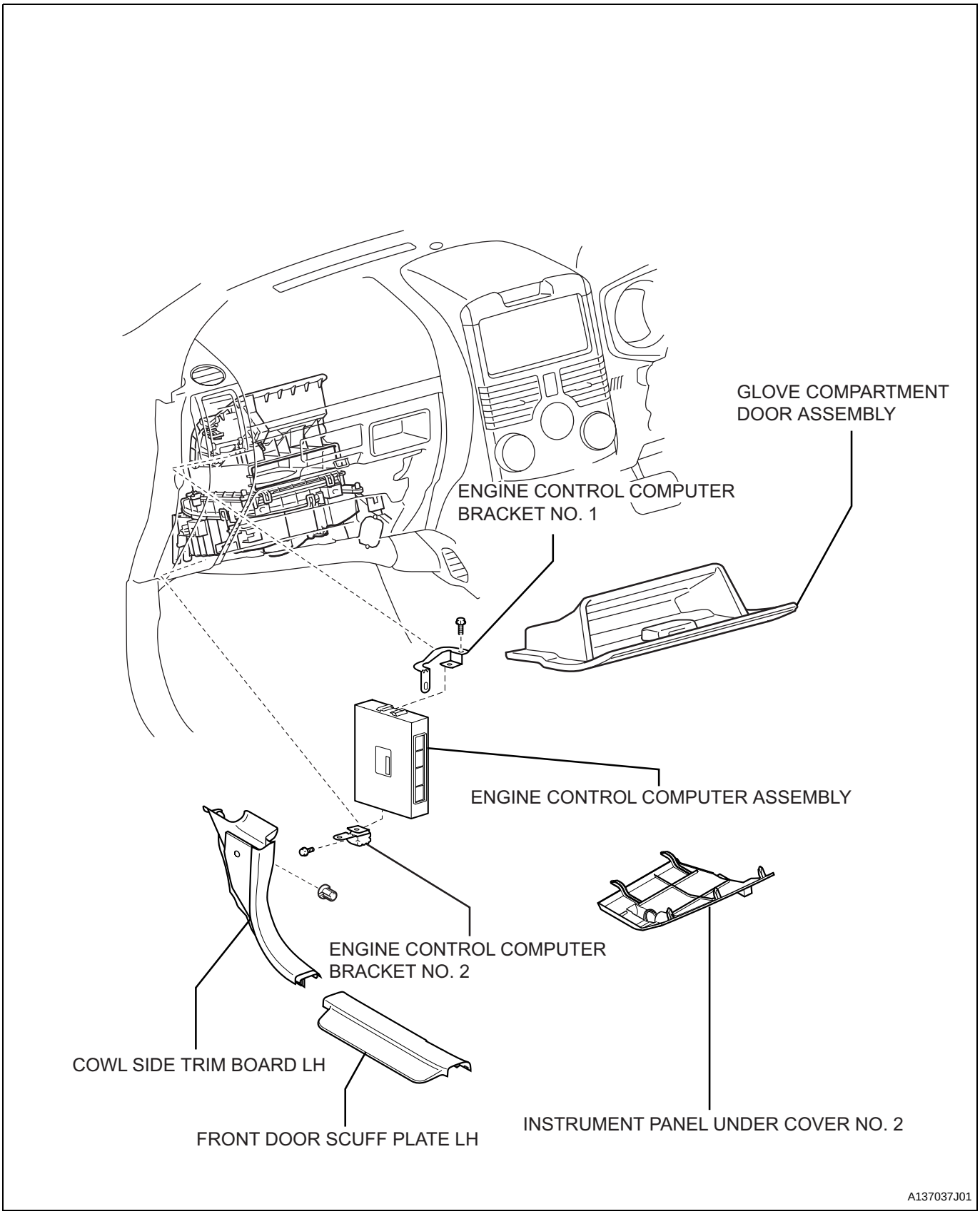
HINT:

If the spool valve does not return due to foreign matter like sludge, the pressure may leak slightly toward the advanced side. This leakage may cause DTCs to be recorded.

ENGINE CONTROL COMPUTER (3SZ-VE)

