HOW TO USE THIS MANUAL

IN01F–08

GENERAL INFORMATION

1. INDEX

An INDEX is provided on the first page of each section to guide you to the item to be repaired. To assist you in finding your way through the manual, the Section Title and major heading are given at the top of every page.

2. GENERAL DESCRIPTION

At the beginning of each section, a General Description is given that pertains to all repair operations contained in that section.

Read these precautions before starting any repair task.

3. TROUBLESHOOTING

TROUBLESHOOTING tables are included for each system to help you diagnose the problem and find the cause. The fundamentals of how to proceed with troubleshooting are described on page IN–8.

Be sure to read this before performing troubleshooting.

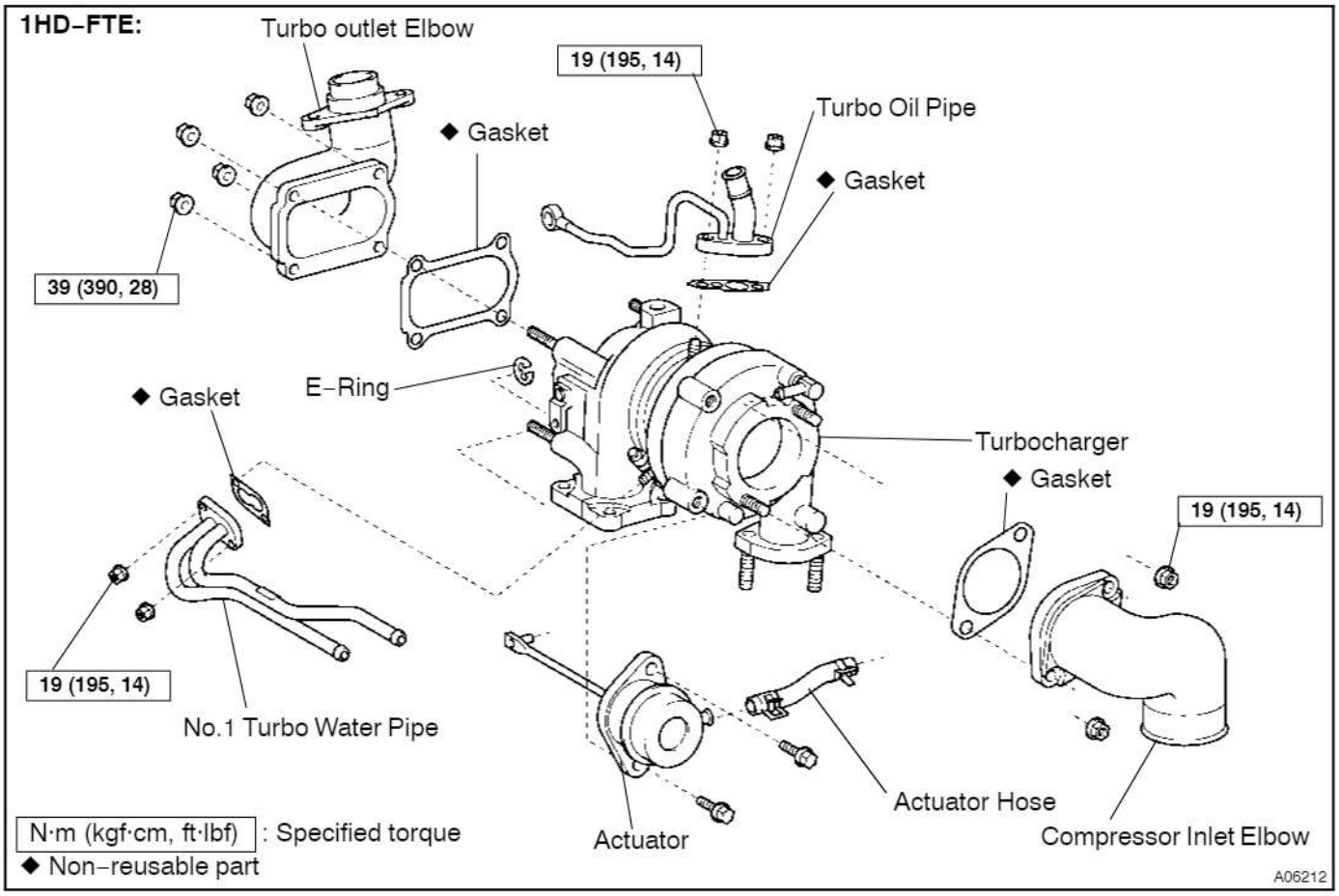
4. PREPARATION

Preparation lists the SST (Special Service Tools), recommended tools, equipment, lubricant and SSM (Special Service Materials) which should be prepared before beginning the operation and explains the purpose of each one.

5. REPAIR PROCEDURES

Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.

Example:



The procedures are presented in a step–by–step format:

- The illustration shows what to do and where to do it.
- The task heading tells what to do.
- The detailed text tells how to perform the task and gives other information such as specifications and warnings.

Example:

Task heading : what to do

21. CHECK PISTON STROKE OF OVERDRIVE BRAKE

(a) Place SST and a dial indicator onto the overdrive brake Piston as shown in the illustration.

SST 09350–30020 (09350–06120)

Set part No. *Component part No.*

Detailed text : how to do task

(b) Measure the stroke applying and releasing the compressed air (392 — 785 kPa, 4 — 8 kgf/cm^2 or 57 — 114 psi) as shown in the illustration.

Piston stroke: 1.40 — 1.70 mm (0.0551 — 0.0669 in.)

Specification

This format provides the experienced technician with a FAST TRACK to the information needed. The upper case task heading can be read at a glance when necessary, and the text below it provides detailed information. Important specifications and warnings always stand out in bold type.

6. REFERENCES

References have been kept to a minimum. However, when they are required you are given the page to refer to.

7. SPECIFICATIONS

Specifications are presented in bold type throughout the text where needed. You never have to leave the procedure to look up your specifications. They are also found in Service Specifications section for quick reference.

8. CAUTIONS, NOTICES, HINTS:

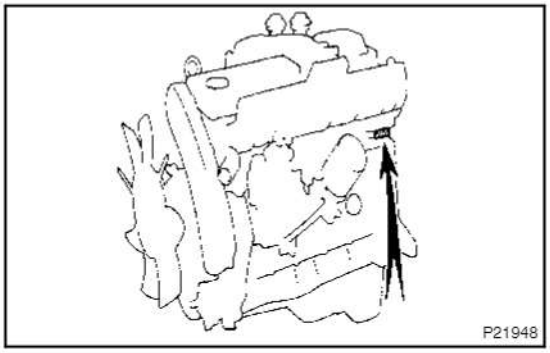
- CAUTIONS are presented in bold type, and indicate there is a possibility of injury to you or other people.
- NOTICES are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- HINTS are separated from the text but do not appear in bold. They provide additional information to help you perform the repair efficiently.

9. SI UNIT

The UNITS given in this manual are primarily expressed according to the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the English System.

Example:

Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

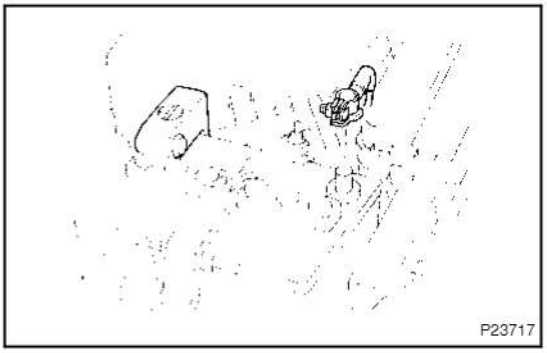


IDENTIFICATION INFORMATION

IN01G-12

ENGINE SERIAL NUMBER

The engine serial number is stamped on the engine block as shown.


P23717

REPAIR INSTRUCTIONS

GENERAL INFORMATION

IN01H–07

BASIC REPAIR HINT

(a) Use fender, seat and floor covers to keep the vehicle clean and prevent damage.

(b) During disassembly, keep parts in the appropriate order to facilitate reassembly.

(c) Observe the following:

(1) Before performing electrical work, disconnect the negative (–) terminal cable from the battery.

(2) If it is necessary to disconnect the battery for inspection or repair, always disconnect the negative (–) terminal cable which is grounded to the vehicle body.

(3) To prevent damage to the battery terminal, loosen the cable nut and raise the cable straight up without twisting or prying it.

(4) Clean the battery terminals and cable ends with a clean shop rag. Do not scrape them with a file or other abrasive objects.

(5) Install the cable ends to the battery terminals with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the cable ends onto the terminals.

(6) Be sure the cover for the positive (+) terminal is properly in place.

(d) Check hose and wiring connectors to make sure that they are secure and correct.

(e) Non–reusable parts

(1) Always replace cotter pins, gaskets, O–rings and oil seals etc. with new ones.

(2) Non–reusable parts are indicated in the component illustrations by the "◆" symbol.

(f) Precoated parts

Precoated parts are bolts and nuts, etc. that are coated with a seal lock adhesive at the factory.

(1) If a precoated part is retightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.

(2) When reusing precoated parts, clean off the old adhesive and dry with compressed air. Then apply the specified seal lock adhesive to the bolt, nut or threads.

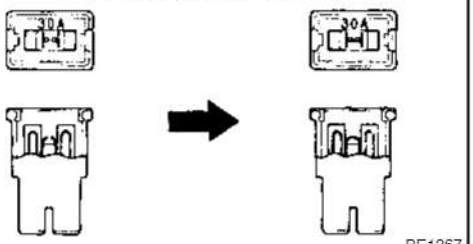
(3) Precoated parts are indicated in the component illustrations by the "★" symbol.

(g) When necessary, use a sealer on gaskets to prevent leaks.

(h) Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.

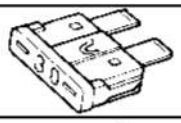
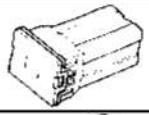
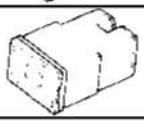
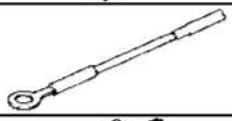
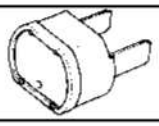
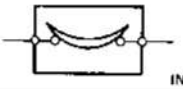
(i) Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found in section PP (Preparation) in this manual.

Medium Current Fuse and High Current Fuse Equal Amperage Rating



BE1367

(j) When replacing fuses, be sure the new fuse has the correct amperage rating. DO NOT exceed the rating or use one with a lower rating.

Illustration	Symbol	Part Name	Abbreviation
 BE5594	 IN0365	FUSE	FUSE
 BE5595	 IN0366	MEDIUM CURRENT FUSE	M–FUSE
 BE5596	 IN0367	HIGH CURRENT FUSE	H–FUSE
 BE5597	 IN0367	FUSIBLE LINK	FL
 BE5598	 IN0368	CIRCUIT BREAKER	CB

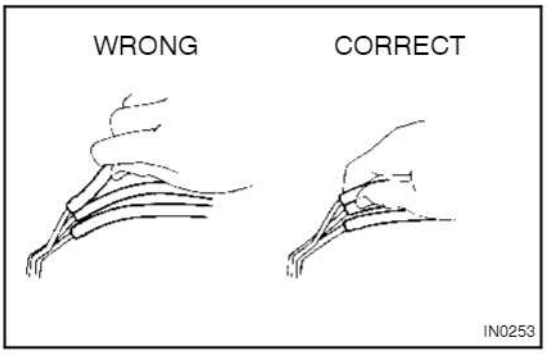
V00076

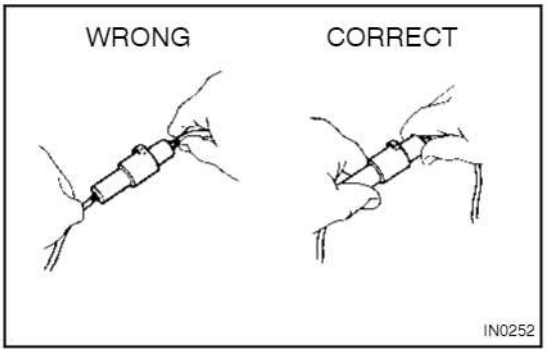
(k) Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.

(1) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels at the opposite end in order to ensure safety.

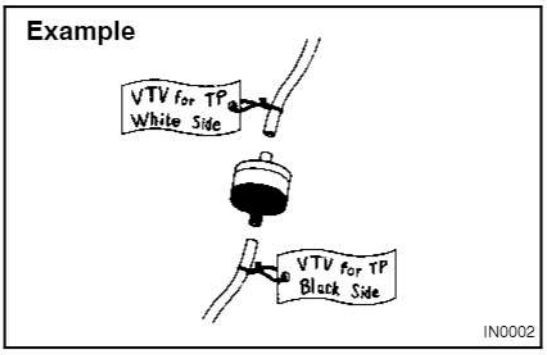
(2) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on a vehicle raised on a jack alone, even for a small job that can be finished quickly.

(l) Observe the following precautions to avoid damage to the following parts:
(1) Do not open the cover or case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)





(2) To disconnect vacuum hoses, pull on the end, not the middle of the hose.
(3) To pull apart electrical connectors, pull on the connector itself, not the wires.
(4) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.
(5) When steam cleaning an engine, protect the electronic components, air filter and emissions–related components from water.
(6) Never use an impact wrench to remove or install temperature switches or temperature sensors.
(7) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
(8) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step–down adapter instead. Once the hose has been stretched, it may leak.



(m) Tag hoses before disconnecting them:
(1) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
(2) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.
(n) Unless otherwise stated, all resistance is measured at an ambient temperature of 20°C (68°F). Because the resistance may be outside specifications if measured at high temperatures immediately after the vehicle has been running, measurements should be made when the engine has cooled down.

FOR ALL OF VEHICLES

PRECAUTION

IN011–06

1. IF VEHICLE IS EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

For vehicles with mobile communication systems such as two–way radios and cellular telephones, observe the following precautions.

(1) Install the antenna as far as possible away from the ECU and sensors of the vehicle's electronic system.
(2) Install the antenna feeder at least 20 cm (7.87 in.) away from the ECU and sensors of the vehicle's electronics systems. For details about ECU and sensors locations, refer to the section on the applicable component.
(3) Do not wind the antenna feeder together with the other wiring. As much as possible, also avoid running the antenna feeder parallel with other wire harnesses.
(4) Confirm that the antenna and feeder are correctly adjusted.
(5) Do not install powerful mobile communications system.

2. FOR USING INTELLIGENT TESTER II

CAUTION:

Observe the following for safety reasons:

- **Before using the intelligent tester II, the intelligent tester II's operator manual should be read throughly.**
- **Be sure to route all cables securely when driving with the intelligent tester II connected to the vehicle. (i.e. Keep cables away from feet, pedals, steering wheel and shift lever.)**
- **Two persons are required when test driving with the intelligent tester II, one person to drive the vehicle and one person to operate the intelligent tester II.**

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

GENERAL INFORMATION

IN01J–09

A large number of ECU controlled systems are used in the LAND CRUISER. In general, the ECU controlled system is considered to be a very intricate system requiring a high level of technical knowledge and expert skill to troubleshoot. However, the fact is that if you proceed to inspect the circuits one by one, troubleshooting of these systems is not complex. If you have adequate understanding of the system and a basic knowledge of electricity, accurate diagnosis and necessary repair can be performed to locate and fix the problem. This manual is designed through emphasis of the above standpoint to help service technicians perform accurate and effective troubleshooting, and is compiled for the following major ECU controlled systems:

System	Page
Engine	DI–1

The troubleshooting procedure and how to make use of it are described on the following pages.

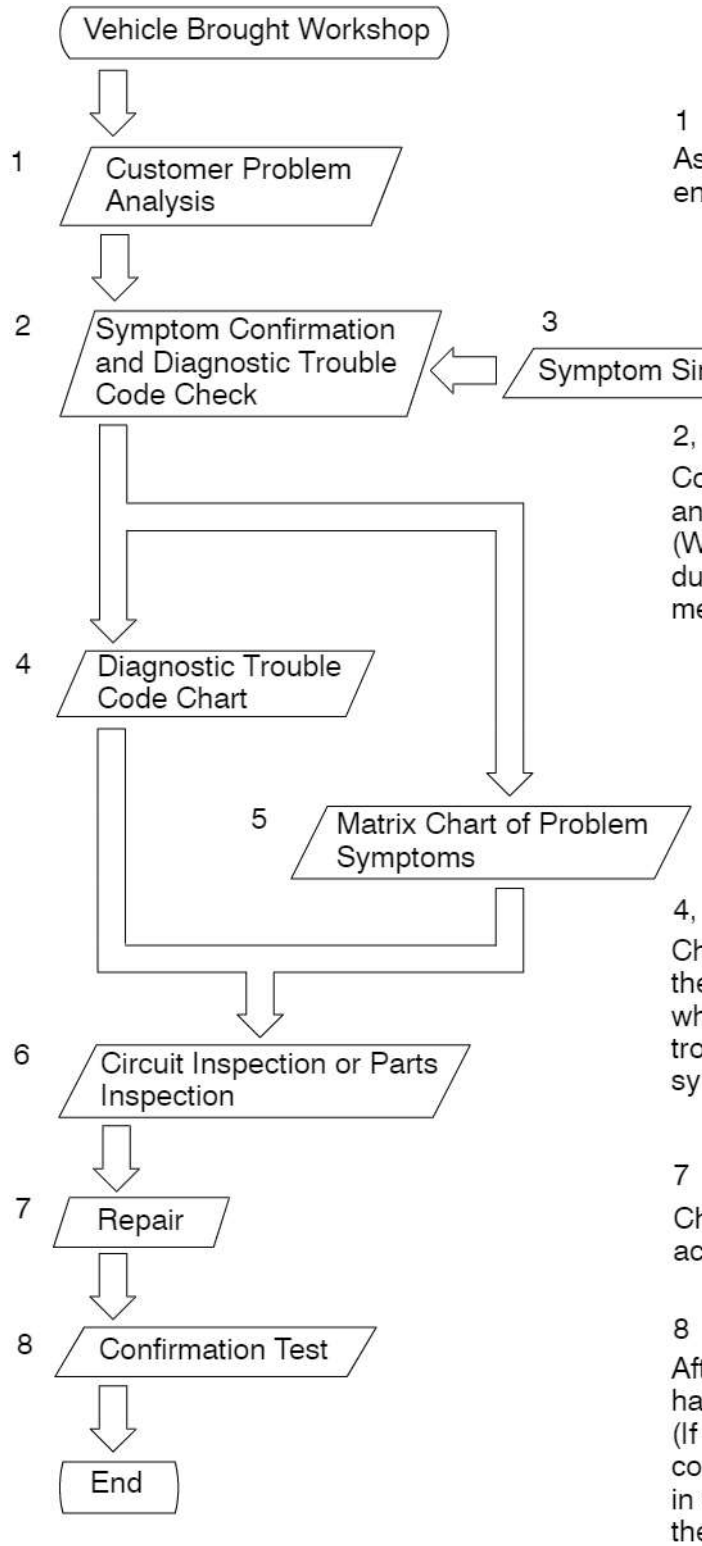
FOR USING HAND–HELD TESTER

- Before using the intelligent tester II, the intelligent tester II's operator manual should be read throughly.
- If the intelligent tester II cannot communicate with ECU controlled systems when you have connected the cable of the intelligent tester II to DLC3, turned the ignition switch ON and operated the scan tool, there is a problem on the vehicle side or tool side.
  (1) If communication is normal when the tool is connected to another vehicle, inspect the diagnosis data link line (Bus ⊕ line) or ECU power circuit of the vehicle.
  (2) If communication is still not possible when the tool is connected to another vehicle, the problem is probably in the tool itself, so perform the Self Test procedures outlined in the Tester Operator's Manual.

IN01K–10

HOW TO PROCEED WITH TROUBLESHOOTING

Carry out troubleshooting in accordance with the procedure on the following page. Here, only the basic procedure is shown. Details are provided in each section, showing the most effective methods for each circuit. Confirm the troubleshooting procedures first for the relevant circuit before beginning troubleshooting of that circuit.



1

Ask the customer about the conditions and the environment when the problem occurred.

2, 3

Confirm the symptoms and the problem conditions, and check the diagnostic trouble codes.
(When the problem symptoms do not appear during confirmation, use the symptom simulation method described later on.)

4, 5, 6

Check the results obtain in Step 2, then confirm the inspection procedure for the system or the part which should be checked using the diagnostic trouble code chart or the matrix chart of problem symptoms.

7

Check and repair the affected system or part in accordance with the instructions in Step 6.

8

After completing repairs, confirm that the problem has been eliminated.
(If the problem is not reproduced, perform the confirmation test under the same conditions and in the same environment as when it occurred for the first time.)

1. CUSTOMER PROBLEM ANALYSIS

In troubleshooting, the problem symptoms must be confirmed accurately and all preconceptions must be cleared away in order to give an accurate judgment. To ascertain just what the problem symptoms are, it is extremely important to ask the customer about the problem and the conditions at the time it occurred.

Important Point in the Problem Analysis:

The following 5 items are important points in the problem analysis. Past problems which are thought to be unrelated and the repair history, etc. may also help in some cases, so as much information as possible should be gathered and its relationship with the problem symptoms should be correctly ascertained for reference in troubleshooting. A customer problem analysis table is provided in the troubleshooting section for each system for your use.

Important Points in the Customer Problem Analysis

- What ––––– Vehicle model, system name
- When ––––– Date, time, occurrence frequency
- Where ––––– Road conditions
- Under what conditions? ––––– Running conditions, driving conditions, weather conditions
- How did it happen? ––––– Problem symptoms

(Sample) Engine control system check sheet.

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

Inspector's Name

Customer's Name		Model and Model Year	
Driver's Name		Frame No.	
Data Vehicle Brought in		Engine Model	
License No.		Odometer Reading	km miles

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

onstant ☐ Sometimes (times per day/month)

2. SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE CHECK

The diagnostic system in the LAND CRUISER fulfills various functions. The first function is the Diagnostic Trouble Code Check in which a malfunction in the signal circuits to the ECU is stored in code in the ECU memory at the time of occurrence, to be output by the technician during troubleshooting. Another function is the Input Signal Check which checks if the signals from various switches are sent to the ECU correctly. By using these check functions, the problem areas can be narrowed down quickly and troubleshooting can be performed effectively. Diagnostic functions are incorporated in the following systems in the LAND CRUISER.

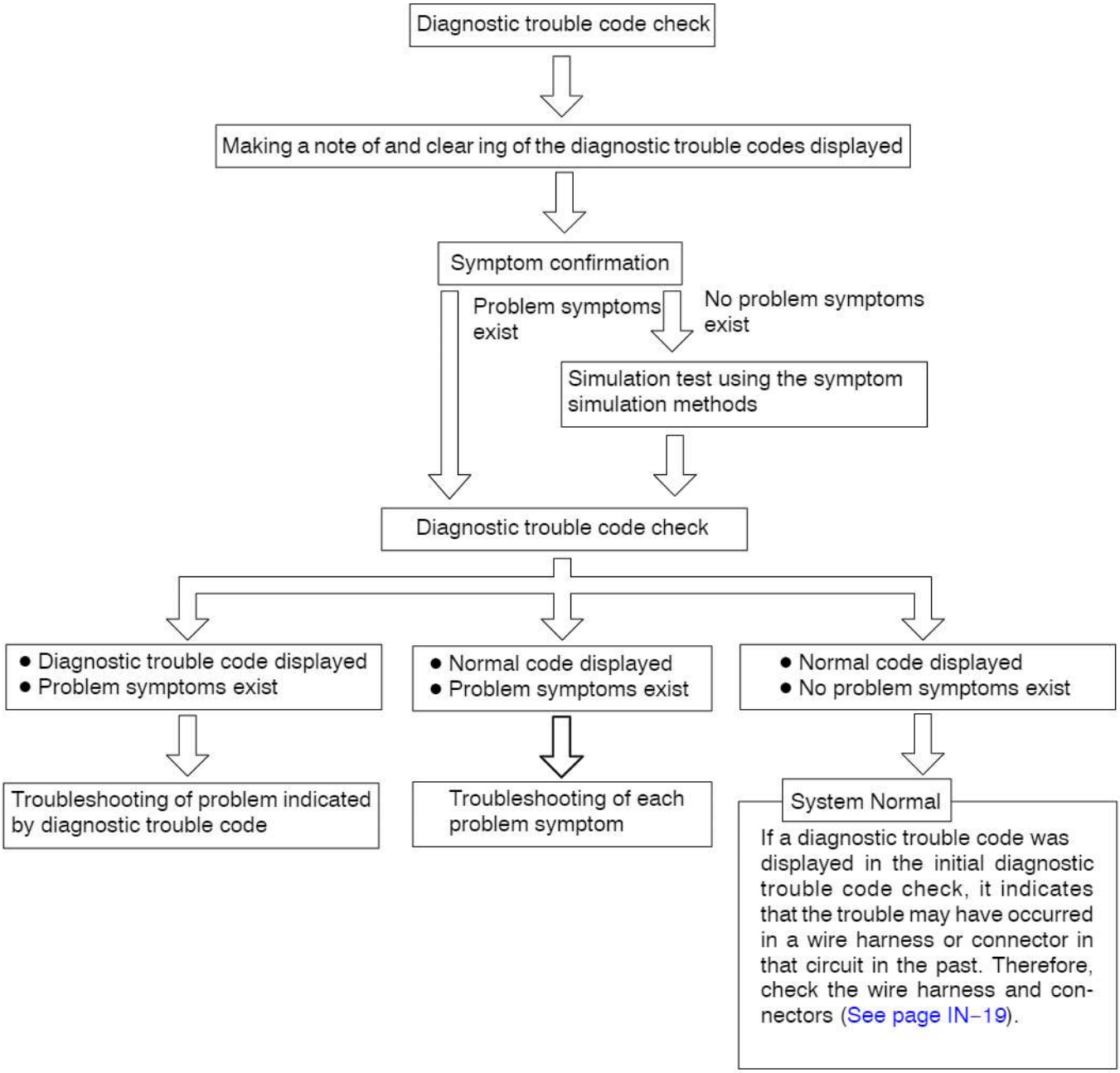
System	Diagnostic Trouble Code Check	Input Signal Check (Sensor Check)	Other Diagnosis Function
Engine	○ (with Check Mode)	○	Diagnostic Test Mode

In diagnostic trouble code check, it is very important to determine whether the problem indicated by the diagnostic trouble code is still occurring or occurred in the past but returned to normal at present. In addition, it must be checked in the problem symptom check whether the malfunction indicated by the diagnostic trouble code is directly related to the problem symptom or not. For this reason, the diagnostic trouble codes should be checked before and after the symptom confirmation to determine the current conditions, as shown in the table below. If this is not done, it may, depending on the case, result in unnecessary troubleshooting for normally operating systems, thus making it more difficult to locate the problem, or in repairs not pertinent to the problem. Therefore, always follow the procedure in correct order and perform the diagnostic trouble code check.

DIAGNOSTIC TROUBLE CODE CHECK PROCEDURE

Diagnostic Trouble Code Check (Make a note of and then clear)	Confirmation of Symptoms	Diagnostic Trouble Code Check	Problem Condition
Diagnostic Trouble Code Display	Problem symptoms exist	Same diagnostic trouble code is displayed	Problem is still occurring in the diagnostic circuit
⇨	⇨	Normal code is displayed	The problem is still occurring in a place other than in the diagnostic circuit. (The diagnostic trouble code displayed first is either for a past problem or it is a secondary problem.)
⇨	No problem symptoms exist	⇨	The problem occurred in the diagnostic circuit in the past.
Normal Code Display ⇨	Problem symptoms exist	Normal code is displayed	The problem is still occurring in a place other than in the diagnostic circuit.
⇨	No problem symptoms exist	Normal code is displayed	The problem occurred in a place other than in the diagnostic circuit in the past.

Taking into account the above points, a flow chart showing how to proceed with troubleshooting using the diagnostic trouble code check is shown below. This flow chart shows how to utilize the diagnostic trouble code check effectively, then by carefully checking the results, indicates how to proceed either to diagnostic trouble code troubleshooting or to troubleshooting of problem symptoms.

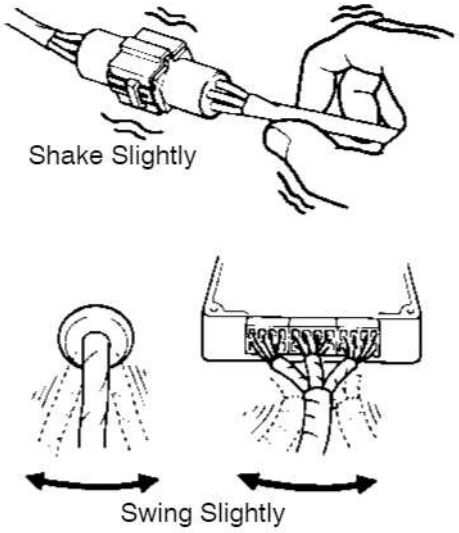
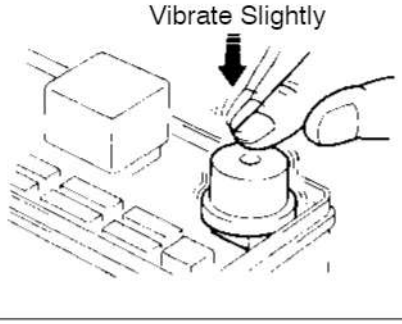


3. SYMPTOM SIMULATION

The most difficult case in troubleshooting is when there are no problem symptoms occurring. In such cases, a thorough customer problem analysis must be carried out, then simulate the same or similar conditions and environment in which the problem occurred in the customer's vehicle. No matter how much experience a technician has, or how skilled he may be, if he proceeds to troubleshoot without confirming the problem symptoms he will tend to overlook something important in the repair operation and make a wrong guess somewhere, which will only lead to a standstill. For example, for a problem which only occurs when the engine is cold, or for a problem which occurs due to vibration caused by the road during driving, etc., the problem can never be determined so long as the symptoms are confirmed with the engine hot condition or the vehicle at a standstill. Since vibration, heat or water penetration (moisture) are likely causes for problems which are difficult to reproduce, the symptom simulation tests introduced here are effective measures in that the external causes are applied to the vehicle in a stopped condition.

Important Points in the Symptom Simulation Test:

In the symptom simulation test, the problem symptoms should of course be confirmed, but the problem area or parts must also be found out. To do this, narrow down the possible problem circuits according to the symptoms before starting this test and connect a tester beforehand. After that, carry out the symptom simulation test, judging whether the circuit being tested is defective or normal and also confirming the problem symptoms at the same time. Refer to the matrix chart of problem symptoms for each system to narrow down the possible causes of the symptom.

1	**VIBRATION METHOD: When vibration seems to be the major cause.**
CONNECTORS Slightly shake the connector vertically and horizontally. **WIRE HARNESS** Slightly shake the wire harness vertically and horizontally. The connector joint, fulcrum of the vibration, and body through portion are the major areas to be checked thoroughly.	
PARTS AND SENSOR Apply slight vibration with a finger to the part of the sensor considered to be the problem cause and check if the malfunction occurs. HINT: Applying strong vibration to relays may result in open relays.	

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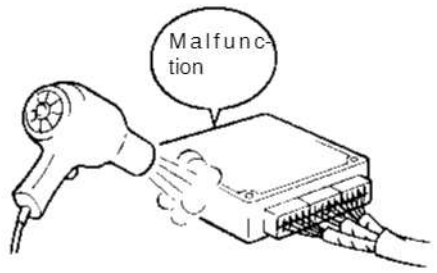
2	**HEAT METHOD: When the problem seems to occur when the suspect area is heated.**

Heat the component that is the likely cause of the malfunction with a hair dryer or similar object. Check to see if the malfunction occurs.

NOTICE:

(1) Do not heat to more than 60 °C (140 °F). (Temperature limit that no damage is done to the component.)

(2) Do not apply heat directly to parts in the ECU.



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3	**WATER SPRINKLING METHOD: When the malfunction seems to occur on a rainy day or in a high–humidity condition.**

Sprinkle water onto the vehicle and check to see if the malfunction occurs.

NOTICE:

(1) Never sprinkle water directly into the engine compartment, but indirectly change the temperature and humidity by applying water spray onto the radiator front surface.

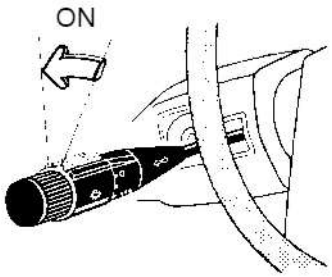
(2) Never apply water directly onto the electronic components.

(Service hint)
If a vehicle is subject to water leakage, the leaked water may contaminate the ECU. When testing a vehicle with a water leakage problem, special caution must be used.

FI6649

4	**OTHER: When a malfunction seems to occur when electrical load is excessive.**

Turn on all electrical loads including the heater blower, head lights, rear window defogger, etc. and check to see if the malfunction occurs.



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4. DIAGNOSTIC TROUBLE CODE CHART

The inspection procedure is shown in the table below. This table permits efficient and accurate troubleshooting using the diagnostic trouble codes displayed in the diagnostic trouble code check. Proceed with troubleshooting in accordance with the inspection procedure given in the diagnostic chart corresponding to the diagnostic trouble codes displayed. The engine diagnostic trouble code chart is shown below as an example.

- DTC No.
  Indicates the diagnostic trouble code.
- Page or Instructions
  Indicates the page where the inspection procedure for each circuit is to be found, or gives instructions for checking and repairs.

- Trouble Area
  Indicates the suspect area of the problem.

- Detection Item
  Indicates the system of the problem or contents of the problem.

DTC CHART (SAE Controlled)

HINT: Parameters listed in the chart may not be exactly the same as your reading due to the type of instrument or other factors.

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

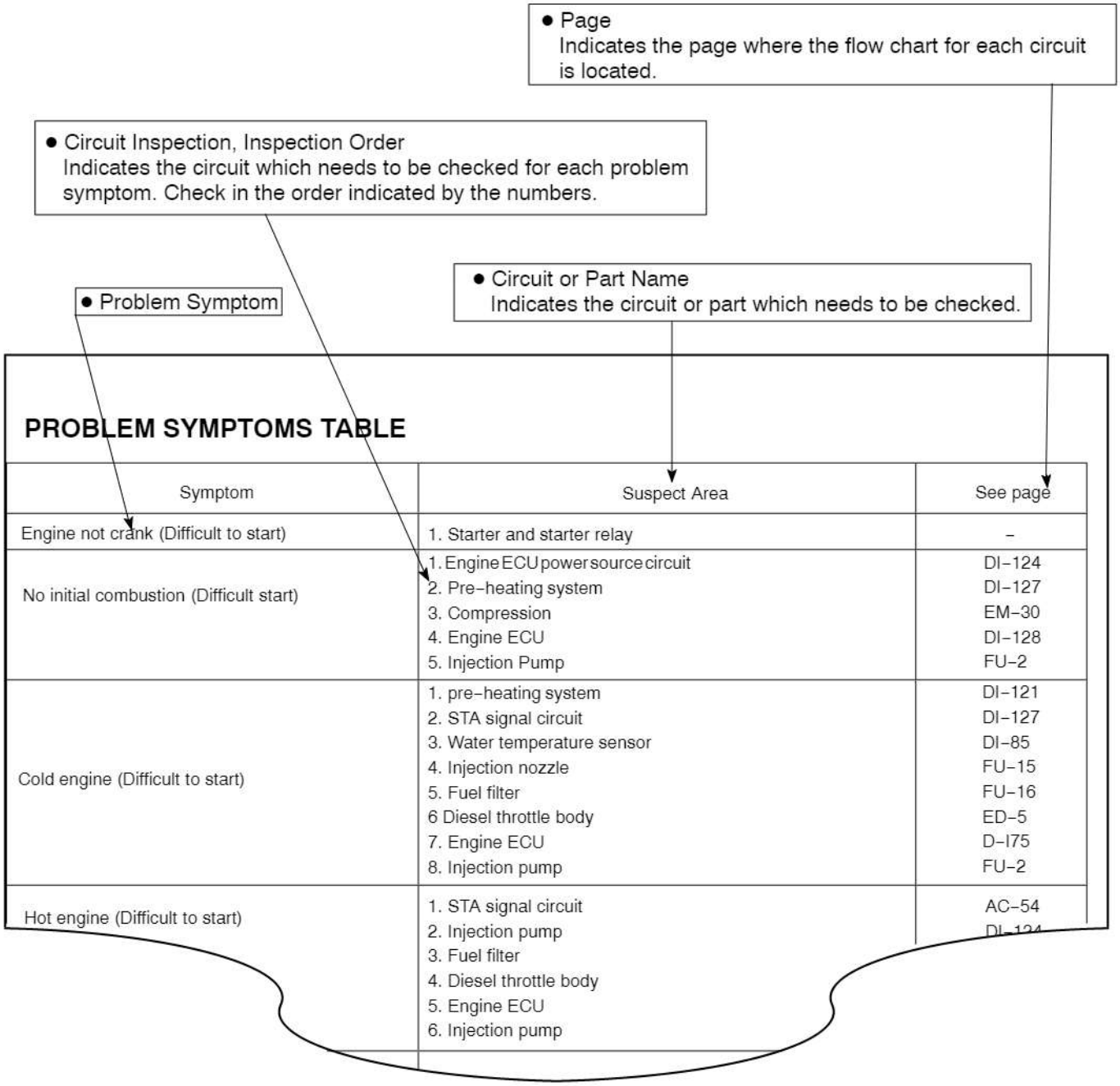
DTC No. (See page)	Detection Item	Trouble Area	*1 CHK ENG	*2 Memory
P0100/31 (DI–25)	Air Flow Meter Circuit	• Open or short in air flow meter circuit • Air flow meter • Engine ECU	○	○
P0105/35 (DI–30)	Manifold Absolute Pressure/ Barometric Pressure Circuit	• Open or short in turbo pressure sensor circuit • Turbo pressure sensor • Open or short in VSV for turbo pressure sensor circuit • Engine ECU	○	○
P0110/24 (DI–35)	Intake Air Temperature Circuit	• Open or short in timing control valve circuit • Intake air temp. sensor • Engine ECU	–	○
P0115/22	Water Temperature Sensor Circuit	• Engine ECU	○	○

5. PROBLEM SYMPTOMS TABLE

The suspect circuits or parts for each problem symptom are shown in the table below. Use this table to troubleshooting the problem when a "Normal" code is displayed in the diagnostic trouble code check but the problem is still occurring. Numbers in the table indicate the inspection order in which the circuits or parts should be checked.

HINT:

When the problem is not detected by the diagnostic system even though the problem symptom is present, it is considered that the problem is occurring outside the detection range of the diagnostic system, or that the problem is occurring in a system other than the diagnostic system.

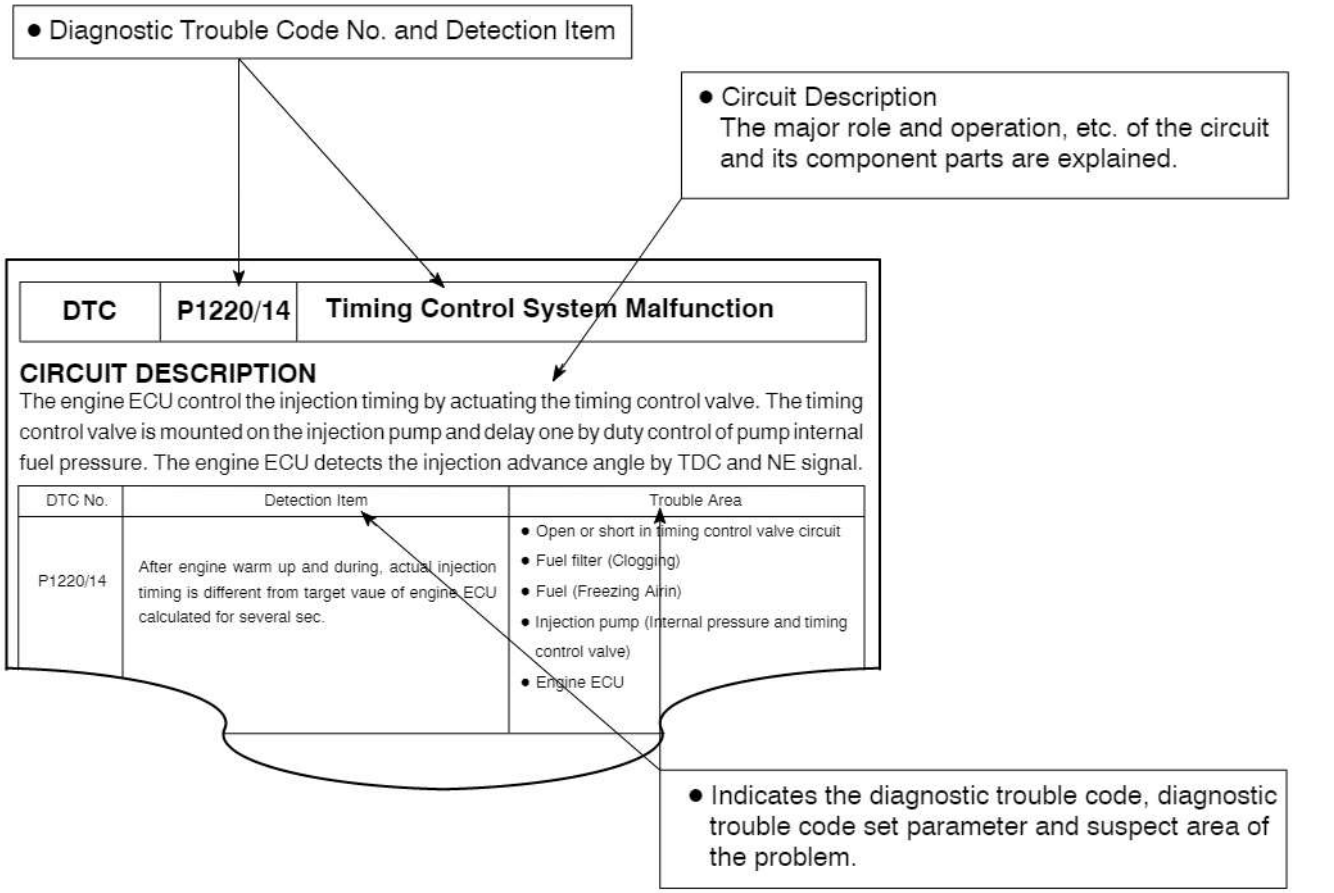


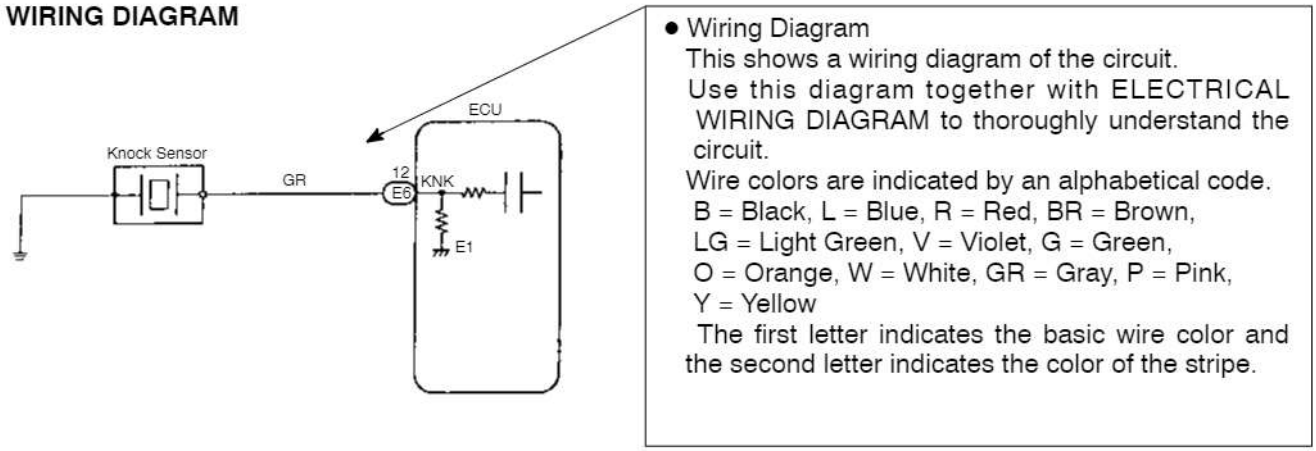
PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	See page
Engine not crank (Difficult to start)	1. Starter and starter relay	–
No initial combustion (Difficult start)	1. Engine ECU power source circuit 2. Pre–heating system 3. Compression 4. Engine ECU 5. Injection Pump	DI–124 DI–127 EM–30 DI–128 FU–2
Cold engine (Difficult to start)	1. pre–heating system 2. STA signal circuit 3. Water temperature sensor 4. Injection nozzle 5. Fuel filter 6 Diesel throttle body 7. Engine ECU 8. Injection pump	DI–121 DI–127 DI–85 FU–15 FU–16 ED–5 D–I75 FU–2
Hot engine (Difficult to start)	1. STA signal circuit 2. Injection pump 3. Fuel filter 4. Diesel throttle body 5. Engine ECU 6. Injection pump	AC–54 DI–124

6. CIRCUIT INSPECTION

How to read and use each page is shown below.





V08423

● Indicates the position of the ignition switch during the check.

LOCK
Ignition Switch LOCK (OFF)

ON
Ignition Switch ON

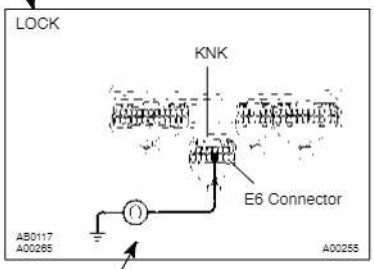
START
Ignition Switch START

ACC
Ignition Switch ACC

● Inspection Procedure
Use the inspection procedure to determine if the circuit is normal or abnormal, and , if it is abnormal, use it to determine whether the problem is located in the sensors, actuators, wire harness or ECU.

INSPECTION PROCEDURE

1	**Check continuity between terminal KNK of ECM connector and body ground.**



PREPARATION:
(a) Remove the glove compartment (See page FI–37).
(b) Disconnect the E6 connector of ECM.

CHECK:
Measure resistance between terminal KNK of ECU connector and body ground.

OK:
Resistance: 1 MΩ or higher

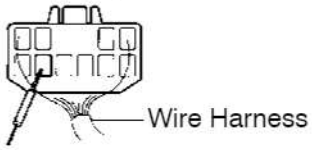
OK → **Go to step 3.**

NG

2	**Check knock sensor (See page FI–34).**

OK → **Replace knock sensor.**

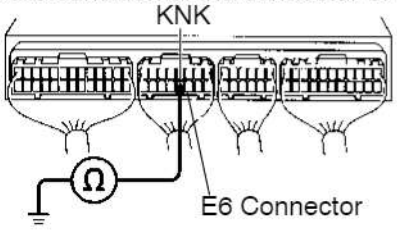
● Indicates the place to check the voltage or resistance.
● Indicates the connector position to checked, from the front or back side.



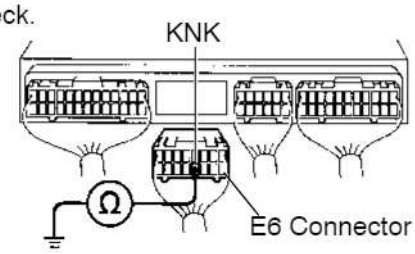
Check from the connector back side. (with harness)

Check from the connector front side. (without harness)
In this case, care must be taken not to bend the terminals.

● Indicates the condition of the connector of ECU during the check.



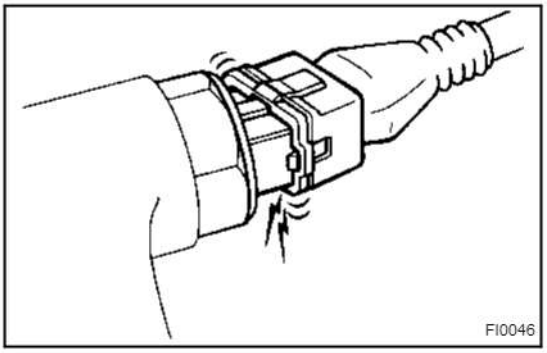
Connector being checked is connected.

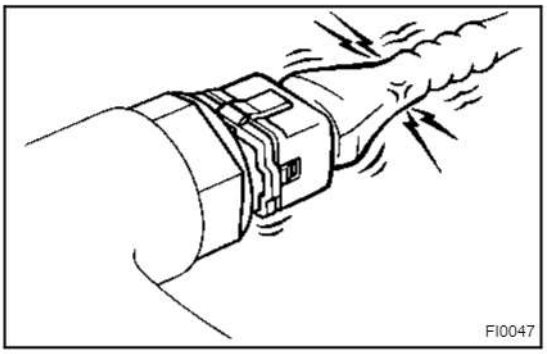


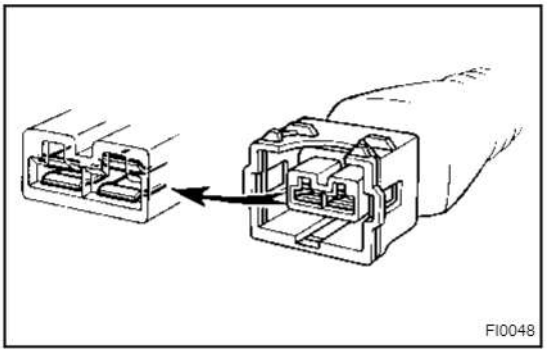
Connector being checked is disconnected.

V08425

IN01L–07


FI0046


FI0047


FI0048

HOW TO USE THE DIAGNOSTIC CHART AND INSPECTION PROCEDURE

1. CONNECTOR CONNECTION AND TERMINAL INSPECTION

- For troubleshooting, diagnostic trouble code charts or problem symptom charts are provided for each circuit with detailed inspection procedures on the following pages.
- When all the component parts, wire harnesses and connectors of each circuit except the ECU are found to be normal in troubleshooting, then it is determined that the problem is in the ECU. Accordingly, if diagnosis is performed without the problem symptoms occurring, the instruction will be to check and replace the ECU, even if the problem is not in the ECU. So always confirm that the problem symptoms are occurring, or proceed with inspection while using the symptom simulation method.
- The instructions "Check wire harness and connector" and "Check and replace ECU" which appear in the inspection procedure, are common and applicable to all diagnostic trouble codes. Follow the procedure outlined below whenever these instructions appear.

OPEN CIRCUIT:

This could be due to a disconnected wire harness, faulty contact in the connector, a connector terminal pulled out, etc.

HINT:

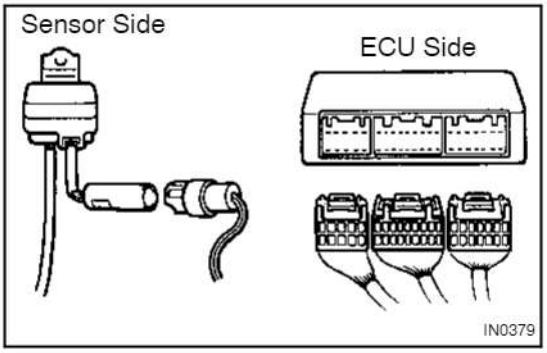
- It is rarely the case that a wire is broken in the middle of it. Most cases occur at the connector. In particular, carefully check the connectors of sensors and actuators.
- Faulty contact could be due to rusting of the connector terminals, to foreign materials entering terminals or a drop in the contact pressure between the male and female terminals of the connector. Simply disconnecting and reconnecting the connectors once changes the condition of the connection and may result in a return to normal operation. Therefore, in troubleshooting, if no abnormality is found in the wire harness and connector check, but the problem disappears after the check, then the cause is considered to be in the wire harness or connectors.

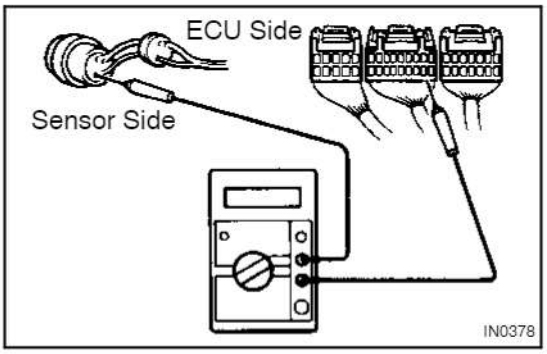
SHORT CIRCUIT:

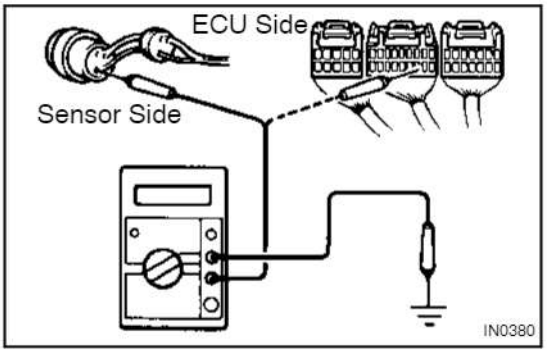
This could be due to a short circuit between the wire harness and the body ground or to a short inside the switch etc.