COMPONENTS

ES



REMOVAL

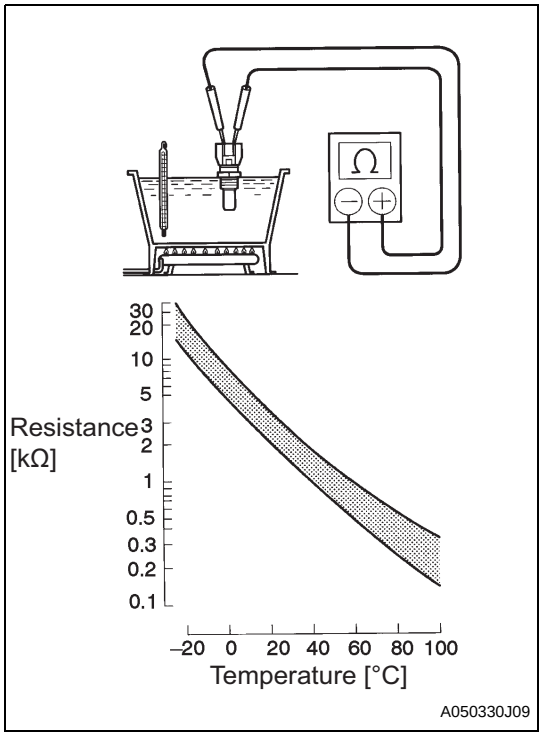
1. **DISCONNECT NEGATIVE BATTERY TERMINAL**
   (See page RS-164.)
2. **REMOVE GLOVE COMPARTMENT DOOR ASSEMBLY (See page IP-11)**
3. **INSTALL INSTRUMENT PANEL UNDER COVER NO.2 (See page IP-12)**
4. **REMOVE FRONT DOOR SCUFF PLATE LH**
5. **REMOVE COWL SIDE TRIM BOARD LH**
6. **REMOVE ENGINE CONTROL COMPUTER**
   (a) Remove each connector.
   (b) Remove the 2 bolts and the engine control computer.
   NOTICE:
   Be careful not to drop the engine control computer.
7. **REMOVE ENGINE CONTROL COMPUTER BRACKET NO.1**
   (a) Disengage the claw and remove engine control computer bracket No.1 from the engine control computer.
8. **REMOVE ENGINE CONTROL COMPUTER BRACKET NO.2**
   (a) Disengage the claw and remove engine control computer bracket No.2 from the engine control computer.

INSTALLATION

1. **INSTALL ENGINE CONTROL COMPUTER BRACKET NO.2**
   (a) Install engine control computer bracket No.2 to the engine control computer.
2. **INSTALL ENGINE CONTROL COMPUTER BRACKET NO.1**
   (a) Install engine control computer bracket No.1 to the engine control computer
3. **INSTALL ENGINE CONTROL COMPUTER**
   (a) Install the engine control computer with the 2 bolts.
   (b) Connect each connector.
4. **INSTALL COWL SIDE TRIM BOARD LH**
5. **INSTALL FRONT DOOR SCUFF PLATE LH**
6. **INSTALL INSTRUMENT PANEL UNDER COVER NO.2 (See page IP-17)**
7. **INSTALL GLOVE COMPARTMENT DOOR ASSEMBLY (See page IP-18)**
8. **CONNECT NEGATIVE BATTERY TERMINAL**
   Torque: 5.4 N*m (55 kgf*cm)
9. **PERFORM INITIALIZATION**
   (See page SS-10.)

E.F.I. WATER TEMPERATURE (3SZ-VE)

INSPECTION



1. CHECK EFI COOLANT TEMPERATURE

(a) Check the resistance.

(1) Using a tester, measure the resistance between the terminals.

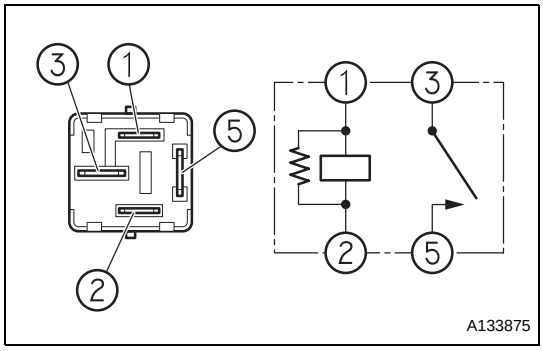
Standard

Measurement Condition	Standard
When approx. 20°C	2.32 to 2.59 kΩ
When approx. 80°C	0.310 to 0.326 kΩ

NOTICE:

Make sure that the terminal area does not get wet when applying the sensor to water during inspection.Wipe the sensor dry after the check.

E.F.I. COMPUTER RELAY (3SZ-VE)



INSPECTION

1. EFI COMPUTER RELAY

(a) Check for continuity.

(1) Using the SST (electrical tester), check the continuity between the terminals of the connector.

Standard

Terminals	Continuity
1←→2	Continuity
3←→5	No continuity

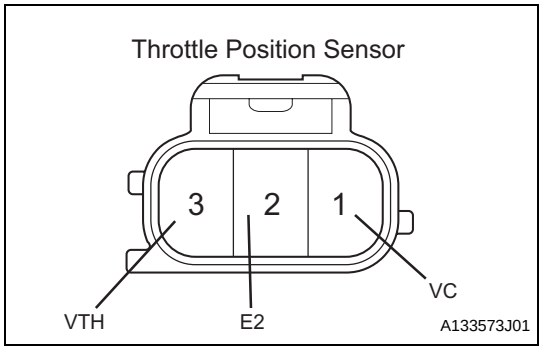
(2) Using a tester, make sure that there is continuity between terminals 3 and 5 when battery voltage is applied between terminals 1 and 2.

Standard:

Continuity

ES

THROTTLE POSITION SENSOR (3SZ-VE)



INSPECTION

1. CHECK RESISTANCE

(a) Disconnect the throttle position sensor connector.

(b) Using a tester, measure the resistance between the throttle position sensor connector terminals.

Standard

Tester Connection (Terminal Symbol)	Throttle Valve	Resistance
1 (VC) ⟷ 3 (VTH)	-	2.5 to 5.9 kΩ
3 (VTH) ⟷ 2 (E2)	Fully Closed	0.2 to 5.7 kΩ
3 (VTH) ⟷ 2 (E2)	Fully open	2.0 to 10.2 kΩ