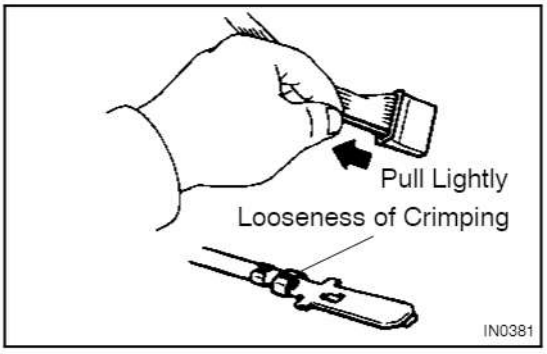
HINT:

When there is a short between the wire harness and body ground, check thoroughly whether the wire harness is caught in the body or is clamped properly.









2. CONTINUITY CHECK (OPEN CIRCUIT CHECK)

(a) Disconnect the connectors at both ECU and sensor sides.

(b) Measure the resistance between the applicable terminals of the connectors.

Resistance: 1 Ω or less

HINT:

- Measure the resistance while lightly shaking the wire harness vertically and horizontally.
- When tester probes are inserted into a connector, insert the probes from the back. For waterproof connectors in which the probes cannot be inserted from the back, be careful not to bend the terminals when inserting the tester probes.

3. RESISTANCE CHECK (SHORT CIRCUIT CHECK)

(a) Disconnect the connectors at both ends.

(b) Measure the resistance between the applicable terminals of the connectors and body ground. Be sure to carry out this check on the connectors on both ends.

Resistance: 1 MΩ or higher

HINT:

Measure the resistance while lightly shaking the wire harness vertically and horizontally.

4. VISUAL CHECK AND CONTACT PRESSURE CHECK

(a) Disconnect the connectors at both ends.

(b) Check for rust or foreign material, etc. in the terminals of the connectors.

(c) Check crimped portions for looseness or damage and check if the terminals are secured in lock portion.

HINT:

The terminals should not come out when pulled lightly.

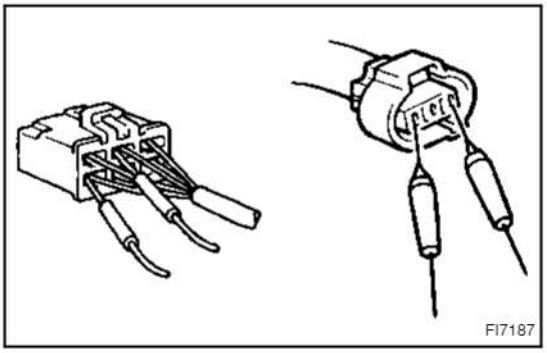
(d) Prepare a test male terminal and insert it in the female terminal, then pull it out.

NOTICE:

When testing a gold–plated female terminal, always use a gold–plated male terminal.

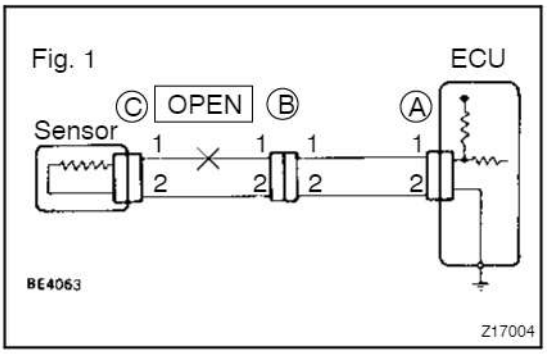
HINT:

When the test terminal is pulled out more easily than others, there may be poor contact in that section.



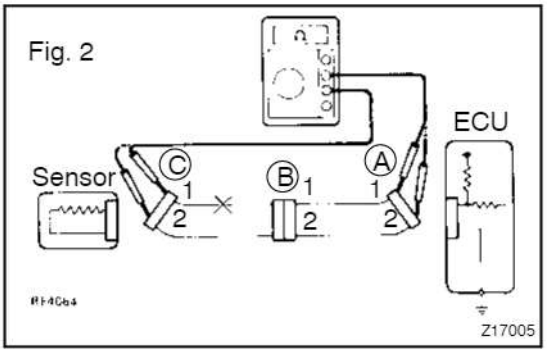
5. CONNECTOR HANDLING

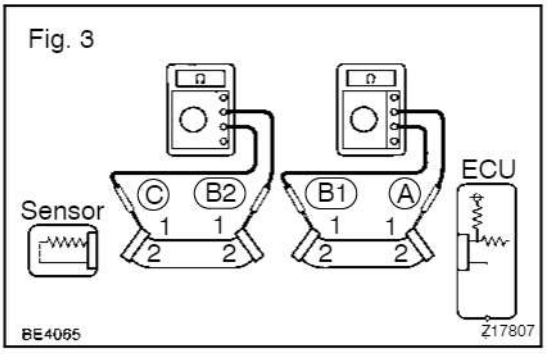
When inserting tester probes into a connector, insert them from the rear of the connector. When necessary, use mini test leads. For water resistant connectors which cannot be accessed from behind, take good care not to deform the connector terminals.



6. CHECK OPEN CIRCUIT

For the open circuit in the wire harness in Fig.1, perform "(a) Continuity Check" or "(b) Voltage Check" to locate the section.



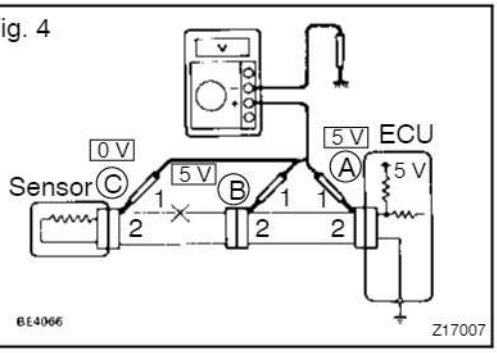


(a) Check the continuity.

(1) Disconnect connectors "A" and "C" and measure the resistance between them.
In the case of Fig.2,
Between terminal 1 of connector "A" and terminal 1 of connector "C" → No continuity (open)
Between terminal 2 of connector "A" and terminal 2 of connector "C" → Continuity
Therefore, it is found out that there is an open circuit between terminal 1 of connector "A" and terminal 1 of connector "C".

(2) Disconnect connector "B" and measure the resistance between them.
In the case of Fig.3,
Between terminal 1 of connector "A" and terminal 1 of connector "B1" → Continuity
Between terminal 1 of connector "B2" and terminal 1 of connector "C" → No continuity (open)
Therefore, it is found out that there is an open circuit between terminal 1 of connector "B2" and terminal 1 of connector "C".

Fig. 4



(b) Check the voltage.

In a circuit in which voltage is applied (to the ECU connector terminal), an open circuit can be checked for by conducting a voltage check.

As shown in Fig.4, with each connector still connected, measure the voltage between body ground and terminal 1 of connector "A" at the ECU 5V output terminal, terminal 1 of connector "B", and terminal 1 of connector "C", in that order.

If the results are:

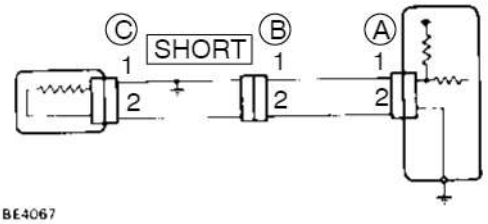
5V: Between Terminal 1 of connector "A" and Body Ground

5V: Between Terminal 1 of connector "B" and Body Ground

0V: Between Terminal 1 of connector "C" and Body Ground

Then it is found out that there is an open circuit in the wire harness between terminal 1 of "B" and terminal 1 of "C".

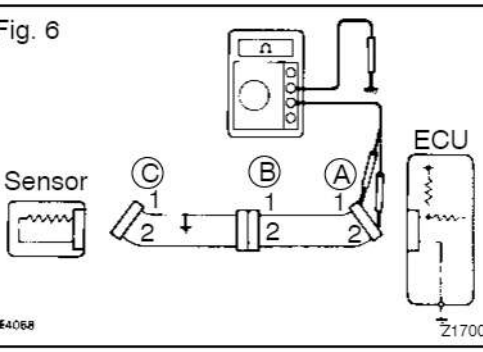
Fig. 5



7. CHECK SHORT CIRCUIT

If the wire harness is ground shorted as in Fig.5, locate the section by conducting a "continuity check with ground".

Fig. 6



Check the continuity with ground.

(1) Disconnect connectors "A" and "C" and measure the resistance between terminal 1 and 2 of connector "A" and body ground.

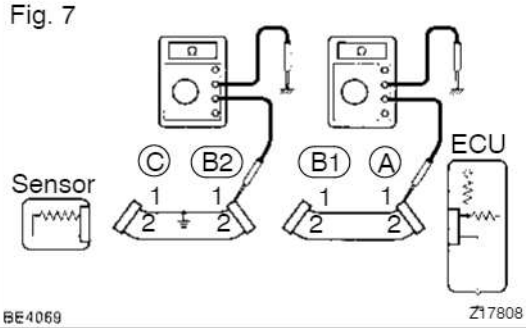
In the case of Fig.6

Between terminal 1 of connector "A" and body ground → Continuity (short)

Between terminal 2 of connector "A" and body ground → No continuity

Therefore, it is found out that there is a short circuit between terminal 1 of connector "A" and terminal 1 of connector "C".

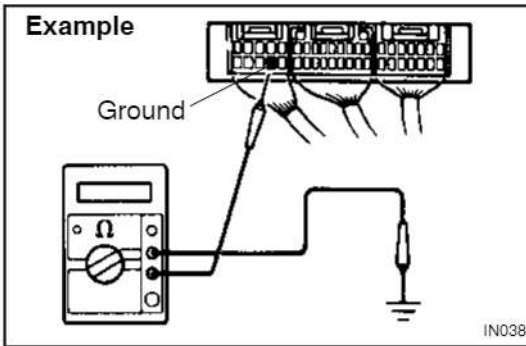
Fig. 7



(2) Disconnect connector "B" and measure the resistance between terminal 1 of connector "A" and body ground, and terminal 1 of connector "B2" and body ground.
Between terminal 1 of connector "A" and body ground → No continuity
Between terminal 1 of connector "B2" and body ground → Continuity (short)
therefore, it is found out that there is a short circuit between terminal 1 of connector "B2" and terminal 1 of connector "C".

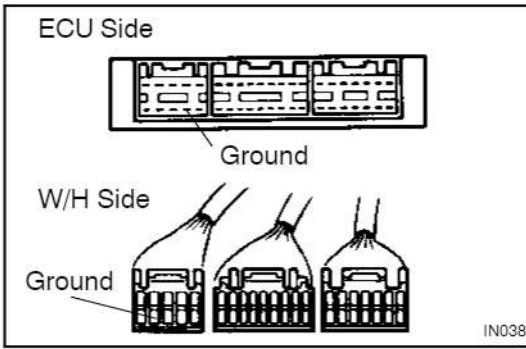
8. CHECK AND REPLACE ECU

First check the ECU ground circuit. If it is faulty, repair it. If it is normal, the ECU could be faulty, so replace the ECU with a known good one and check if the symptoms appear.



(1) Measure the resistance between the ECU ground terminal and the body ground.

Resistance: 1 Ω or less



(2) Disconnect the ECU connector, check the ground terminals on the ECU side and the wire harness side for bend and check the contact pressure.

TERMS

ABBREVIATIONS USED IN THIS MANUAL

IN01M–07

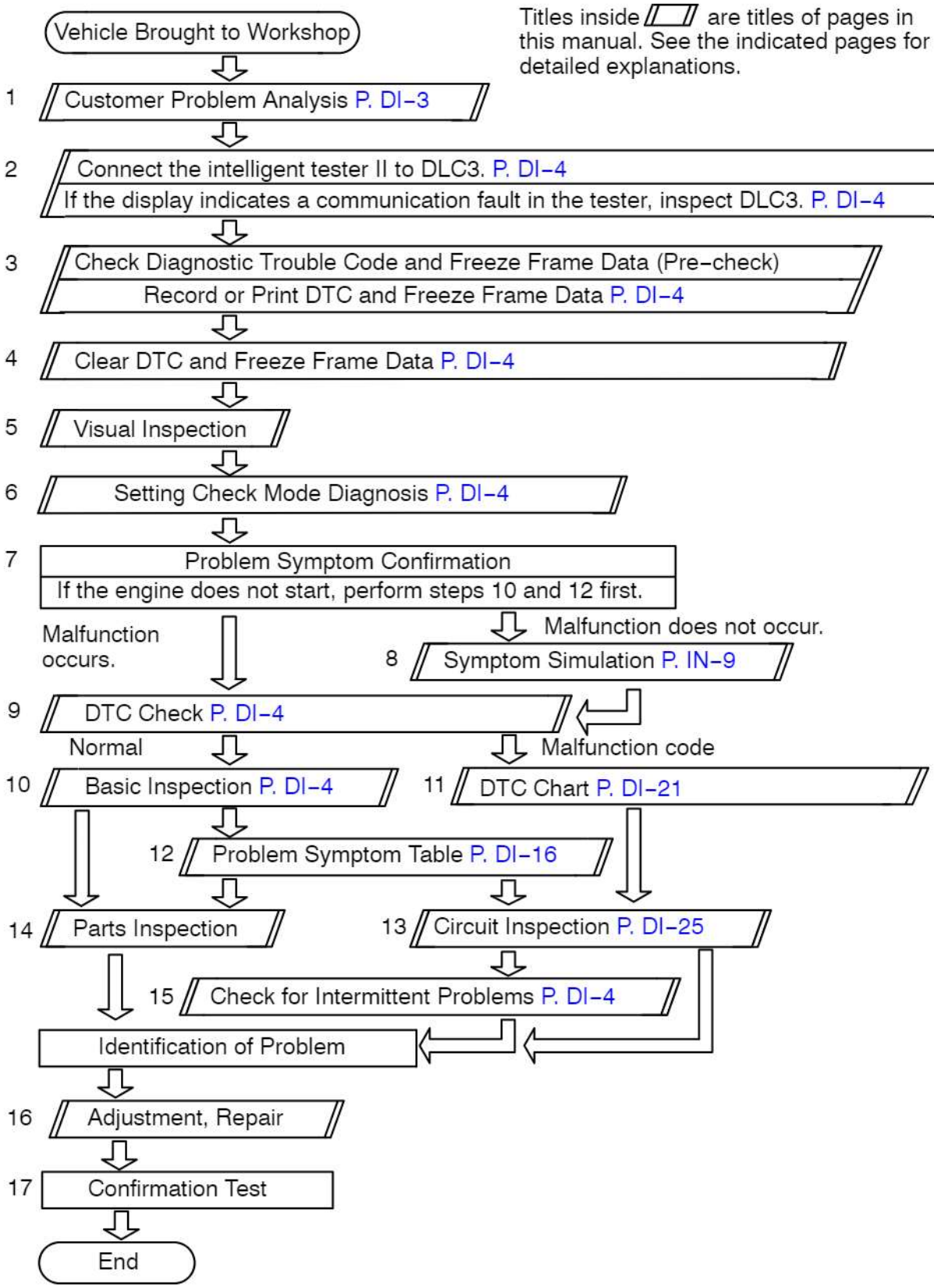
Abbreviations	Meaning
ACSD	Automatic Cold Start Device
A/C	Air Conditioner
Approx.	Approximately
A/T	Automatic Transmission
BTDC	Before Top Dead Center
BACS	Boost and Altitude Compensation Stopper
CCo	Catalytic Converter for Oxidation
ECD	Electronic Control Diesel
ECU	Electronic Control Unit
EGR	Exhaust Gas Recirculation
E–VRV	Electronic Vacuum Regulating Valve
EX	Exhaust
EDU	Electronic Drive Unit
FIPG	Formed In Place Gasket
FL	Fusible Link
HAC	High Altitude Compensator
IG	Ignition
IN	Intake
J/C	Junction Connecter
LH	Left–Hand
M/T	Manual Transmission
MP	Multipurpose
LHD	Left–Hand Drive
O/S	Oversized
PCV	Positive Crankcase Ventilation
RH	Right–Hand
RHD	Right–Hand Drive
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TDC	Top Dead Center
U/S	Undersized
VSV	Vacuum Switching Valve
w/	With
w/ o	Without

ENGINE

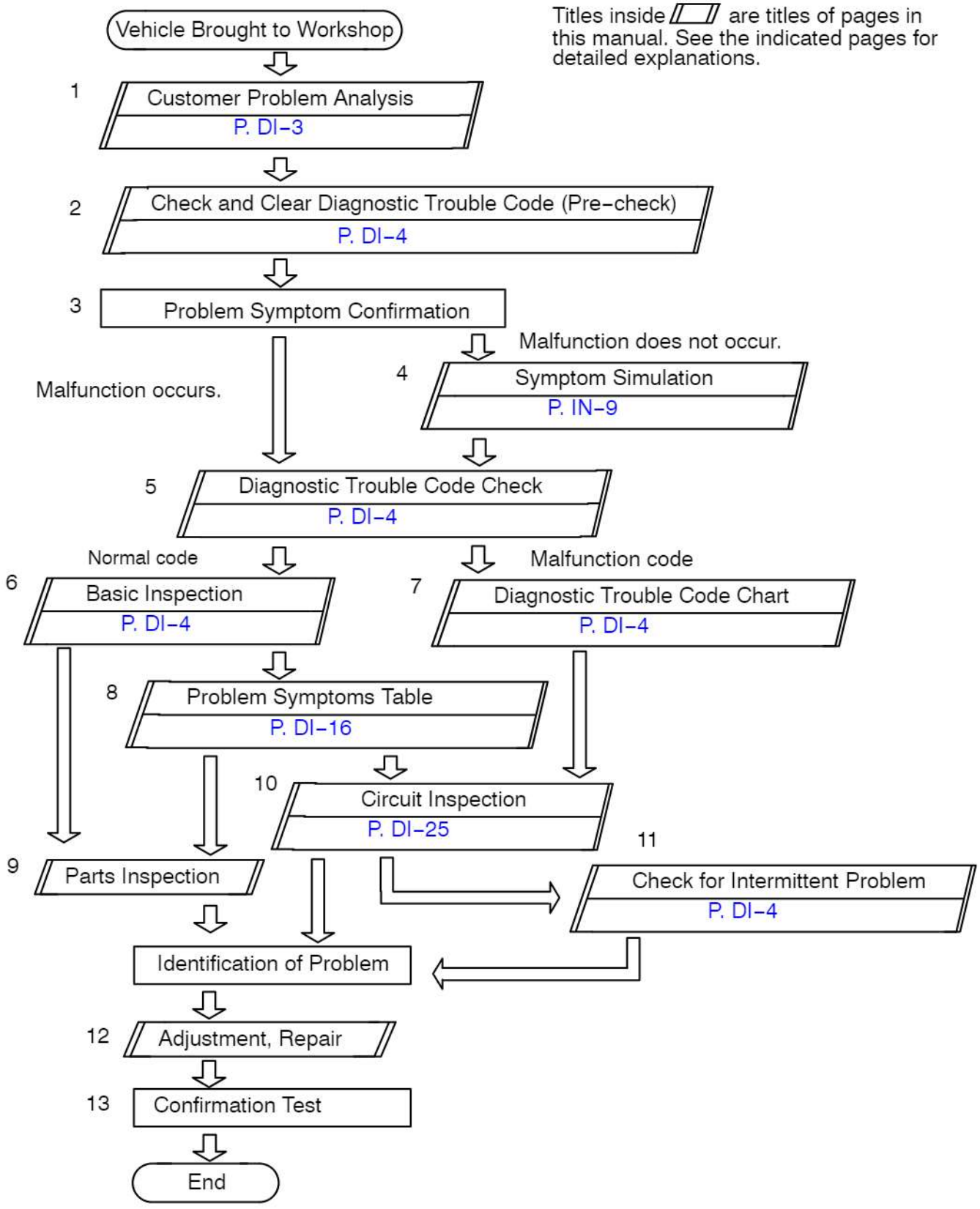
HOW TO PROCEED WITH TROUBLESHOOTING

DIDY0–01

When using the intelligent tester II, troubleshoot in accordance with the procedure on the following pages.



When not using intelligent tester II, troubleshoot in accordance with the procedure on the following pages.



DIDY1–01

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

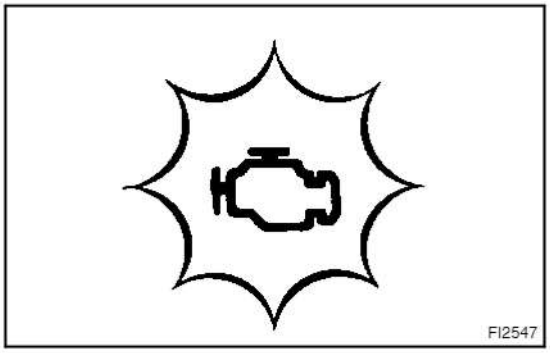
Inspector's Name _____

Customer's Name		Model and Model Year	
Driver's Name		Frame No.	
Date Vehicle Brought in		Engine Model	
License No.		Odometer Reading	km / miles

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

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

Condition of Check Engine Warning Light		☐ Remains on	☐ Sometimes lights up ☐ Does not light up
Diagnostic Trouble Code Inspection	Normal mode (Pre–check)	☐ Normal	☐ Malfunction code(s) (code) ☐ Freeze frame data ( )
	Check Mode	☐ Normal	☐ Malfunction code(s) (code) ☐ Freeze frame data ( )


FI2547

DIDY2–01

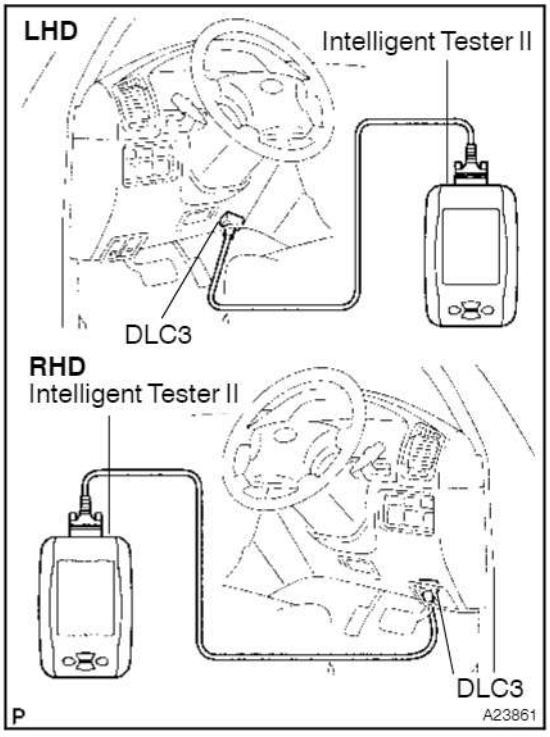
PRE–CHECK

1. DIAGNOSIS SYSTEM

(a) Description

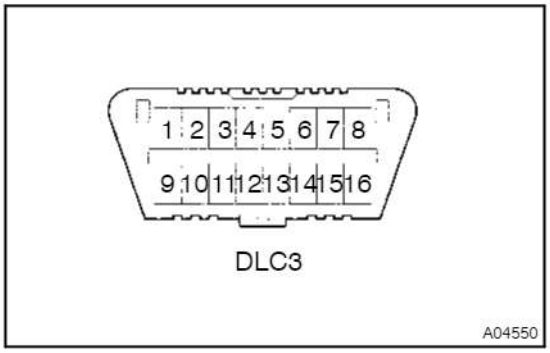
- When troubleshooting Multiplex OBD (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the intelligent tester II to the vehicle, and read off various data output from the vehicle's engine ECU.
- The vehicle's on–board computer lights up the check engine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

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



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

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

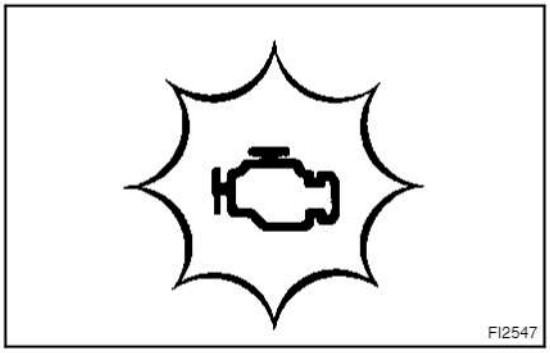


(b) Check the DLC3.
The vehicle's engine ECU uses ISO 14230 for communication. The terminal arrangement of the DLC3 complies with ISO 15031–3 and matches the ISO 14230 format.

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

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

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



2. INSPECT DIAGNOSIS (Normal Mode)

(a) Check the CHK ENG.

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

HINT:

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

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

(b) Check the DTC using the intelligent tester II.

NOTICE:

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

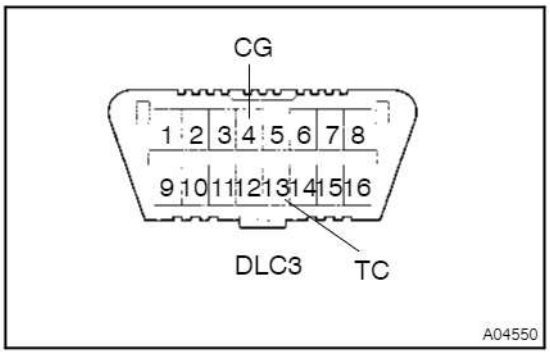
(1) Connect the intelligent tester II to the DLC3.

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

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

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

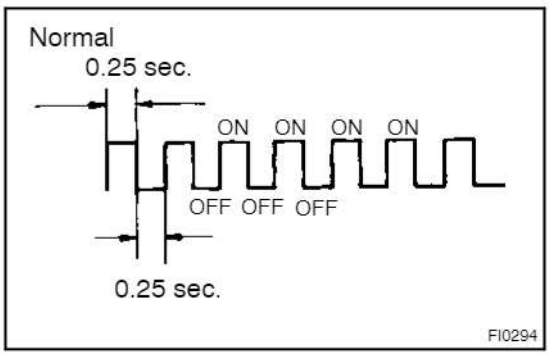
(5) Confirm the details of the DTCs.



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

(1) Turn the ignition switch ON.

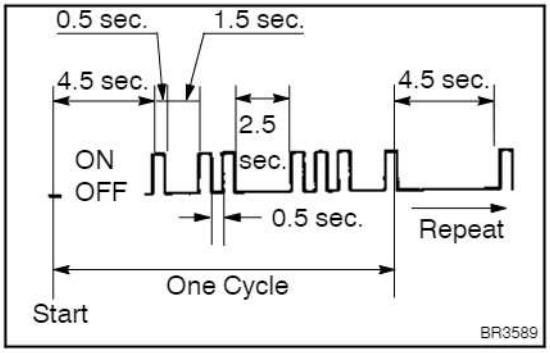
(2) Using SST, connect between terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843–18040



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

HINT:

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



(d) Example

As an example, the blinking patterns for codes 12 and 31 are as shown on the illustration.

DTCs 12 and 31 are detected and the CHK ENG starts displaying the DTCs, as shown on the left. The CHK ENG blinking pattern of DTC 12 will be displayed first.

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

(2) The CHK ENG blinking pattern of DTC 31 will be displayed.

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

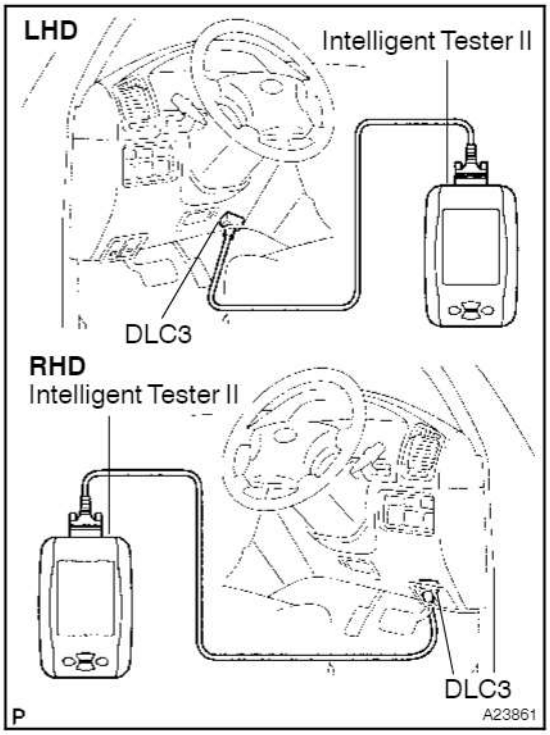
(4) The MIL will repeat the display of the string of DTCs again.

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

HINT:

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

- Confirm the details of the DTCs.



3. INSPECT DIAGNOSIS (Check Mode)

HINT:

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

NOTICE:

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

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

(a) Check mode procedure.

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

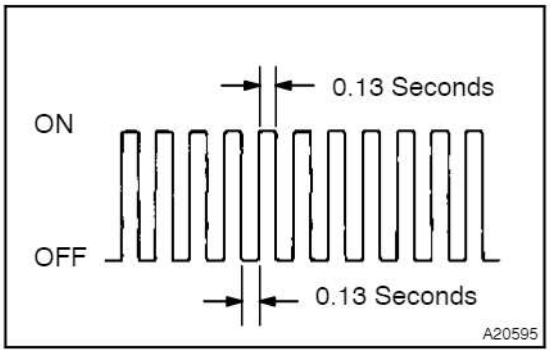
- Battery positive voltage 11 V or more
- Throttle valve fully closed
- Transmission in neutral position
- Air conditioning switch OFF

(2) Turn the ignition switch OFF.

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

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

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



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

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

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

4. FAIL–SAFE CHART

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

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

HINT:

*: Only for Europe

5. CHECK FOR INTERMITTENT PROBLEMS

HINT:

Intelligent tester II:

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

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

6. BASIC INSPECTION

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

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

NO → **Charge or replace battery.**

YES

2	**Is engine cranked?**

NO → **Proceed to problem symptoms table on page DI–16.**

YES

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

CHECK:

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

NG → **Repair or replace.**

OK

4	**Check fuel quality.**

CHECK:

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

NG → **Replace fuel.**

OK

5	**Check fuel for air.**

NG → **Bleed air from fuel.**

OK

6	**Check fuel pipes and hoses.**

CHECK:

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

NG → **Repair or replace.**

OK

7	**Check fuel filter for blockage.**

NG → **Clean or replace.**

OK

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

NG → Add or replace.

OK

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

NG → Replace coolant.

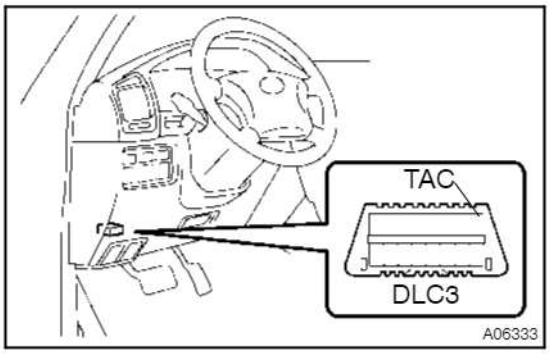
OK

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

NG → Adjust injection timing.

OK

11	Check idle speed and maximum speed.



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

NG → **Repair or replace injection pump.**

OK

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

NG → **Repair or replace.**

OK

13	Check vacuum pump.

NG → **Repair or replace.**

OK

Proceed to problem symptoms table on page DI–16.

7. DATA LIST

HINT:

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

NOTICE:

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

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

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

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

HINT:

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

8. ACTIVE TEST

HINT:

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

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

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

DIDY3–01

PROBLEM SYMPTOMS TABLE

When the malfunction code is not confirmed by the DTC check and the problem still cannot be confirmed in the basic inspection, proceed to this table and perform troubleshooting according to the numbered order given in the table below.

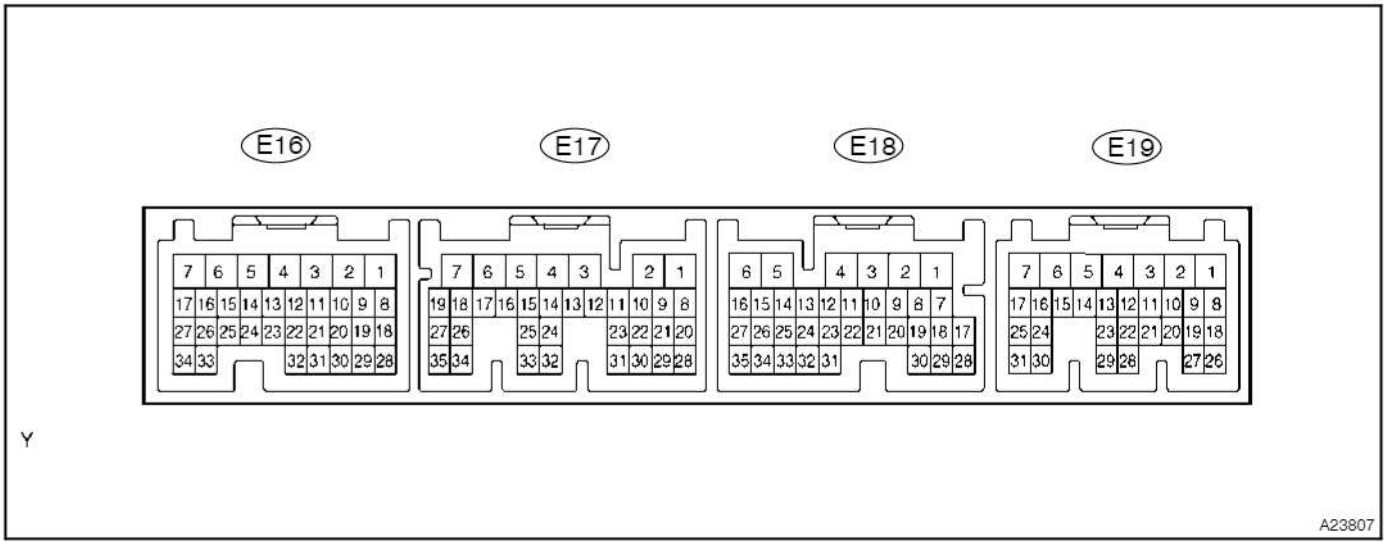
Symptom	Suspected Area	See page
Does not crank (Difficult to start)	1. Starter 2. Starter relay	ST–20*1 ST–35*1
Cold engine (Difficult to start)	1. Starter signal circuit 2. Heater idle–up switch circuit 3. Injection nozzle 4. Fuel filter 5. Engine ECU 6. Injection pump 7. Compression	DI–151 DI–159 FU–1*2 FU–1*1 ED–11*2 FU–113*1 EM–2*1
Hot engine (Difficult to start)	1. Starter signal circuit 2. Injection nozzle 3. Fuel filter 4. Compression 5. Engine ECU 6. Injection pump	DI–151 FU–1*2 FU–1*1 EM–2*1 ED–11*2 FU–113*1
Soon after starting (Engine stall)	1. Fuel filter 2. ECU power source circuit 3. Engine ECU 4. Injection pump 5. Injection nozzle	FU–1*1 DI–122 ED–11*2 FU–113*1 FU–1*2
Other Problem (Engine stall)	1. ECU power source circuit 2. Spill valve relay circuit 3. Engine ECU 4. Injection pump 5. Injection nozzle	DI–122 DI–157 ED–11*2 FU–113*1 FU–1*2
Incorrect first idle (Poor idling)	1. Fuel filter 2. Engine ECU 3. Injection pump 4. Injection nozzle	FU–1*1 ED–11*2 FU–113*1 FU–1*2
High engine idle speed (Poor idling)	1. A/C signal circuit 2. Starter signal circuit 3. Engine ECU 4. Injection pump 5. Injection nozzle 6. Heater idle–up switch circuit	DI–138 DI–151 ED–11*2 FU–113*1 FU–1*2 DI–159
Lower engine idle speed (Poor idling)	1. A/C signal circuit 2. Injection nozzle 3. EGR control circuit 4. Compression 5. Valve clearance 6. Fuel line (Air in) 7. Engine ECU 8. Injection pump	DI–138 FU–1*2 DI–128 EM–2*1 EM–9*1 – ED–11*2 FU–113*1
Rough idling (Poor idling)	1. Injection nozzle 2. Fuel line (Air in) 3. EGR control circuit 4. Compression 5. Valve clearance 6. Engine ECU 7. Injection pump	FU–1*2 – DI–128 EM–2*1 EM–9*1 ED–11*2 FU–113*1

Hunting at hot engine (Poor idling)	1. Injection nozzle 2. ECU power source circuit 3. Compression 4. Fuel line (Air in) 5. Valve clearance 6. Engine ECU 7. Injection pump	FU–1*2 DI–122 EM–2*1 – EM–9*1 ED–11*2 FU–113*1
Hunting at cold engine (Poor idling)	1. Injection nozzle 2. ECU power source circuit 3. Compression 4. Fuel line (Air in) 5. Valve clearance 6. Engine ECU 7. Injection pump	FU–1*2 DI–122 EM–2*1 – EM–9*1 ED–11*2 FU–113*1
Hesitation/Poor acceleration (Poor driveability)	1. Injection nozzle 2. Fuel filter 3. EGR control circuit 4. Compression 5. Engine ECU 6. Injection pump	FU–1*2 FU–1*1 DI–128 EM–2*1 ED–11*2 FU–113*1
Knocking (Poor driveability)	1. Injection nozzle 2. EGR control circuit 3. Engine ECU	FU–1*2 DI–128 ED–11*2
Black smoke (Poor driveability)	1. Injection nozzle 2. EGR control circuit 3. Engine ECU 4. Injection pump	FU–1*2 DI–128 ED–11*2 FU–113*1
White smoke (Poor driveability)	1. EGR control circuit 2. Injection nozzle 3. Fuel filter 4. Engine ECU 5. Injection pump	DI–128 FU–1*2 FU–1*1 ED–11*2 FU–113*1
Surging/Hunting (Poor driveability)	1. Injection nozzle 2. Engine ECU 3. Injection pump	FU–1*2 ED–11*2 FU–113*1

*1: See Pub No. RM617E
*2: See Pub No. RM896E

TERMINALS OF ECU

DIDY4–01



HINT:
Each engine ECU terminal's standard voltage is shown in the table below.
In the table, first follow the information under "Condition". Look under "Symbols (Terminal No.)" for the terminals to be inspected. The standard voltage between the terminals is shown under "STD Voltage".
Use the illustration above as a reference for the engine ECU terminals.

Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage
BATT (E19–6) – E1 (E16–1)	B–R – BR	Always	9 to 14 V
+B (E19–1) – E1 (E16–1)	B–Y – BR	Ignition switch ON	9 to 14 V
VC (E16–18) – E2 (E16–28)	L–R – BR	Ignition switch ON	4.5 to 5.5 V
VCC (E18–33) – E2C (E18–34)	L–R – BR–W	Ignition switch ON	4.5 to 5.5 V
VA (E18–27) – E2C (E18–34)	R–Y – BR–W	Accelerator pedal fully closed	0.3 to 0.8 V
		Accelerator pedal fully opened	2.9 to 4.9 V
VAS (E18–35) – E2C (E18–34)	P–L – BR–W	Accelerator pedal fully closed	0.3 to 0.8 V
		Accelerator pedal fully opened	2.9 to 4.9 V
IDL (E19–15) – E1 (E16–1)	LG–B – BR	Accelerator pedal fully closed	9 to 14 V
		Accelerator pedal fully opened	0 to 3 V
PIM (E17–25) – E2 (E16–28)	P–L – BR	Apply vacuum 40 kPa (300 mmHg, 11.8 in.Hg)	1.0 to 1.8 V
		Apply vacuum 135 kPa (1,000 mmHg, 39.4 in.Hg)	2.3 to 3.2 V
THOP (E17–5) – E1 (E16–1)	GR – BR	Engine warmed up, idling	9 to 14 V
		After ignition switch ON, once within 5 sec.	0 to 3 V
THAF*1 (E16–31) – E2 (E16–28)	Y–B – BR	Ignition switch ON	0.2 to 3.8 V
THA (E16–20) – E2 (E16–28)	W–G – BR	Idling, air intake temp. 0°C (32°F) to 80°C (176°F)	0.5 to 3.4 V
THW (E16–19) – E2 (E16–28)	G–B – BR	Idling, engine coolant temp. 60°C (140°F) to 120°C (248°F)	0.2 to 1.0 V
THF (E16–29) – E2 (E16–28)	G–R – BR	Ignition switch ON (at engine cold)	0.5 to 3.4 V
VG*1 (E17–24) – EVG*1 (E17–32)	L–Y – G–W	Idling, A/C switch OFF	0.2 to 4.9 V
STA (E17–9) – E1 (E16–1)	B–R – BR	Cranking	6.0 V or more
TDC+ (E16–11) – TDC– (E16–10)	B – W	Idling	Pulse generation (See page DI–59)
NE+ (E16–27) – NE– (E16–34)	L – G	Idling	Pulse generation (See page DI–56)

SP1 (E18–30) – E1 (E16–1)	V – BR	Ignition switch ON Rotate driving wheel slowly	Pulse generation
VNT*1 (E17–4) – E01 (E16–7)	B – W–B	Ignition switch ON	9 to 14 V
		Idling	Pulse generation (See page DI–96)
TCV (E16–5) – E01 (E16–7)	R–Y – W–B	Ignition switch ON	9 to 14 V
		Idling	Pulse generation (See page DI–67)
SPVD (E17–7) – E1 (E16–1)	L–Y – BR	Idling	Pulse generation (See page DI–82)
SPVF (E17–6) – E1 (E16–1)	L–R – BR	Idling	Pulse generation (See page DI–82)
EGR (E16 – 4) – E01 (E16–7)	R–G – W–B	Ignition switch ON	9 to 14 V
		Engine warmed up, idling	Pulse generation (See page DI–128)
PA (E16–2) – E01 (E16–7)	W–R – W–B	VSV for atmospheric pressure leaning OFF	9 to 14 V
		VSV for atmospheric pressure leaning ON	0 to 3 V
MREL (E19–8) – E01 (E16–7)	B–W – W–B	Ignition switch ON	9 to 14 V
IGSW (E19–9) – E1 (E16–1)	B–R – BR	Ignition switch ON	9 to 14 V
AC1 (E18–15) – E1 (E16–1)	W–G – BR	A/C switch ON (at idling)	0 to 1.5 V
		A/C switch OFF	9 to 14 V
ACT (E18–4) – E1 (E16–1)	L–B – BR	Ignition switch ON	9 to 14 V
		At A/C cut controlled (Driving below 30 km/h (18.6 mph), accelerator pedal fully opened for 5 sec.)	0 to 3 V
PDL (E18–16) – E1 (E16–1)	GR – BR	Accelerator pedal fully closed	9 to 14 V
		Accelerator pedal fully opened	0 to 3 V
TAC (E19–5) – E1 (E16–1)	B – BR	Idling	Pulse generation
TC (E19–11) – E1 (E16–1)	P–B – BR	Ignition switch ON	9 to 14 V
W (E19–12) – E1 (E16–1)	W – BR	Check engine warning light lights up	0 to 3 V
		Warning light other than check engine warning light lights up	9 to 14 V
DATA (E16–26) – E1 (E16–1)	LG – BR	For 0.5 sec. after ignition switch ON	Pulse generation (See page DI–117)
CLK (E16–33) – E1 (E16–1)	L – BR	For 0.5 sec. after ignition switch ON	Pulse generation (See page DI–117)
THWO (E18–14) – E1 (E16–1)	Y–B – BR	Ignition switch ON	Pulse generation (See page DI–141)
LU+A (E16–15) – E1 (E16–1)	G–R – BR	Ignition switch ON	Pulse generation (See page DI–91)
LU–A (E16–14) – E1 (E16–1)	G–W – BR	Ignition switch ON	Pulse generation (See page DI–91)
LU+B (E16–13) – E1 (E16–1)	V – BR	Ignition switch ON	Pulse generation (See page DI–91)
LU–B (E16–12) – E1 (E16–1)	G – BR	Ignition switch ON	Pulse generation (See page DI–91)
EGRC (E16–21) – E1 (E16–1)	R – BR	Ignition switch ON	0 to 3 V
		Maintain engine speed at 1,500 rpm after warming up	9 to 14 V
VCH*2 (E18–3) – E1 (E16–1)	Y–R – BR	Heater blower switch ON	9 to 14 V
		Heater blower switch OFF	0 to 3 V

SVR (E16–23) – E1 (E16–1)	L–W – BR	Ignition switch ON	9 to 14 V
SCV*1 (E16–9) – E1 (E16–1)	Y – BR	Ignition switch ON	9 to 14 V
NSW (E17–8) – E1 (E16–1)	B–W – BR	Ignition switch ON, shift lever P or N position	0 to 3 V
		Ignition switch ON, shift lever not in P or N position	9 to 14 V
IREL (E18–1) – E1 (E16–1)	G–Y – BR	Ignition switch ON (engine coolant temperature is 10°C (50°F) or more)	9 to 14 V
		Intake heater ON	0 to 3 V
STP (E18–19) – E1 (E16–1)	G–W – BR	Ignition switch ON, brake pedal depressed	7.5 to 14 V
		Ignition switch ON, brake pedal released	0 to 1.5 V
ST1– (E18–12) – E1 (E16–1)	R–G – BR	Ignition switch ON, brake pedal released	7.5 to 14 V
		Ignition switch ON, brake pedal depressed	0 to 1.5 V
VCT (E19–4) – E1 (E16–1)	L–B – BR	Heater blower switch ON	0 to 3 V
		Heater blower switch OFF	9 to 14 V
HSW*2 (E18–32) – E1 (E16–1)	B–L – BR	Push on power heater switch	0 to 3 V
		Push off power heater switch	9 to 14 V
FSW (E19–28) – E1 (E16–1)	R–L – BR	With shift lever in first position	9 to 14 V
		With shift lever not in first position	0 to 3 V
PS (E17–10) – E1 (E16–1)	P – BR	Idling, turn steering wheel	0 to 3 V
		Ignition switch ON	9 to14 V
SIL (E19–18) – E1 (E16–1)	V–W – BR	Connect intelligent tester II to DLC3	Pulse generation
IMI (E19–23) – E1 (E16–1)	L–B – BR	Idling	Pulse generation
IMO (E19–29) – E1 (E16–1)	L–R – BR	A few sec. after engine staring	Pulse generation

HINT:
*1: Only for Europe
*2: M/T

DIDY5-01

DIAGNOSTIC TROUBLE CODE CHART

HINT:

Parameters listed in the chart may not be exactly the same as your instrument reading due to the type of instrument or other factors.

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

DTC No. (See Page)	Detection Item	Trouble Area	*1 CHK ENG	*2 Memory
P0100/31*3 (DI–25)	Air Flow Meter Circuit	• Open or short in air flow meter circuit • Air flow meter • Engine ECU	○	○
P0105/35 (DI–32)	Manifold Absolute Pressure/ Barometric Pressure Circuit	• Open or short in turbo pressure sensor circuit • Turbo pressure sensor • Open or short in VSV for turbo pressure sensor circuit • VSV for turbo pressure sensor • Vacuum hose disconnected or blocked • Engine ECU	○	○
P0110/24*3 (DI–40)	Intake Air Temperature Circuit	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor (built into air flow meter) • Engine ECU	–	○
P0115/22 (DI–46)	Water Temperature Sensor Circuit	• Open or short in water temp. sensor circuit • Water temp. sensor • Engine ECU	○	○
P0180/39 (DI–51)	Fuel Temperature Sensor Circuit	• Open or short in fuel temp. sensor circuit • Fuel temp. sensor • Engine ECU	○	○
P0335/13 (DI–56)	Engine Speed Sensor Circuit 2 (NE Circuit)	• Open or short in engine speed sensor circuit • Engine speed sensor • Engine ECU	○	○
P0340/12 (DI–59)	Engine Speed Sensor Circuit 1 (TDC or G1 Circuit)	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Engine ECU	○	○
P0500/42 (DI–61)	Vehicle Speed Sensor Signal Circuit	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • Combination meter • Engine ECU	○	○
P0605/17 (DI–63)	Interior IC Malfunction	• Engine ECU	○	○
P1115/23 (DI–64)	Atmospheric Temperature Circuit	• Open or short in atmospheric temp. sensor circuit • Atmospheric temp. sensor • Engine ECU	–	○
P1120/19 (DI–67)	Accel. Position Sensor Circuit (Open/Short)	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • Engine ECU	○	○
P1121/19 (DI–74)	Accel. Position Sensor Circuit (IDL SW/Range)	• Accelerator pedal position sensor • Engine ECU	○	○
P1122/19 (DI–80)	Accel. Closed Position SW Circuit (Short)	• Short in accelerator pedal closed position switch circuit • Accelerator pedal closed position switch • Engine ECU	○	○

P1123/19 (DI–80)	Accel. Closed Position SW Circuit (Open)	• Open in accelerator pedal closed position switch circuit • Accelerator pedal closed position switch • Engine ECU	○	○
P1215/97 (DI–82)	EDU Circuit	• Open or short in EDU circuit • EDU • Spill control valve	○	○
P1220/14 (DI–87)	Timing Control System Malfunction	• Open or short in timing control valve circuit • Timing control valve • Fuel filter (Clogging) • Fuel (Freezing, air in) • Injection pump (Internal pressure and timing control valve) • Engine ECU	○	○
P1222/15 (DI–91)	Throttle Motor Circuit	• Open or short in throttle control motor circuit • Open or short in diesel throttle position switch circuit • Throttle control motor • Throttle valve • Throttle drive gear • Diesel throttle body • Diesel throttle position • Engine ECU	○	○
P1250/34*3 (DI–96)	Turbocharger System Malfunction	• VNT valve • Turbocharger • EGR valve • Vacuum hose • E–VRV for intake pressure charge • VSV for turbo pressure sensor • Air flow meter • Engine ECU	○	○
P1255/34*3 (DI–96)	Turbocharger Stick Detected (Close)	• VNT valve • Turbocharger • EGR valve • Vacuum hose • E–VRV for intake pressure charge • VSV for turbo pressure sensor • Air flow meter • Engine ECU	–	○
P1256/34*3 (DI–96)	Turbocharger Stick Detected (Open)	• VNT valve • Turbocharger • EGR valve • Vacuum hose • E–VRV for intake pressure charge • VSV for turbo pressure sensor • Air flow meter • Engine ECU	–	○
P1416/58*3 (DI–105)	SCV Control Circuit	• SCV valve • VSV for SCV • Air flow meter • Vacuum hose • Engine ECU	○	○
P1520/52 (DI–113)	Stop Light Switch Circuit	• Short in stop light switch signal circuit • Stop light switch • Engine ECU	–	○
P1633/89 (DI–63)	Interior IC Malfunction	• Engine ECU	○	○

P1670/32 (DI–117)	Injection Pump System Malfunction	• Injection pump correction unit circuit • Injection pump correction unit • Engine ECU	–	○
B2799/99 (★)	Engine Immobiliser System Malfunction	• Open or short in engine immobilizer system circuit • Transponder key amplifier • Transponder key computer • Transponder key coil • Engine ECU	–	○

HINT:

*1: "○" displayed in the diagnosis mode column indicates that the check engine warning light (CHK ENG) lights up when a malfunction is detected.

"–" indicates that the CHK ENG does not light up during malfunction diagnosis, even if a malfunction is detected.

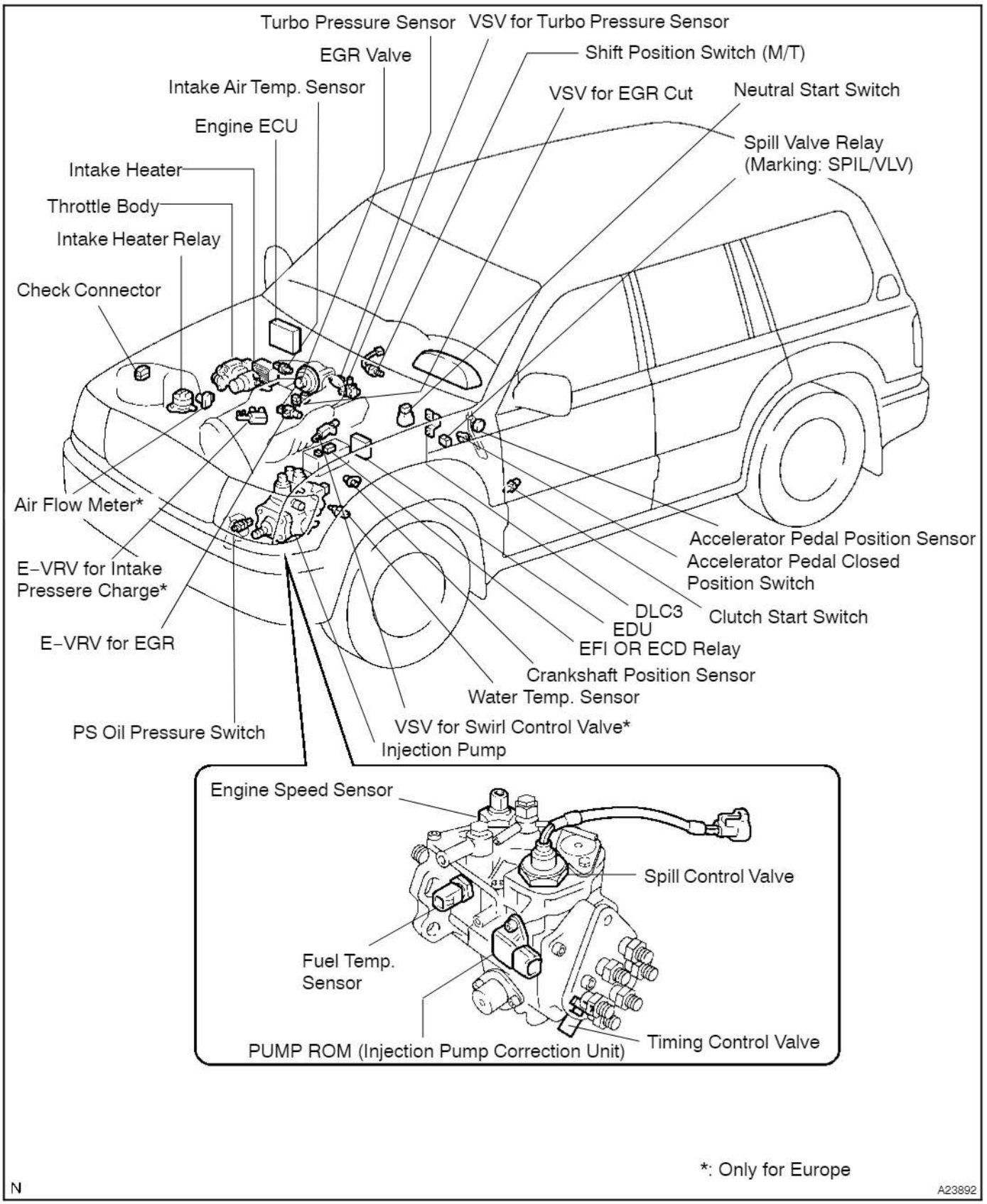
*2: "◯" in the memory column indicates that a diagnostic trouble code is recorded in the engine ECU memory when a malfunction occurs. Accordingly, output of diagnostic results in normal or test mode is done with the ignition switch ON.

*3: Only for Europe

★: See Pub. No. RM 970E

DIDY6-01

PARTS LOCATION



DI3OW-16

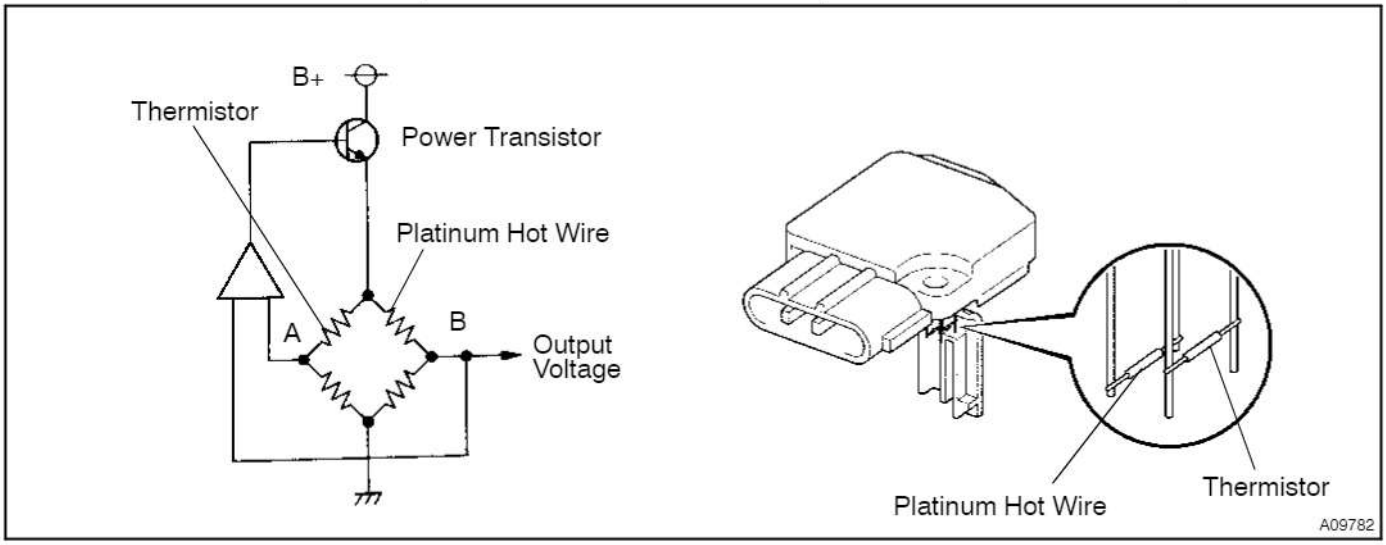
CIRCUIT INSPECTION

DTC	P0100/31*	Air Flow Meter Circuit

HINT:
*: Only for Europe

CIRCUIT DESCRIPTION

The air flow meter uses a platinum hot wire. The hot wire air flow meter consists of a platinum hot wire, thermistor and a control circuit installed in a plastic housing. The hot wire air flow meter works on the principle that the hot wire and thermistor, located in the intake air bypass of the housing, detect changes in the intake air temperature.
The hot wire is maintained at the set temperature by controlling the current flow through the hot wire. This current flow is then measured as the output voltage of the air flow meter.
The circuit is constructed so that the platinum hot wire and thermistor provide a bridge circuit with the power transistor controlled so that the potential of A and B remains equal to maintain the set temperature.

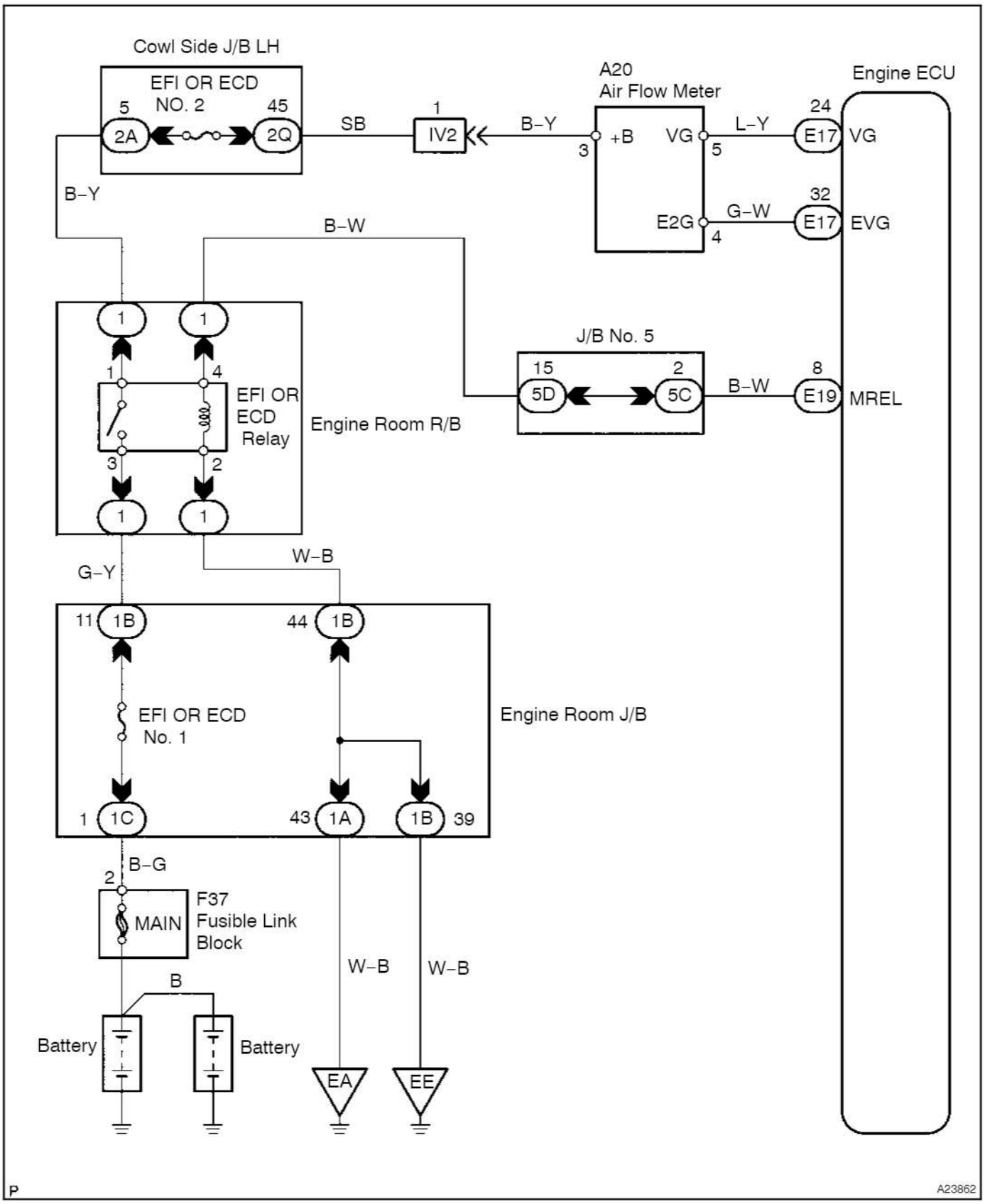


DTC No.	DTC Detection Condition	Trouble Area
P0100/31	Open or short in air flow meter circuit with more than 3 sec.	• Open or short in air flow meter circuit • Air flow meter • Engine ECU

HINT:
When DTC P0100/31 is detected, check the airflow ratio by entering the following menus on the intelligent tester II: Powertrain / Engine and ECT / Data List / MAF.

Air Flow Value (gm/sec.)	Malfunction
Approx. 0.0	• Air flow meter power source circuit open • VG circuit open or short
184.0 or more	• EVG circuit open

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

When using intelligent tester II:

1	**Connect intelligent tester II, and read value of air flow rate.**

PREPARATION:

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.
(c) Start the engine.

CHECK:

Read the air flow rate on the intelligent tester II.

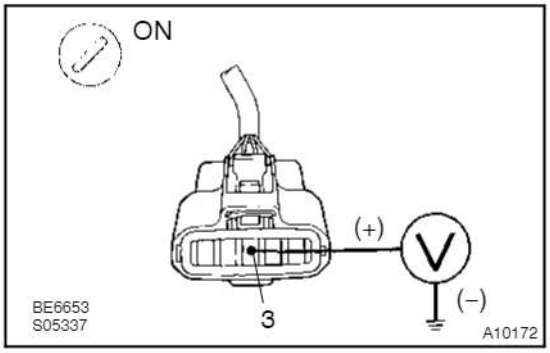
RESULT:

–	Type I	Type II
Air Flow Rata (gm/sec.)	0.0	271.0 or more

Type I → **Go to step 2.**

Type II → **Go to step 5.**

2	**Check voltage of air flow meter power source.**



PREPARATION:

(a) Disconnect the air flow meter connector.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal 3 of the air flow meter connector and body ground.

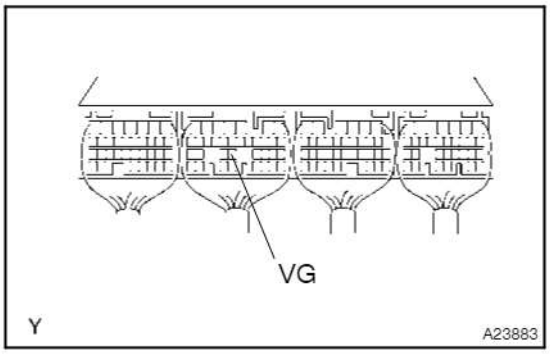
OK:

Voltage: 9 to 14 V

NG → **Check for open in harness and connector between EFI OR ECD relay and air flow meter (See page IN–19).**

OK

3	Check voltage between terminals VG of engine ECU connector and body ground.



PREPARATION:

(a) Remove the glove compartment door.

(b) Start the engine.

CHECK:

Measure the voltage between terminal VG of the engine ECU connector and body ground while the engine is idling.

OK:

Voltage:

0.2 to 4.9 V (Neutral position and A/C switch OFF)

OK	Check and replace engine ECU (See page IN–19).

NG

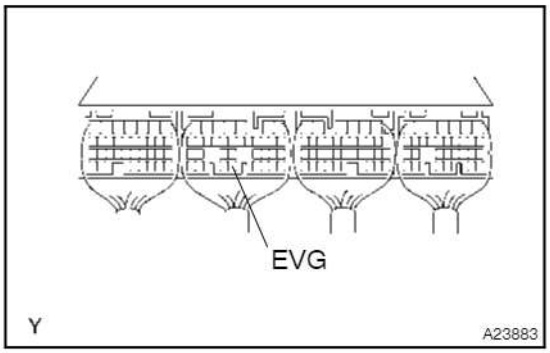
4	Check for open and short in harness and connector between air flow meter and engine ECU (See page IN–19).

NG	Repair or replace harness or connector.

OK

Replace air flow meter.

5	Check resistance between terminal EVG of engine ECU connector and body ground.



PREPARATION:
Remove the glove compartment door.
CHECK:
Check the resistance between terminal EVG of the engine ECU connector and body ground.
OK:
Resistance: Below 1 Ω

NG → **Check and replace engine ECU (See page IN–19).**

OK

6	Check for open in harness and connector between air flow meter and engine ECU (See page IN–19).

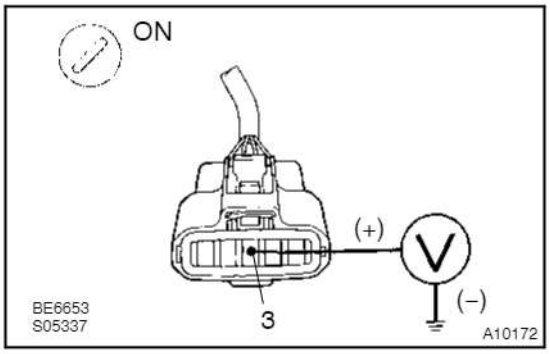
NG → **Repair or replace harness or connector.**

OK

Replace air flow meter.

When not using intelligent tester II:

1	**Check voltage of air flow meter power source.**



PREPARATION:

(a) Disconnect the air flow meter connector.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal 3 of the air flow meter connector and body ground.

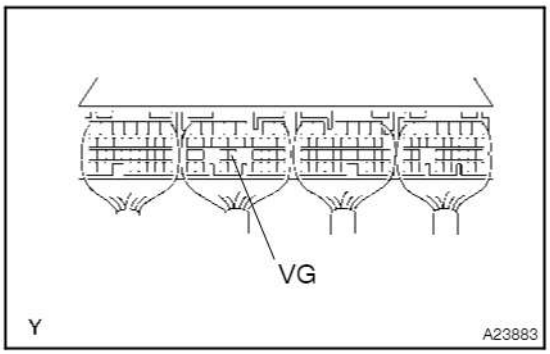
OK:

Voltage: 9 to 14 V

NG	**Check for open in harness and connector between EFI OR ECD relay and air flow meter (See page IN–19).**

OK

2	**Check voltage between terminals VG of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Start the engine.

CHECK:

Measure the voltage between terminal VG of the engine ECU connector and body ground while the engine is idling.

OK:

Voltage:

0.2 to 4.9 V (Neutral position and A/C switch OFF)

OK	**Check and replace engine ECU (See page IN–19).**

NG

3	Check for open in harness and connector between air flow meter and engine ECU (See page IN–19).

NG → Repair or replace harness or connector.

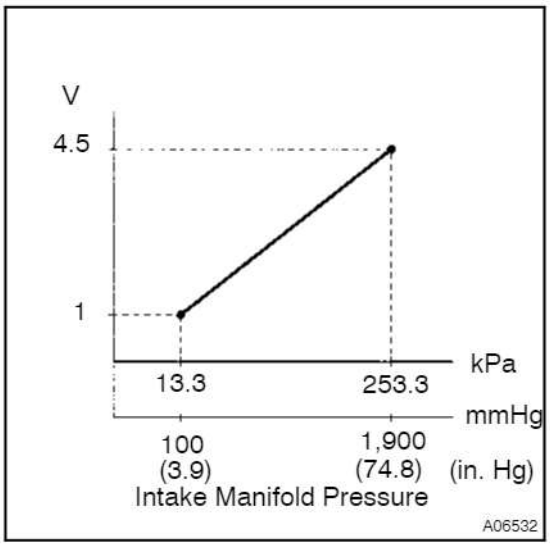
OK →

Replace air flow meter.

DIDY8–01

DTC	P0105/35	Manifold Absolute Pressure/Barometric Pressure Circuit

CIRCUIT DESCRIPTION



The turbo pressure sensor is connected to the intake manifold. The engine ECU detects the intake manifold pressure as a voltage by the sensor. The engine ECU uses the intake manifold pressure signal for correction of injection volume control and injection timing control.

The VSV for turbo pressure sensor switches the atmosphere applied to the turbo pressure sensor to the intake manifold pressure. The turbo pressure sensor monitors both the atmospheric pressure and intake manifold pressure and transmits the output voltage to the engine ECU. Then the engine ECU uses this atmospheric pressure value for correcting the injection volume.

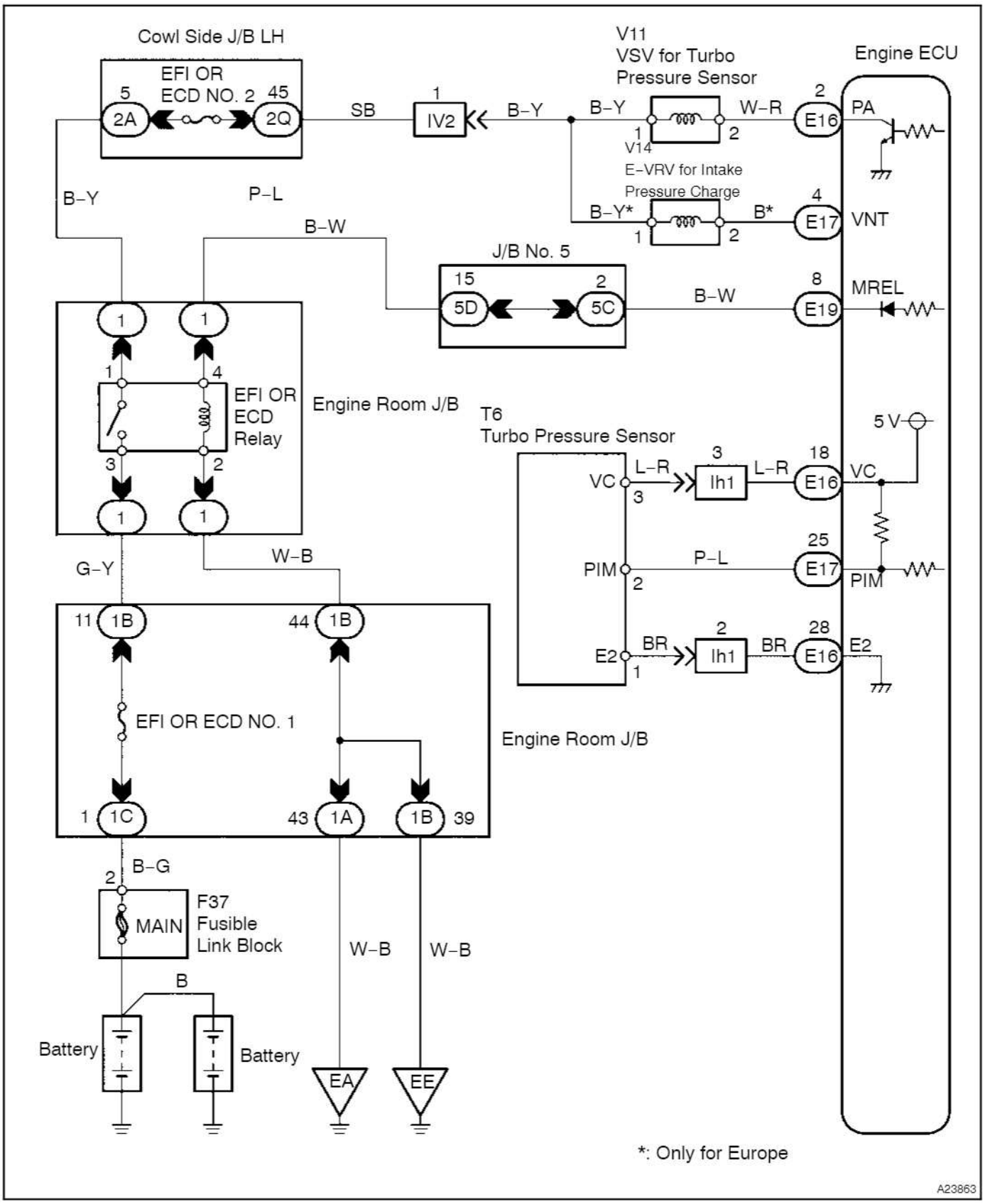
DTC No.	DTC Detection Condition	Trouble Area
P0105/35	Open or short in turbo pressure sensor circuit for 2 sec. or more	• Open or short in turbo pressure sensor circuit • Turbo pressure sensor • Open or short in VSV for turbo pressure sensor circuit • VSV for turbo pressure sensor • Vacuum hose disconnected or blocked • Engine ECU

HINT:

When DTC P0105/35 is detected, check the intake manifold pressure by entering the following menus on the intelligent tester II: Powertrain / Engine and ECT / Data List / MAP.

Intake manifold pressure (kPa)	Malfunction
Approx. 0	• PIM circuit short • VC circuit open
130 or more	• PIM circuit open • E2 circuit open

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

When using intelligent tester II

1	**Connect intelligent tester II, and read value of intake manifold pressure.**

PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

CHECK:

Read value of the intake manifold pressure on the intelligent tester II.

OK:

Same as atmospheric pressure.

OK → **Go to step 5.**

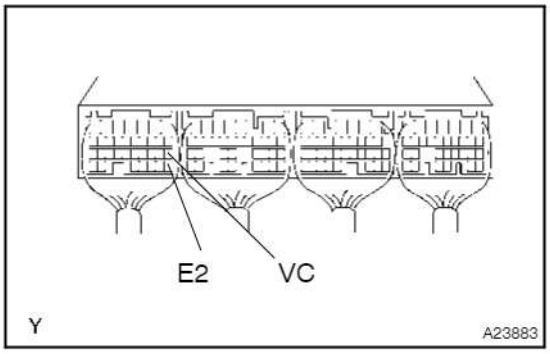
NG

2	**Check turbo pressure sensor (See Pub No. RM 617E, page TC–17).**

NG → **Replace turbo pressure sensor.**

OK

3	**Check voltage between terminals VC and E2 of engine ECU.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals VC and E2 of the engine ECU.

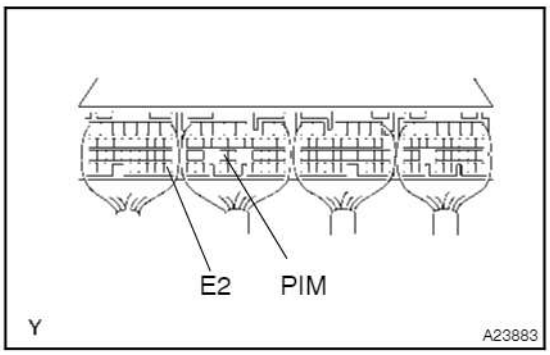
OK:

Voltage: 4.5 to 5.5 V

NG → **Check and replace engine ECU (See page IN–19).**

OK

4	Check voltage between terminals PIM and E2 of engine ECU.



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals PIM and E2 of the engine ECU.

OK:

Voltage: 1.7 to 2.9 V

OK	Check and replace engine ECU (See page IN–19).

NG

Check for open and short in harness and connector between engine ECU and turbo pressure sensor (See page IN–19).

5	Check connection of vacuum hose between turbo pressure sensor and VSV for turbo pressure sensor, VSV for turbo pressure sensor and intake manifold.

NG	Repair or replace harness or connector.

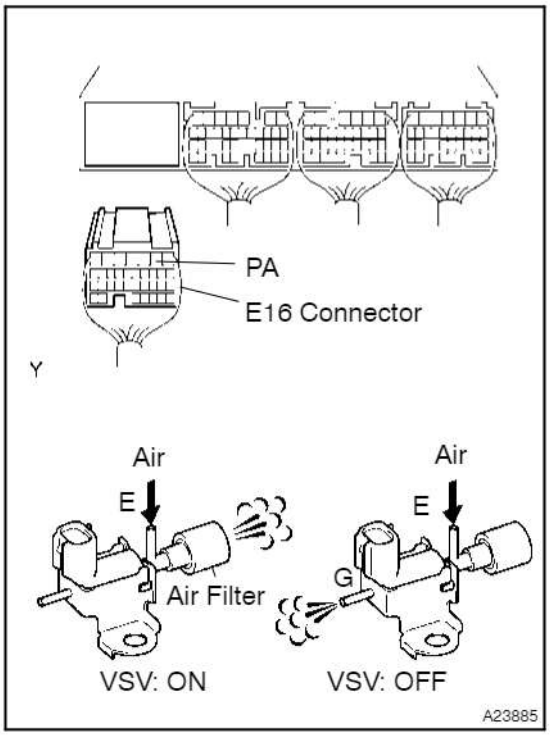
OK

6	Check resistance of VSV for turbo pressure sensor (See Pub No. RM617E, page TC–19).

NG	Replace VSV for turbo pressure sensor.

OK

7	Check VSV for turbo pressure sensor.



PREPARATION:

(a) Remove the glove compartment door.
(b) Disconnect the E16 connector of the engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Check VSV function.

(a) Connect between terminal PA of the engine ECU and body ground (VSV is ON).
(b) Disconnect between terminal PA of the engine ECU and body ground (VSV is OFF).

OK:

VSV is ON:
Air from pipe E flows out through air filter.
VSV is OFF:
Air from pipe E flows out through pipe G.

OK	Check and replace engine ECU (See page IN–19).

NG

8	Check for open and short in harness and connector between engine ECU and VSV for turbo pressure sensor, VSV for turbo pressure sensor and EFI OR ECD relay (See page IN–19).

NG	Repair or replace harness or connector.

OK

Replace VSV for turbo pressure sensor.

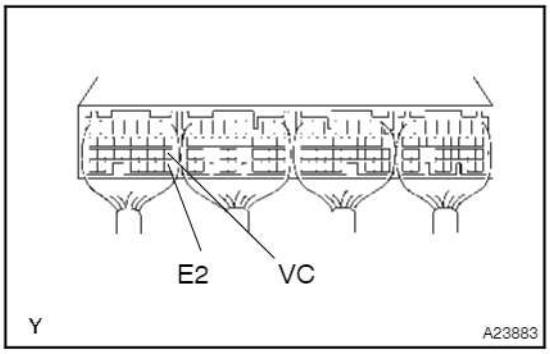
When not using intelligent tester II

1	**Check turbo pressure sensor (See Pub No. RM617E, page TC–17).**

NG → **Replace turbo pressure sensor.**

OK

2	**Check voltage between terminals VC and E2 of engine ECU.**



PREPARATION:
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

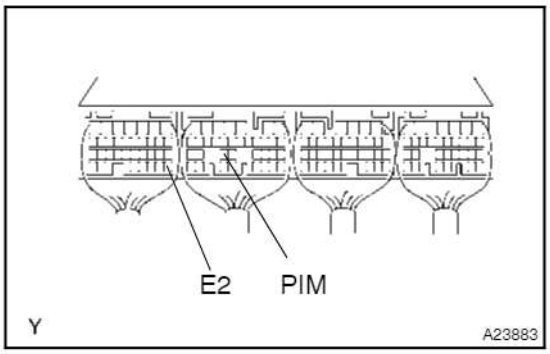
CHECK:
Measure the voltage between terminals VC and E2 of the engine ECU.

OK:
Voltage: 4.5 to 5.5 V

NG → **Check and replace engine ECU (See page IN–19).**

OK

3	**Check voltage between terminals PIM and E2 of engine ECU.**



PREPARATION:
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:
Measure the voltage between terminals PIM and E2 of the engine ECU.

OK:
Voltage: 1.7 to 2.9 V

OK → **Check and replace engine ECU (See page IN–19).**

NG

4	Check for open and short in harness and connector between engine ECU and turbo pressure sensor (See page IN–19).

NG → Repair or replace harness or connector.

OK

5	Check connection of vacuum hose between turbo pressure sensor and VSV for turbo pressure sensor, VSV for turbo pressure sensor and intake manifold.

NG → Repair or replace harness or connector.

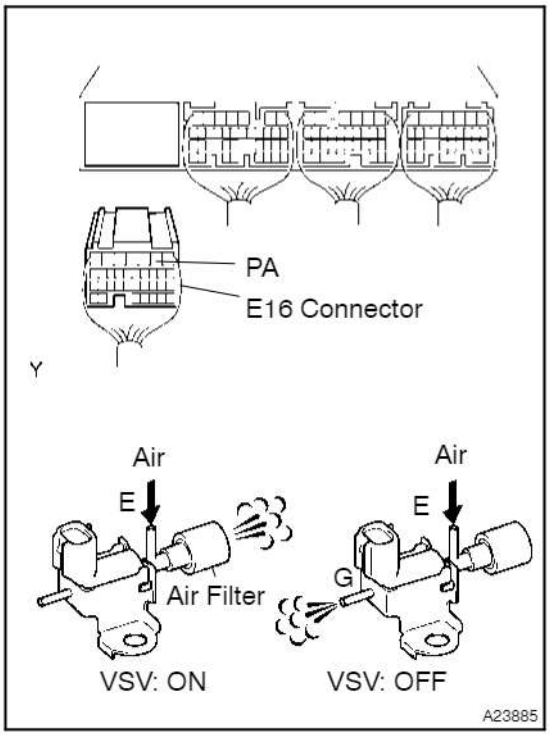
OK

6	Check resistance of VSV for turbo pressure sensor (See Pub No. RM 617E, page TC–19).

NG → Replace VSV for turbo pressure sensor.

OK

7	Check VSV for turbo pressure sensor.



PREPARATION:

(a) Remove the glove compartment door.
(b) Disconnect the E16 connector of the engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Check VSV function.

(a) Connect between terminal PA of the engine ECU and body ground (VSV is ON).
(b) Disconnect between terminal PA of the engine ECU and body ground (VSV is OFF).

OK:

VSV is ON:
Air from pipe E flows out through air filter.
VSV is OFF:
Air from pipe E flows out through pipe G.

OK	Check and replace engine ECU (See page IN–19).

NG

8	Check for open and short in harness and connector between engine ECU and VSV for turbo pressure sensor and EFI OR ECD relay (See page IN–19).

NG	Repair or replace harness or connector.

OK

Replace VSV for turbo pressure sensor.

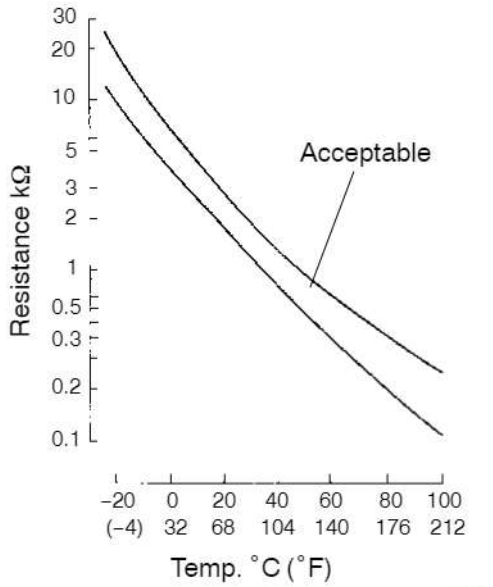
DIDYA–01

DTC	P0110/24*	Intake Air Temperature Sensor Circuit

HINT:
*: Only for Europe

CIRCUIT DESCRIPTION

Fig. 1



The intake air temperature sensor is built into the air flow meter and senses the intake air temperature. A thermistor built in the sensor changes the resistance value according to the intake air temperature. The lower the intake air temperature, the greater the thermistor resistance value, and the higher the intake air temperature, the lower the thermistor resistance value (See Fig. 1).

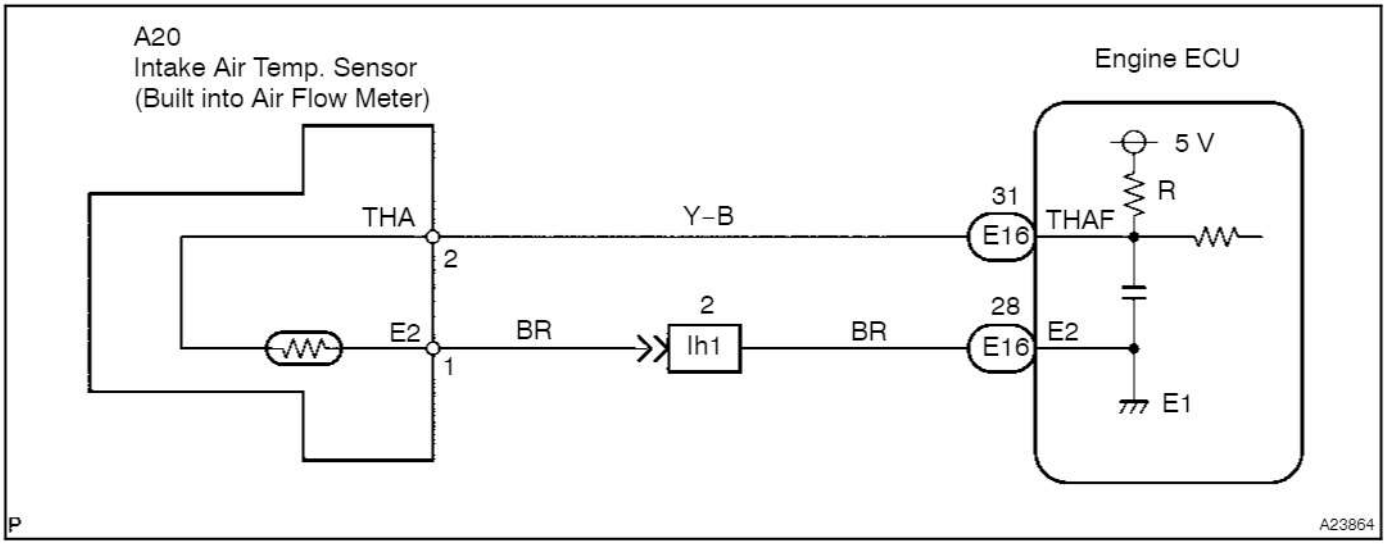
The intake air temperature sensor is connected to the engine ECU. The 5 V power source voltage in the engine ECU is applied to the intake air temperature sensor from terminal THAF via resistor R. That is, resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes, according to changes in the intake air temperature, the voltage at terminal THAF also varies. Based on this signal, the engine ECU increases the fuel injection volume to improve driveability during cold engine operation.

DTC No.	DTC Detection Condition	Trouble Area
P0110/24	Open or short in intake air temp. sensor circuit for 0.5 sec. or more	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor (built into air flow meter) • Engine ECU

HINT:
When DTC P0110/24 is detected, check the intake air temperature by entering the following menus on the intelligent tester II: Powertrain / Engine and ECT / Data List / Intake Air.

Temperature displayed	Malfunction
–40°C (–40°F)	Open circuit
140°C (284°F) or more	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

When using intelligent tester II:

1	**Connect intelligent tester II, and read value of intake air temperature.**

PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

OK:

Same as actual intake air temperature.

HINT:

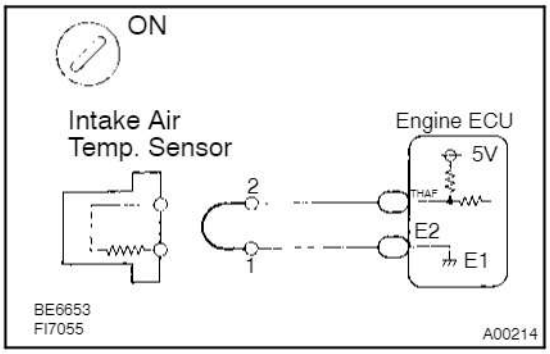
- If there is open circuit, intelligent tester II indicates –40°C (–40°F).
- If there is short circuit, intelligent tester II indicates 140°C (284°F) or more.

NG → **–40°C (–40°F) ... Go to step 2.**
140°C (284°F) or more ... Go to step 4.

OK

Check for intermittent problems (See page DI–4).

2	Check for open in harness or engine ECU.



PREPARATION:

(a) Disconnect the air flow miter connector.
(b) Connect the sensor wire harness terminals together.
(c) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

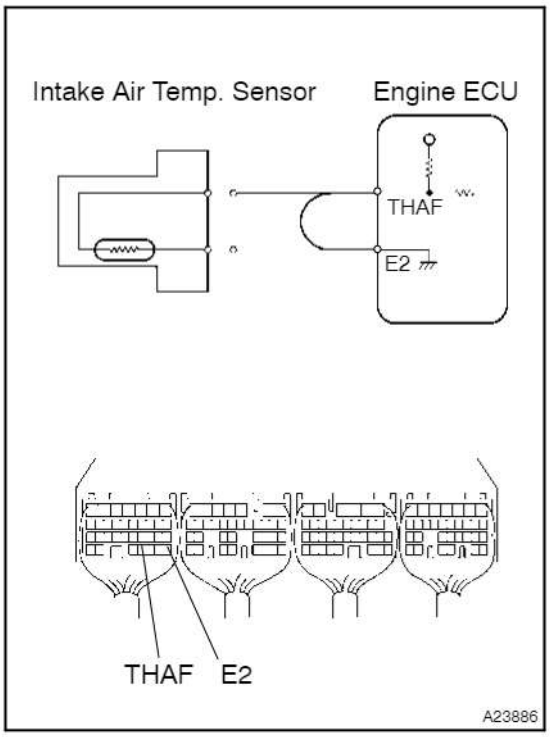
OK:

Temperature value: 140°C (284°F) or more

OK	Confirm good connection at sensor. If OK, replace air flow meter.

NG

3	Check for open in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.
(b) Connect between terminals THAF and E2 of the engine ECU connector.

HINT:

The air flow meter connector is disconnected. Before checking, do a visual and contact pressure check for the engine ECU connector (See page IN–19).

(c) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

OK:

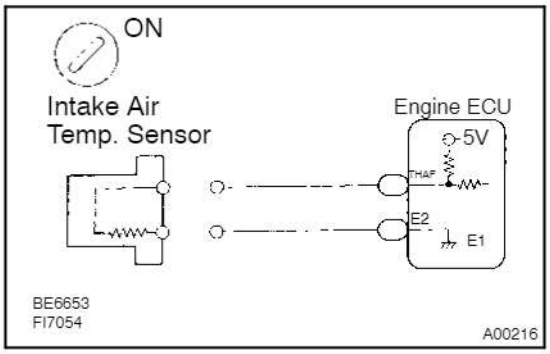
Temperature value: 140°C (284°F) or more

OK	Open in harness between terminal E2 or THAF, repair or replace harness.

NG

Confirm good connection at engine ECU. If OK, replace engine ECU.

4	Check for short in harness and engine ECU.



PREPARATION:

(a) Disconnect the air flow meter connector.

(b) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

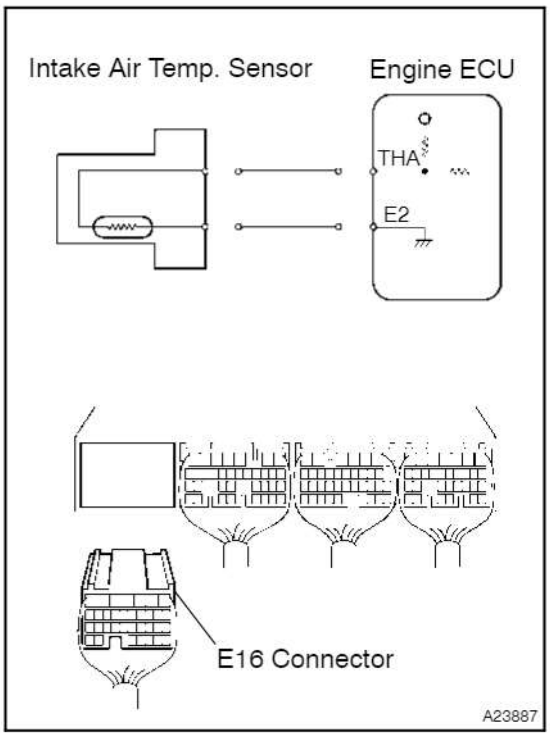
OK:

Temperature value: –40°C (–40°F)

OK	Replace air flow meter.

NG

5	Check for short in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.

(b) Disconnect the E16 connector from the engine ECU.

HINT:

The air flow meter connector is disconnected.

(c) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

OK:

Temperature value: –40°C (–40°F)

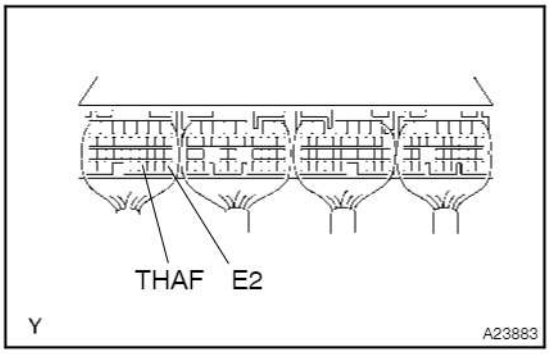
OK	Repair or replace harness or connector.

NG

Check and replace engine ECU (See page IN–19).

When not using intelligent tester II:

1	Check voltage between terminals THAF and E2 of engine ECU connector.



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals THAF and E2 of the engine ECU connector.

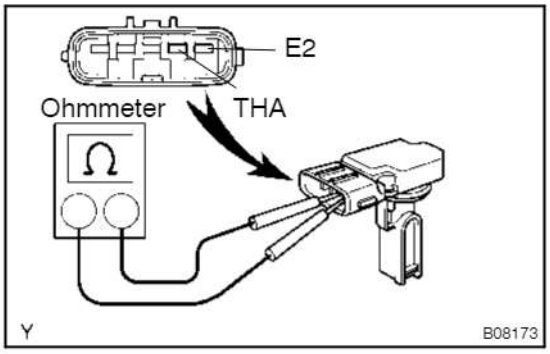
OK:

Atmospheric Temperature	Voltage
20°C (68°F) (Engine is cool)	0.2 to 3.8 V
80°C (176°F) (Engine is hot)	0.1 to 1.5 V

OK	Check for intermittent problems (See page DI–4).

NG

2	Check intake air temperature sensor.



PREPARATION:

Disconnect the air flow meter connector.

CHECK:

Using an ohmmeter, measure the resistance between terminals THA and E2.

OK:

Terminals	Resistance	Temperature
THA – E2	12.5 to 16.9 kΩ	–20°C (–4°F)
THA – E2	2.19 to 2.67 kΩ	20°C (68°F)
THA – E2	0.50 to 0.68 kΩ	60°C (140°F)

NG	Replace air flow meter.

OK

3	Check for open and short in harness and connector between engine ECU and atmospheric temperature sensor (See page IN–19).

NG	Repair or replace harness or connector.

OK

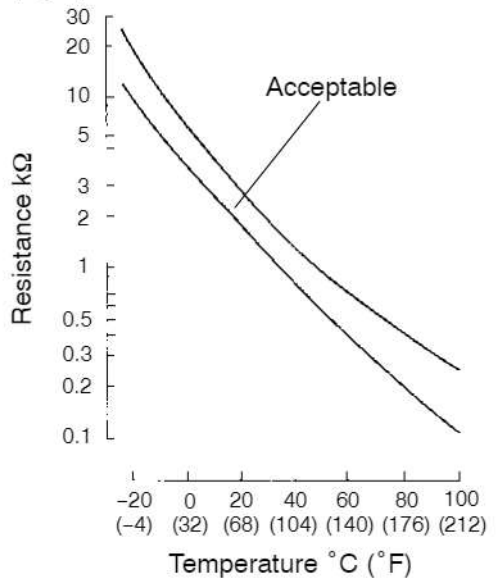
Check and replace engine ECU (See page IN–19).

DI3S7-08

DTC	P0115/22	Water Temperature Sensor Circuit

CIRCUIT DESCRIPTION

(Fig.1)



The water temperature sensor senses the coolant temperature. A thermistor built into the sensor changes the resistance value according to the coolant temperature. The lower the coolant temperature, the greater the thermistor resistance value, and the higher the coolant temperature, the lower the thermistor resistance value (See Fig.1).

The water temperature sensor is connected to the engine ECU (see next page). The 5 V power source voltage in the engine ECU is applied to the water temperature sensor from the terminal THW via resistor R. That is, the resistor R and the water temperature sensor are connected in series. When the resistance value of the water temperature sensor changes, in accordance with changes in the coolant temperature, the potential at the terminal THW also changes. Based on this signal, the engine ECU increases the fuel injection volume to improve driveability during cold engine operation.

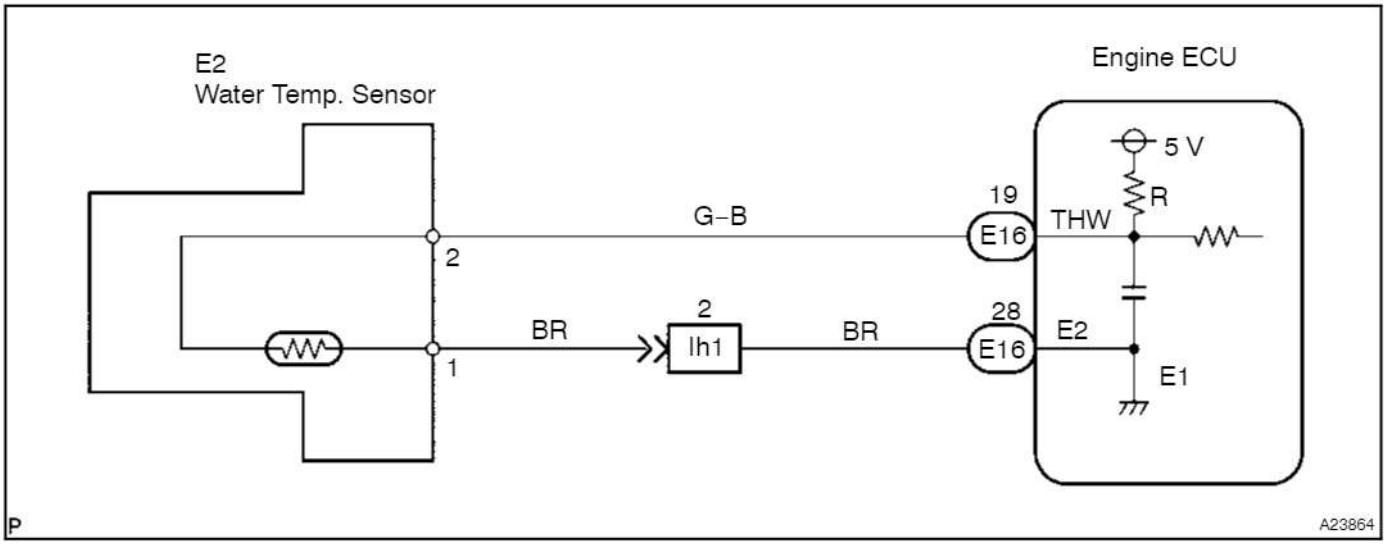
DTC No.	DTC Detection Condition	Trouble Area
P0115/22	Open or short in water temp. sensor circuit for 0.5 sec. or more	• Open or short in water temp. sensor circuit • Water temp. sensor • Engine ECU

HINT:

When DTC P0115/22 is detected, check the engine coolant temperature by entering the following menus on the intelligent tester II: Powertrain / Engine and ECT / Data List / Coolant Temp.

Temperature displayed	Malfunction
–40°C (–40°F)	Open circuit
140°C (284°F) or more	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

When using intelligent tester II:

1	**Connect intelligent tester II, and read value of water temperature.**

PREPARATION:

(a) Connect the intelligent tester II to the DLC 3.

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

OK:

Same as actual water temperature.

HINT:

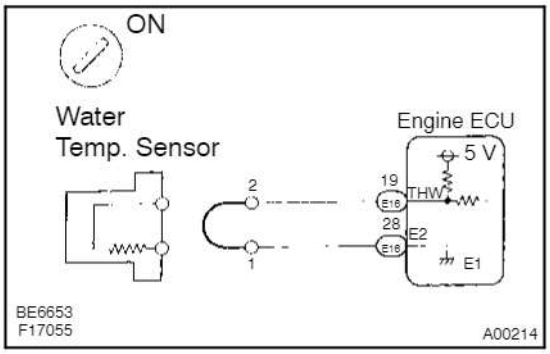
- If there is an open circuit, the intelligent tester II indicates –40°C (–40°F).
- If there is a short circuit, the intelligent tester II indicates 140°C (284°F) or more.

NG → **–40°C (–40°F) ... Go to step 2.**
140°C (284°F) or more ... Go to step 4.

OK

Check for intermittent problems (See page DI–4).

2	Check for open in harness or engine ECU.



PREPARATION:

(a) Disconnect the water temp. sensor connector.
(b) Connect sensor wire harness terminals together.
(c) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

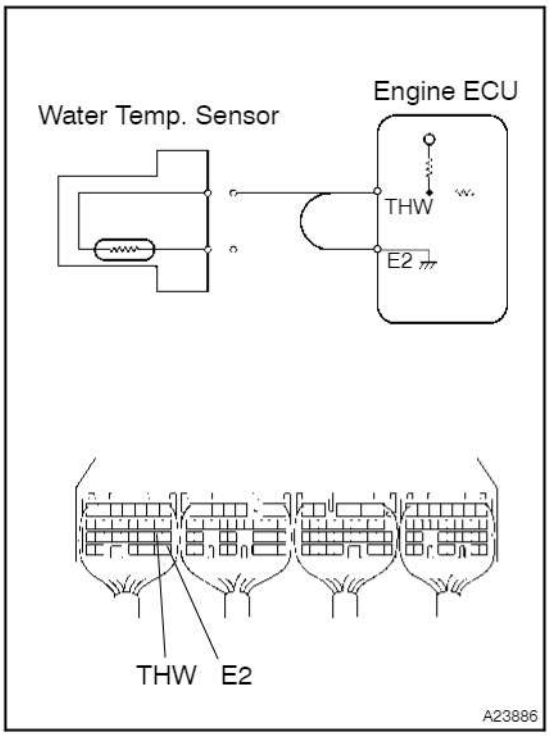
OK:

Temperature value: 140°C (284°F) or more

OK	Confirm good connection at sensor. If OK, replace water temp. sensor.

NG

3	Check for open in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.
(b) Connect between terminals THW and E2 of the engine ECU connector.

HINT:

Water temp. sensor connector is disconnected.

Before checking, do a visual and contact pressure check for the engine ECU connector (see page IN–19).

(c) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

OK:

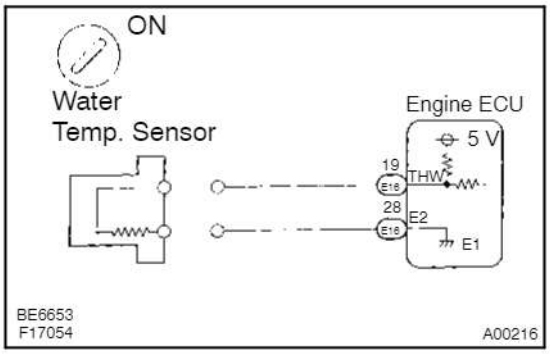
Temperature value: 140°C (284°F) or more

OK	Open in harness between terminal E2 or THW, repair or replace harness.

NG

Confirm good connection at engine ECU. If OK, replace engine ECU.

4	Check for short in harness and engine ECU.



PREPARATION:

(a) Disconnect the water temp. sensor connector.

(b) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

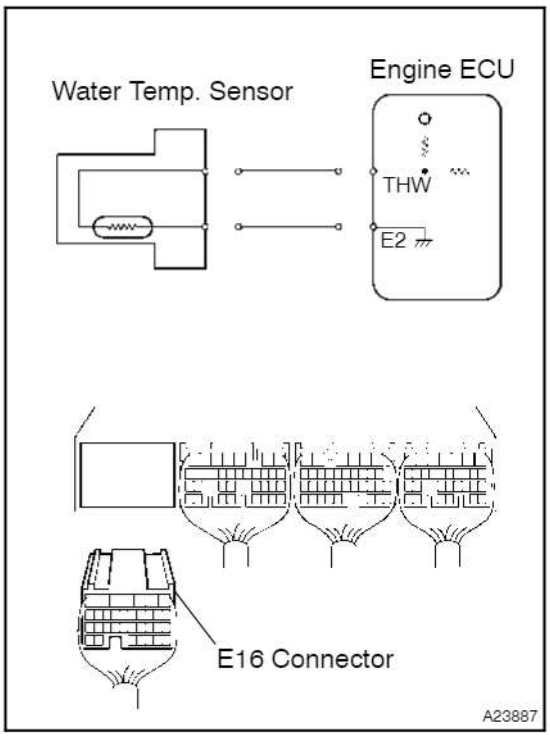
OK:

Temperature value: –40°C (–40°F)

OK	Replace water temp. sensor.

NG

5	Check for short in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.

(b) Disconnect the E16 connector of the engine ECU.

HINT:

Water temp. sensor connector is disconnected.

(c) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

OK:

Temperature value: –40°C (–40°F)

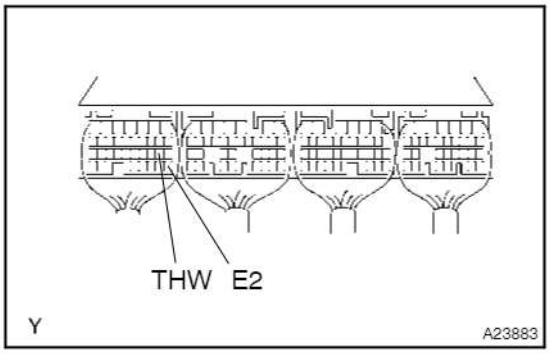
OK	Repair or replace harness or connector.

NG

Check and replace engine ECU (See page IN–19).

When not using intelligent tester II:

1	**Check voltage between terminals THW and E2 of engine ECU connector.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals THW and E2 of the engine ECU connector.

OK:

Water temp.	Voltage
20°C (68°F) (Engine is cool)	0.2 to 3.8 V
80°C (176°F) (Engine is hot)	0.1 to 1.5 V

OK → **Check for intermittent problems (See page DI–4).**

NG

2	**Check water temp. sensor (See Pub. No. RM617E on page ED–5).**

NG → **Replace water temp. sensor.**

OK

3	**Check for open and short in harness and connector between engine ECU and water temp. sensor (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

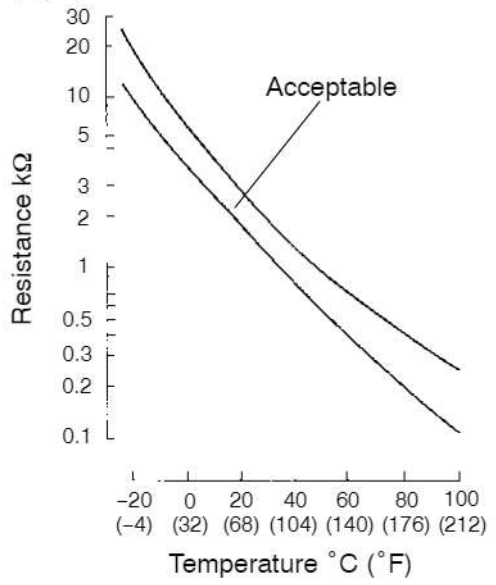
Check and replace engine ECU (See page IN–19).

DI3S9-07

DTC	P0180/39	Fuel Temperature Sensor Circuit

CIRCUIT DESCRIPTION

(Fig.1)



The fuel temperature sensor senses the fuel temperature. A thermistor built into the sensor changes the resistance value according to the fuel temperature. The lower the fuel temperature, the greater the thermistor resistance value, and the higher the fuel temperature, the lower the thermistor resistance value (See Fig.1).

The fuel temperature sensor is connected to the engine ECU (see next page). The 5 V power source voltage in the engine ECU is applied to the fuel temperature sensor from the terminal THF via resistor R. That is, the resistor R and the fuel temperature sensor are connected in series. When the resistance value of the fuel temperature sensor changes, in accordance with changes in the fuel temperature, the potential at the terminal THF also changes. Based on this signal, the engine ECU increases the fuel injection volume to improve driveability during low engine revolution and high fuel temperature.

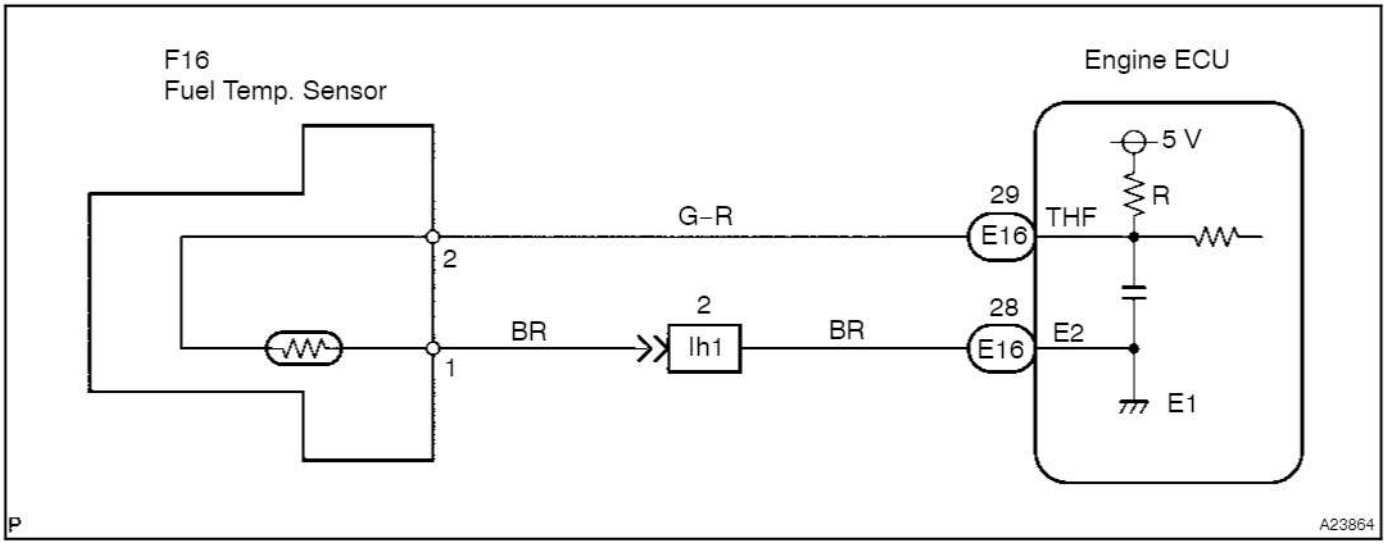
DTC No.	DTC Detection Condition	Trouble Area
P0180/39	Open or short in fuel temp. sensor circuit for 0.5 sec. or more	• Open or short in fuel temp. sensor circuit • Fuel temp. sensor • Engine ECU

HINT:

When DTC P0180/39 is detected, check the engine coolant temperature by entering the following menus on the intelligent tester II: Powertrain / Engine and ECT / Data List / Fuel Temp.

Temperature displayed	Malfunction
–40°C (–40°F)	Open circuit
140°C (284°F) or more	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

When using intelligent tester II:

1	**Connect intelligent tester II, and read value of fuel temperature.**

PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

OK:

Same as actual fuel temperature.

HINT:

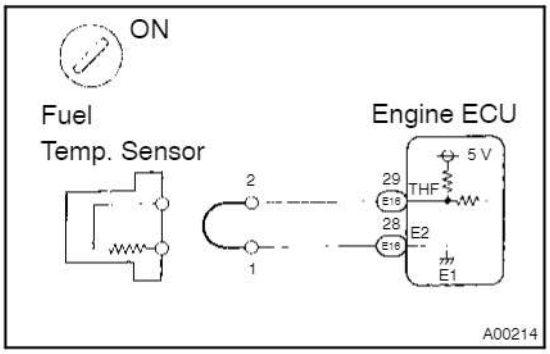
- If there is an open circuit, the intelligent tester II indicates –40°C (–40°F).
- If there is a short circuit, the intelligent tester II indicates 140°C (284°F) or more.

NG → **–40°C (–40°F) ... Go to step 2.**
140°C (284°F) or more ... Go to step 4.

OK

Check for intermittent problems (See page DI–4).

2	Check for open in harness or engine ECU.



PREPARATION:

(a) Disconnect the fuel temp. sensor connector.
(b) Connect sensor wire harness terminals together.
(c) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

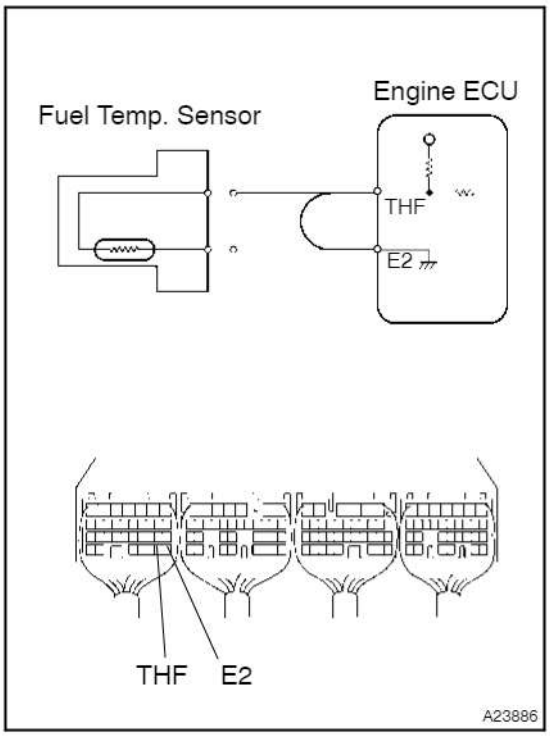
OK:

Temperature value: 140°C (284°F) or more

OK	Confirm good connection at sensor. If OK, replace fuel temp. sensor.

NG

3	Check for open in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.
(b) Connect between terminals THF and E2 of the engine ECU connector.

HINT:

Fuel temp. sensor connector is disconnected. Before checking, do a visual and contact pressure check for the engine ECU connector (see page IN–19).

(c) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

OK:

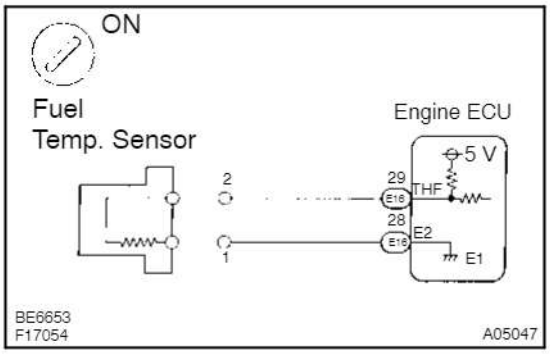
Temperature value: 140°C (284°F) or more

OK	Open in harness between terminal E2 or THF, repair or replace harness.

NG

Confirm good connection at engine ECU. If OK, replace engine ECU.

4	Check for short in harness or engine ECU.



PREPARATION:

(a) Disconnect the fuel temp. sensor connector.

(b) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

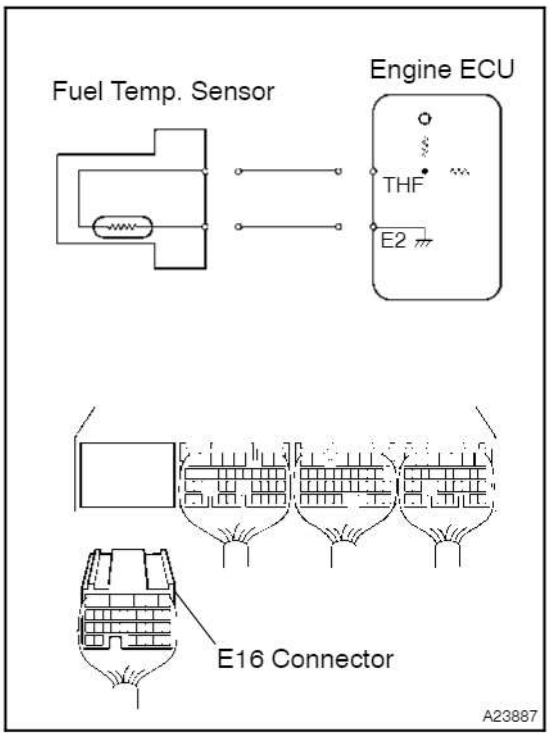
OK:

Temperature value: –40°C (–40°F)

OK	Replace fuel temp. sensor.

NG

5	Check for short in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.

(b) Disconnect the E16 connector of the engine ECU.

HINT:

Fuel temp. sensor connector is disconnected.

(c) Turn the ignition switch ON.

CHECK:

Read the temperature value on the intelligent tester II.

OK:

Temperature value: –40°C (–40°F)

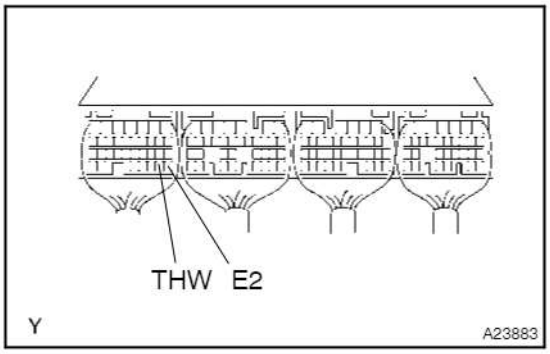
OK	Repair or replace harness or connector.

NG

Check and replace engine ECU (See page IN–19).

When not using intelligent tester II:

1	**Check voltage between terminals THF and E2 of engine ECU connector.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals THF and E2 of the engine ECU connecter.

OK:

Fuel temp.	Voltage
20°C (68°F) (Engine is cool)	0.2 to 3.8 V
80°C (176°F) (Engine is hot)	0.1 to 1.5 V

OK → **Check for intermittent problems (See page DI–4).**

NG

2	**Check fuel temp. sensor (See Pub. No. RM617E on page ED–6).**

NG → **Replace fuel temp. sensor.**

OK

3	**Check for open and short in harness and connector between engine ECU and fuel temp. sensor (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–19).

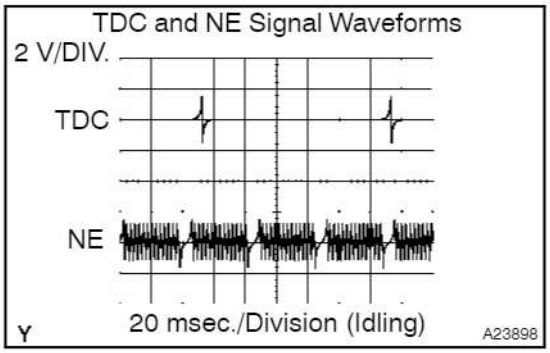
DIDYD–01

DTC	P0335/13	Engine Speed Sensor Circuit 1 (NE Circuit)

CIRCUIT DESCRIPTION

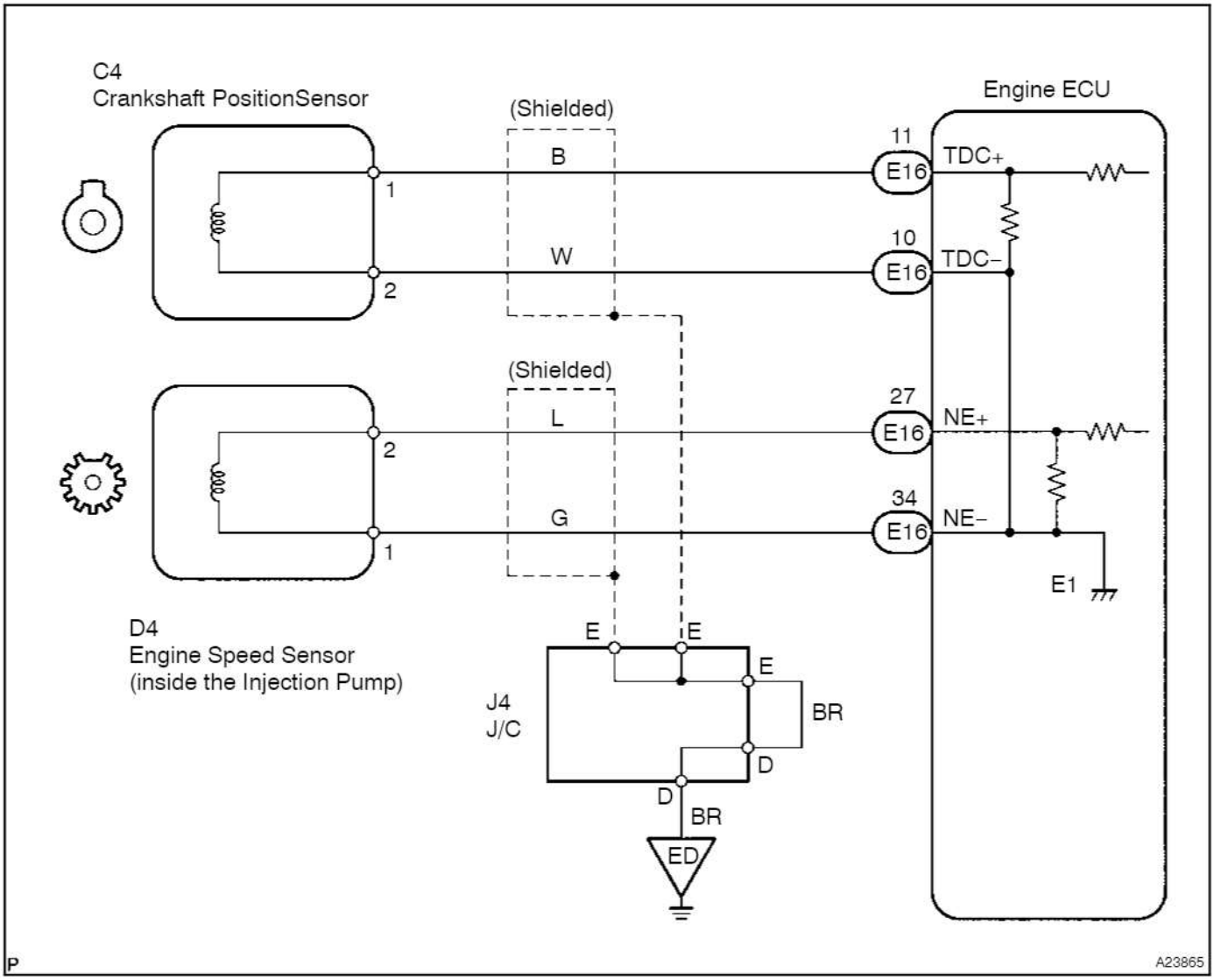
The crankshaft position sensor in the engine control system contains signal plate and a pickup coil for TDC signal. The TDC signal plate has 1 tooth on its outer circumference. The TDC signal sensor generates 1 signal for every engine revolution. The engine ECU detects the top dead center by the TDC signals.
The engine speed sensor in the engine control system contains signal plate and a pickup coil for NE signal. The NE signal plate has 78 teeth and is mounted in the injection pump. The NE signal sensor generates 78 signals every 2 engine revolutions. The engine ECU detects the engine speed and cam lift position of the injection pump. The engine ECU uses TDC signal and NE signals for injection timing control. The NE signal is also used for injection volume control.

DTC No.	DTC Detection Condition	Trouble Area
P0335/13	No NE signal to engine ECU for 0.5 sec. or more at 580 rpm or more	• Open or short in engine speed sensor circuit • Engine speed sensor • Engine ECU
	No NE signal to engine ECU for 2.0 sec. or more during cranking	



Reference: INSPECTION USING OSCILLOSCOPE
During cranking or idling, check between terminals NE+ and NE– of the engine ECU.
HINT:
The correct waveforms are as shown.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check resistance of engine speed sensor (See Pub No. RM617E, FU–113).**

NG → **Check and replace injection pump (See Pub No. RM617E, FU–113).**

OK

2	Check for open and short in harness and connector between engine ECU and engine speed sensor (See page IN–19).

NG → Repair or replace harness or connector.

OK

3	Inspect sensor installation.

NG → Tighten sensor.

OK

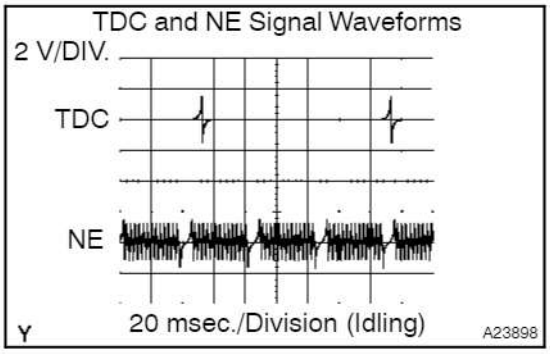
Check and replace engine ECU (See page IN–19).

DTC	P0340/12	Engine Speed Sensor Circuit 1 (TDC or G1 Circuit)

CIRCUIT DESCRIPTION

Refer to DTC P0335/13 on page DI–56.

DTC No.	DTC Detection Condition	Trouble Area
P0340/12	No TDC signal to engine ECU at 400 rpm or more	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Engine ECU



Reference: INSPECTION USING OSCILLOSCOPE

During cranking or idling, check between terminals TDC+ and TDC– of the engine ECU.

HINT:

The correct waveforms are as shown.

WIRING DIAGRAM

Refer to DTC P0335/13 on page DI–56.

INSPECTION PROCEDURE

1	**Check resistance of crankshaft position sensor (TDC) (See Pub No. RM617E, page ED–8).**

NG → **Replace crankshaft position sensor.**

OK

2	**Check for open and short in harness and connector between engine ECU and crankshaft position sensor (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

3	Inspect sensor installation.

NG → Tighten sensor.

OK →

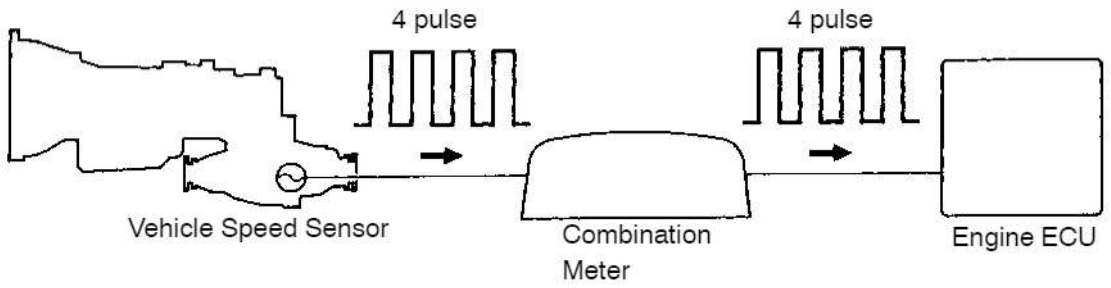
Check and replace engine ECU (See page IN–19).

DIDYG–01

DTC	P0500/42	Vehicle Speed Sensor Signal Circuit Malfunction

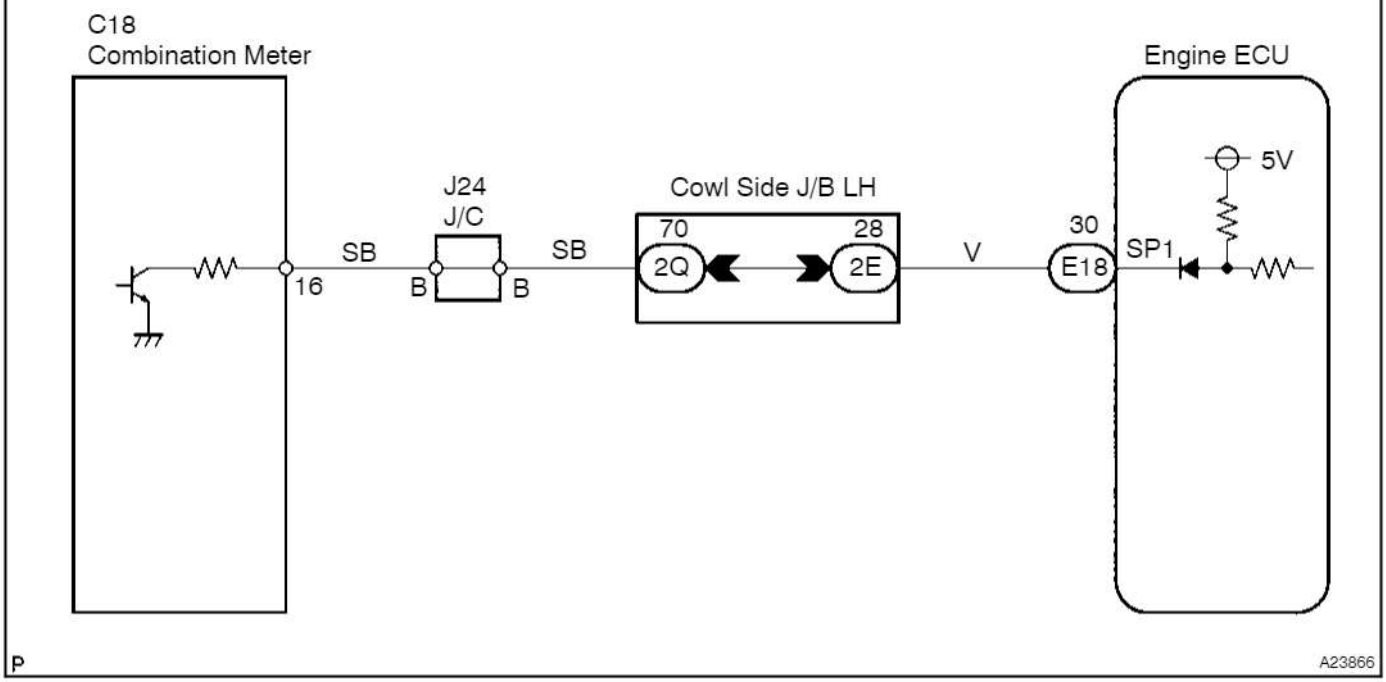
CIRCUIT DESCRIPTION

The vehicle speed sensor outputs a 4 pulse signal for every revolution of the rotor shaft, which is rotated by the transmission output shaft via the driven gear. After this signal is converted into a more precise rectangular waveform by the waveform shaping circuit inside the combination meter, it is then transmitted to the engine ECU. The engine ECU determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	DTC Detection Condition	Trouble Area
P0500/42	All conditions below are detected continuously for 8 sec. or more: (a) Vehicle speed signal: 0 km/h (0 mph) (b) Engine speed: 2,000 to 3,000 rpm (c) Engine coolant temp.: 60°C (176°F) or more (d) Accelerator pedal opening angle: 45% or more	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • Combination meter • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check operation of speedometer.**

CHECK:

Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.

HINT:

The vehicle speed sensor is operating normally if the speedometer display is normal.

NG → **Check speedometer.**

OK

2	**Check for open and short in harness and connector between engine ECU and combination meter (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–19).

DTC	P0605/17	Interior IC Malfunction

DTC	P1633/89	Interior IC Malfunction

CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
P0605/17 P1633/89	ECU malfunction	• Engine ECU

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

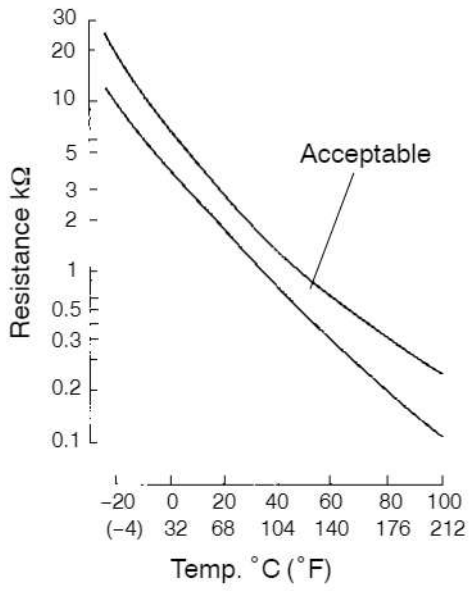
Replace engine ECU.

DI9MO–02

DTC	P1115/23	Atmospheric Temperature Circuit

CIRCUIT DESCRIPTION

Fig. 1

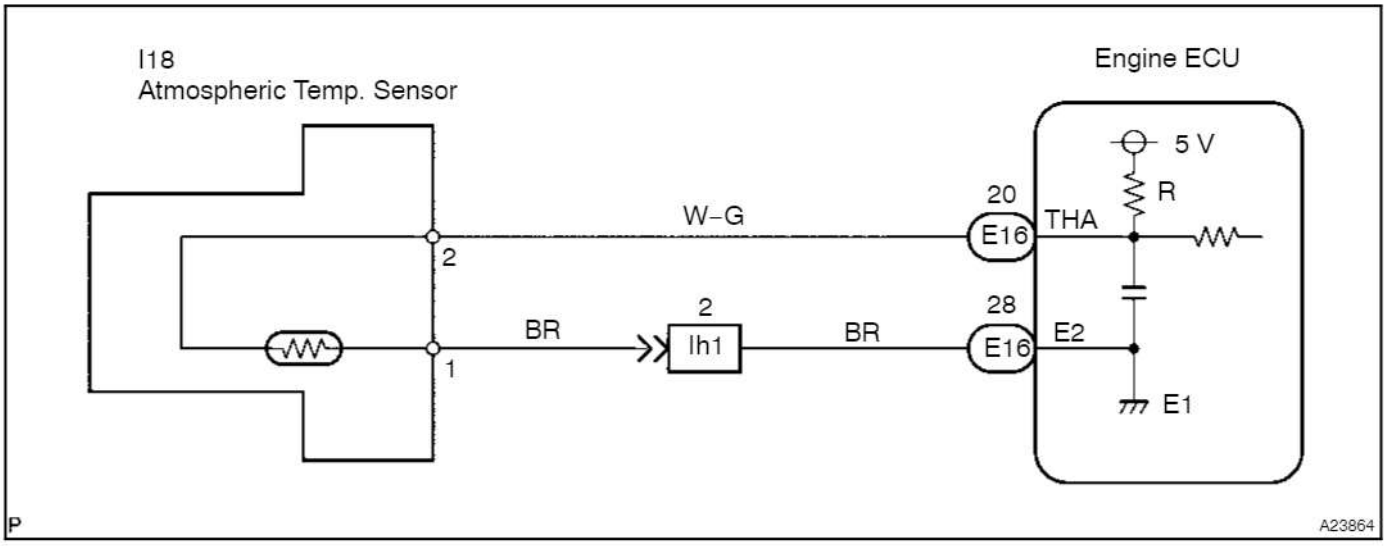


The atmospheric temperature sensor is built into the intake manifold and senses the atmospheric temperature. A thermistor built in the sensor changes the resistance value according to the intake air temperature. The lower the atmospheric temperature, the greater the thermistor resistance value, and the higher the atmospheric temperature, the lower the thermistor resistance value (See Fig. 1).

The atmospheric temperature sensor is connected to the engine ECU. The 5 V power source voltage in the engine ECU is applied to the atmospheric temperature sensor from terminal THA via a resistor R. That is, the resistor R and the atmospheric temperature sensor are connected in series. When the resistance value of the atmospheric temperature sensor changes, according to changes in the atmospheric temperature, the voltage at terminal THA also varies. Based on this signal, the engine ECU increases the fuel injection volume to improve driveability during cold engine operation.

DTC No.	DTC Detection Condition	Trouble Area
P1115/23	Open or short in atmospheric temp. sensor circuit for 0.5 sec. or more	• Open or short in atmospheric temp. sensor circuit • Atmospheric temp. sensor • Engine ECU

WIRING DIAGRAM

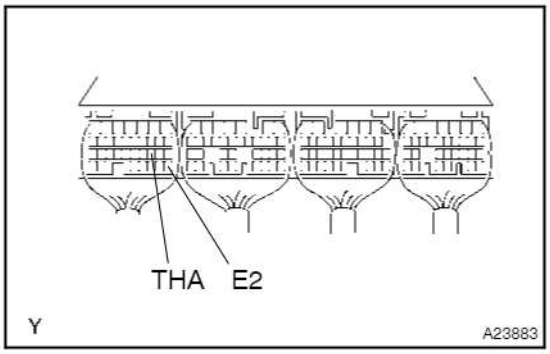


INSPECTION PROCEDURE

HINT:

- If DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

1	**Check voltage between terminals THA and E2 of engine ECU connector.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals THA and E2 of the engine ECU connector.

OK:

Intake Air Temp.	Voltage
20°C (68°F) (Engine is cool)	0.2 to 3.8 V
80°C (176°F) (Engine is hot)	0.1 to 1.5 V

OK	**Check for intermittent problems (See page DI–4).**

NG

2	**Check atmosphereric temperature sensor (See Pub. No. RM617E on page ED–7).**

NG	**Replace atmosphereric temperature sensor.**

OK

3	**Check for open and short in harness and connector between engine ECU and atmosphereric temperature sensor (See page IN–19).**

NG	**Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–19).

DIDYO–01

DTC	P1120/19	Accel. Position Sensor circuit (Open/Short)

CIRCUIT DESCRIPTION

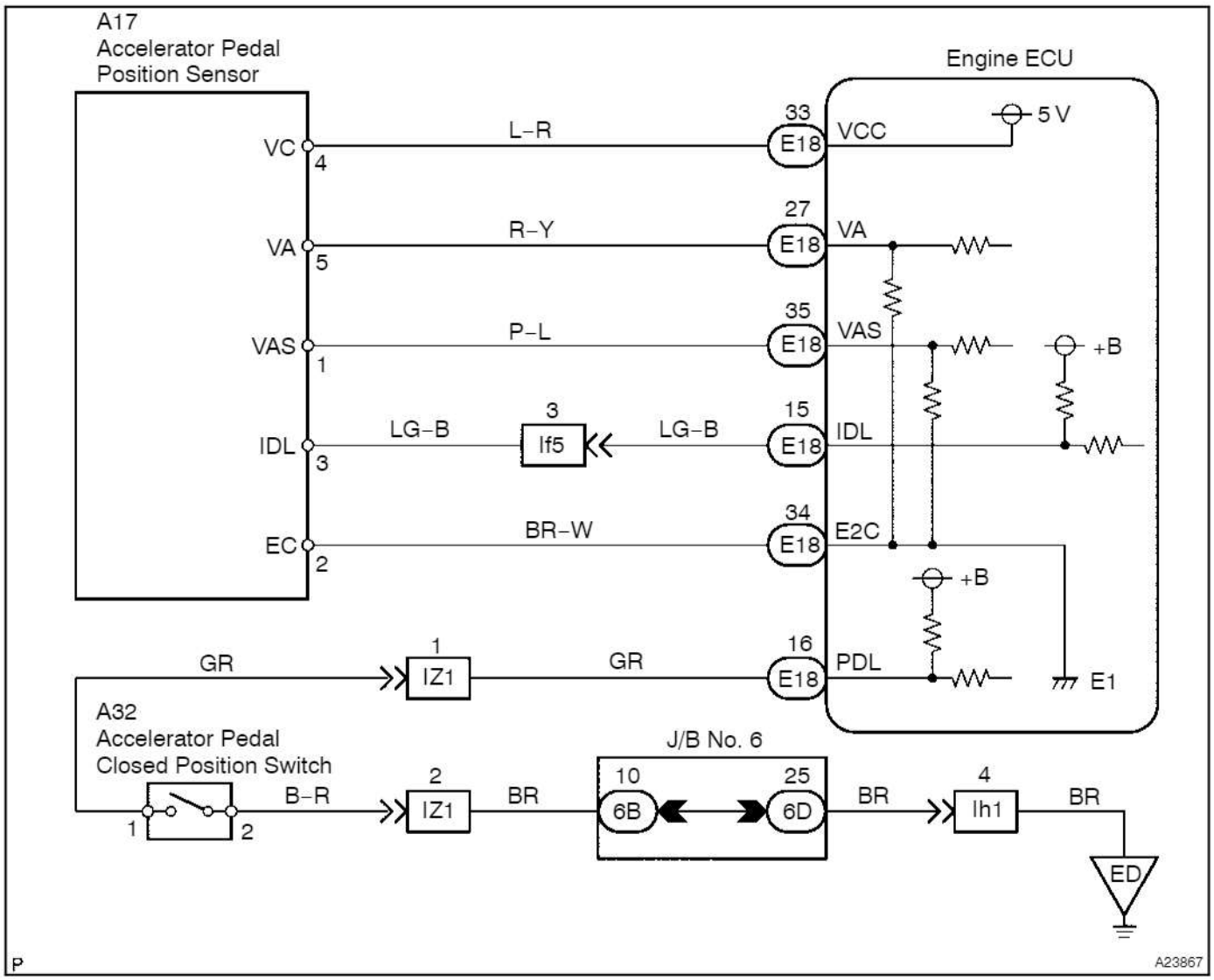
The accelerator pedal position sensor is mounted at the accelerator pedal and detects the accelerator pedal opening angle. When the accelerator pedal is fully closed, a voltage of approximately 1.0 V is applied to terminals VA, VAS of the engine ECU. The voltage applied to the terminals VA, VAS of the engine ECU increases in proportion to the opening angle of the accelerator pedal and becomes approximately 3.8 V when the accelerator pedal is fully opened. The engine ECU judges the vehicle driving conditions from these signals input from terminals VA, VAS and uses them as one of the conditions to control the injection volume and diesel throttle valve position. The idle switch is mounted in the accelerator pedal position sensor and sends the IDL signal to the engine ECU when the accelerator pedal is fully depressed.
This system has 2 way accelerator pedal position sensor and accelerator pedal closed position switch for fail safe.

DTC No.	DTC Detection Condition	Trouble Area
P1120/19	Open or short in accelerator pedal position sensor circuit for 0.05 sec. or more	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • Engine ECU

HINT:
After confirming DTC P1120/19 use the intelligent tester II to confirm the accelerator pedal opening percentage and accelerator pedal close position switch condition.

Accelerator pedal opening position expressed as percentage		Trouble area
Accelerator pedal fully closed	Accelerator pedal fully open	
0%	0%	VCC line open VA, VAS line open or short
Approx. 100%	Approx. 100%	E2C line open

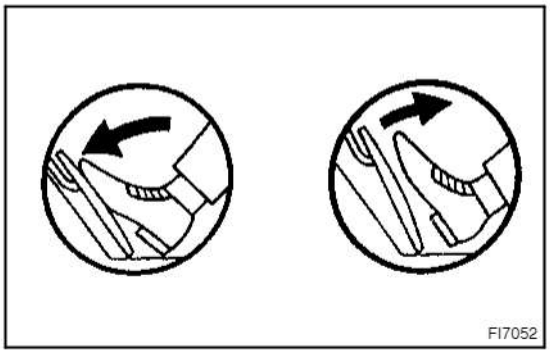
WIRING DIAGRAM



INSPECTION PROCEDURE

When using intelligent tester II:

1	**Connect intelligent tester II, and read accelerator pedal opening percentage.**



PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

(c) Depress and release the accelerator pedal

CHECK:

(a) Read the accelerator pedal opening percentage.

Resalt:

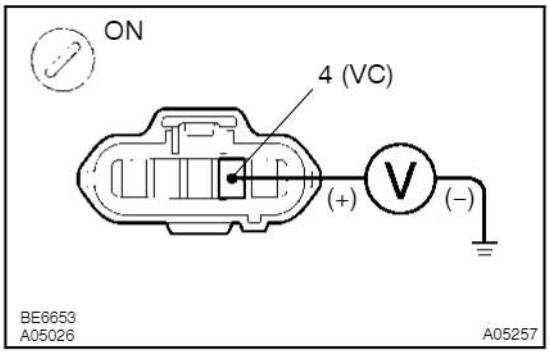
Condition	Proceed to
Value changes in accordance with accelerator pedal position	A
Value is fixed at 100%	B
Value is fixed at 0%	C

A → **Check for intermittent problems (See page DI–4).**

B → **Go to step 6.**

C

2	**Check voltage between terminal 4 of wire harness side connector and body ground.**



PREPARATION:

(a) Disconnect the accelerator pedal position sensor connector.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal 4 of wire harness side connector and body ground.

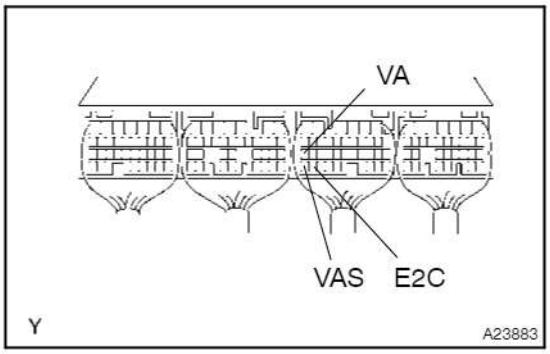
OK:

Voltage: 4.5 to 5.5 V

NG → **Go to step 5.**

OK

3	Check voltage between terminals VA, VAS and E2C of engine ECU.



PREPARATION:

(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals VA, VAS and E2C of the engine ECU.

OK:

Accelerator pedal	Voltage
Fully closed	0.6 to 1.3 V
Fully open	2.8 to 4.5 V

OK	Check and replace engine ECU (See page IN–19).

NG

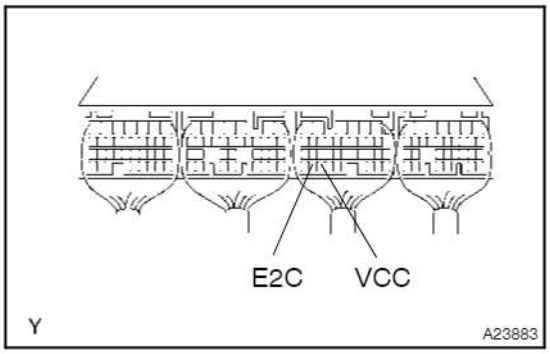
4	Check for open and short in harness and connector between engine ECU and accelerator pedal position sensor (VA, VAS line) (See page IN–19).

NG	Repair or replace harness or connector.

OK

Replace accelerator pedal position sensor.

5	Check voltage between terminals VCC and E2C of engine ECU.



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals VCC and E2C of the engine ECU connector.

OK:

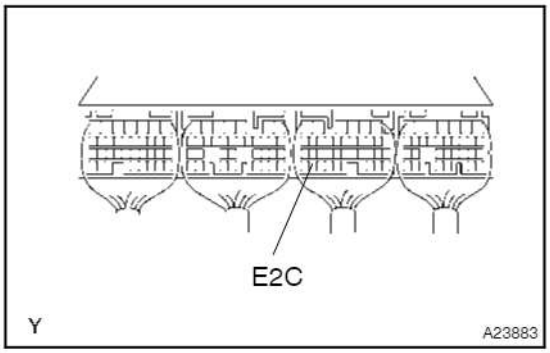
Voltage: 4.5 to 5.5 V

NG	Check and replace engine ECU (See page IN–19).

OK

Check for open in harness and connector between engine ECU and accelerator pedal position sensor (VCC line) (See page IN–19).

6	Check resistance between terminals E2C of engine ECU and body ground.



PREPARATION:

(a) Remove the glove compartment door.

CHECK:

Measure the resistance between terminals E2C of the engine ECU connector and body ground.

OK:

Resistance: Below 1 Ω

NG	Check and replace engine ECU (See page IN–19).

OK

7	Check for open and short in harness and connector between engine ECU and accelerator pedal position sensor (E2C line) (See page IN–19).

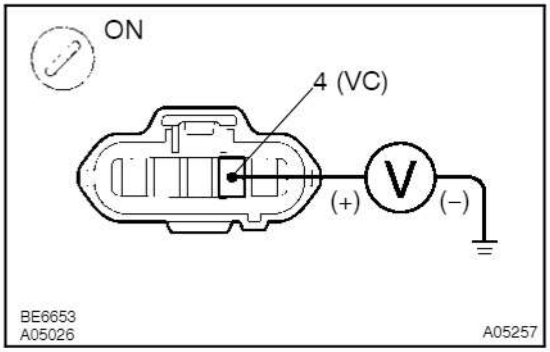
NG	Repair or replace harness or connector.

OK

Replace accelerator pedal position sensor.

When not using intelligent tester II:

1	**Check voltage between terminal 4 of wire harness side connector and body ground.**



PREPARATION:

(a) Disconnect the accelerator pedal position sensor connector.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal 4 of wire harness side connector and body ground.

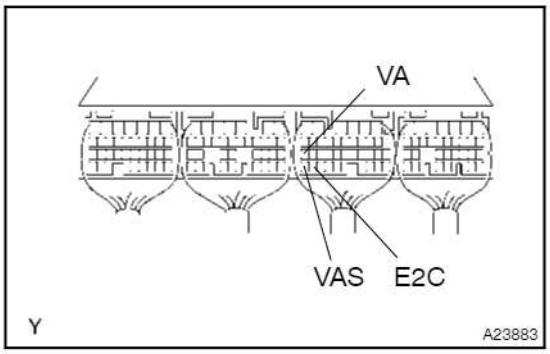
OK:

Voltage: 4.5 to 5.5 V

NG	**Go to step 4.**

OK

2	**Check voltage between terminals VA, VAS and E2C of engine ECU.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals VA, VAS and E2C of the engine ECU.

OK:

Accelerator pedal	Voltage
Fully closed	0.6 to 1.3 V
Fully open	2.8 to 4.5 V

OK	**Check and replace engine ECU (See page IN–19).**

NG

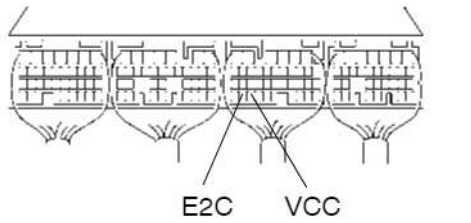
3	**Check for open and short in harness and connector between engine ECU and accelerator pedal position sensor (VA, VAS line) (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

Replace accelerator pedal position sensor.

4	**Check voltage between terminals VCC and E2C of engine ECU.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals VCC and E2C of the engine ECU connector.

OK:

Voltage: 4.5 to 5.5 V

NG → **Check and replace engine ECU (See page IN–19).**

OK

Check for open in harness and connector between engine ECU and accelerator pedal position sensor (VCC line) (See page IN–19).

DIDYJ–01

DTC	P1121/19	Accel. Position Sensor Circuit (IDL SW/ Range)

CIRCUIT DESCRIPTION

Refer to DTC P1120/19 on page DI–67.

DTC No.	DTC Detection Condition	Trouble Area
P1121/19	Condition (a) or (b) continues 0.05 sec. or more: (a) IDL ON and VA > 1.4 V (b) IDL ON and VAS > 1.4 V	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • Engine ECU
	Condition (a) or (b) continues 0.5 sec. or more: (a) IDL OFF and VA < 0.6 V (b) IDL OFF and VAS < 0.6 V	
	Conditions (a) and (b) continue 0.05 sec. or more: (a) 0.6 V < VA < 4.4 V and 0.6 V < VAS < 4.4 V (b) VA – VAS > 0.5 V	

WIRING DIAGRAM

Refer to DTC P1120/19 on page DI–67.

INSPECTION PROCEDURE

When using intelligent tester II:

1	Connect intelligent tester II and read IDL signal.

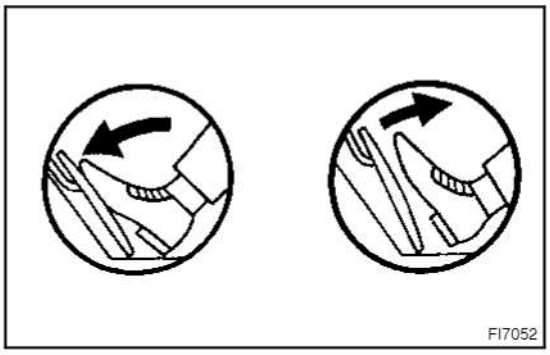
PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

CHECK:

Read the IDL signal.



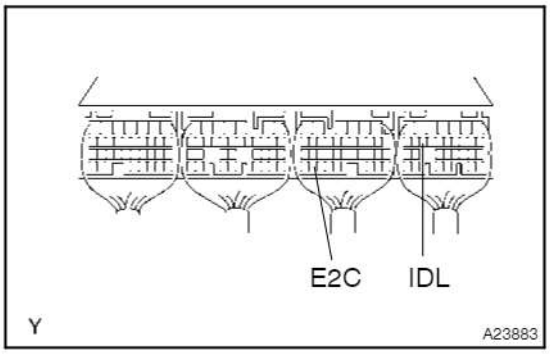
OK:

Accelerator pedal	IDL signal
Fully open	OFF
Fully closed	ON

OK → Go to step 4.

NG

2	Check voltage between terminals IDL and E2C of engine ECU.



PREPARATION:

(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals IDL and E2C of the engine ECU.

OK:

Accelerator pedal	Voltage
Fully closed	9 to 14 V
Fully open	0 to 3 V

OK → **Check and replace engine ECU (See page IN–19).**

NG

3	Check for open and short in harness and connector between engine ECU and accelerator pedal position sensor (IDL line) (See page IN–19).

NG → **Repair or replace harness or connector.**

OK

Replace accelerator pedal position sensor.

4	**Connect intelligent tester II, and read accelerator pedal operating percentage.**

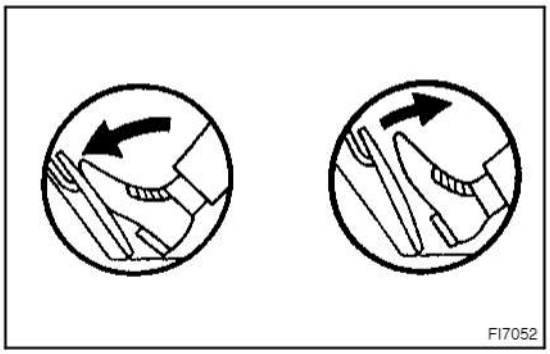
PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

CHECK:

Read the accelerator pedal opening percentage.



OK:

Accelerator pedal	Accelerator pedal opening position expressed as percentage
Fully open	Approx. 65%
Fully closed	Approx. 18%

OK → **Check for intermittent problems (See page DI–4).**

NG

5	**Check voltage between terminal VCC of wire harness side connector and body ground (See page DI–67, Step 2).**

NG → **Go to step 8.**

OK

6	**Check voltage between terminals VA, VAS and E2C of engine ECU (See page DI–67, Step 3).**

OK → **Check and replace engine ECU (See page IN–19).**

NG

7	**Check for open and short in harness and connector between engine ECU and accelerator pedal position sensor (VA, VAS line) (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

Replace accelerator pedal position sensor.

8	**Check voltage between terminals VCC and E2C of engine ECU (See page DI–67, Step 5).**

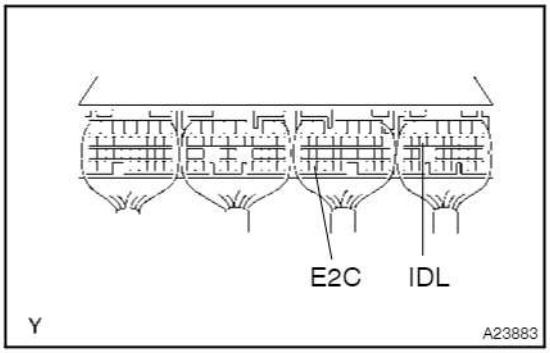
NG → **Check and replace engine ECU (See page IN–19).**

OK

Check for open in harness and connecter between engine ECU and accelerator pedal position sensor (VCC line) (See page IN–19).

When not using intelligent tester II:

1	**Check voltage between terminals IDL and E2C of engine ECU.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals IDL and E2C of the engine ECU.

OK:

Accelerator pedal	Voltage
Fully closed	9 to 14 V
Fully open	0 to 3 V

OK → **Go to step 3.**

NG

2	**Check for open and short in harness and connector between engine ECU and accelerator pedal position sensor (IDL line) (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

Replace accelerator pedal position sensor.

3	Check voltage between terminal 4 of wire harness side connector and body-ground (See page DI–67, Step 2).

NG → Go to step 6.

OK

4	Check voltage between terminals VA, VAS and E2C of engine ECU (See page DI–67, Step 3).

OK → Check and replace engine ECU (See page IN–19).

NG

5	Check for open and short in harness and connector between engine ECU and accelerator pedal position sensor (VA, VAS line) (See page IN–19).

NG → Repair or replace harness or connector.

OK

Replace accelerator pedal position sensor.

6	Check voltage between terminals VCC and E2C of engine ECU (See page DI–67, Step 5).

NG → Check and replace engine ECU (See page IN–19).

OK

Check for open in harness and connector between engine ECU and accelerator pedal position sensor (VCC line) (See page IN–19).

DI31U–05

DTC	P1122/19	Accel. Closed Position SW Circuit (Short)

DTC	P1123/19	Accel. Closed Position SW Circuit (Open)

CIRCUIT DESCRIPTION

Refer to DTC P1120/19 on page DI–67.

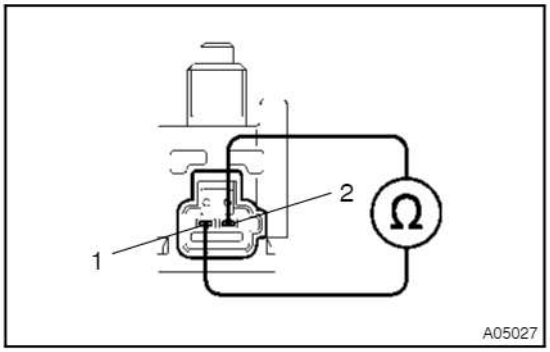
DTC No.	DTC Detection Condition	Trouble Area
P1122/19	Conditions (a) and (b) continue 0.5 sec. or more: (a) PDL ON (b) VA > Fully closed study voltage +0.41 V	• Short in accelerator pedal closed position switch circuit • Accelerator pedal closed position switch • Engine ECU
P1123/19	PDL does not turn ON even once while driving vehicle (2 trip detection logic)	• Open in accelerator pedal closed position switch circuit • Accelerator pedal closed position switch • Engine ECU
	Conditions (a) and (b) continue 5 sec. or more: (a) PDL OFF (b) IDL ON	

WIRING DIAGRAM

Refer to DTC P1120/19 on page DI–67.

INSPECTION PROCEDURE

1	Check accelerator pedal closed position switch.



PREPARATION:

Disconnect the accelerator pedal closed position switch connector.

CHECK:

Measure the resistance between terminals of the accelerator pedal closed position switch.

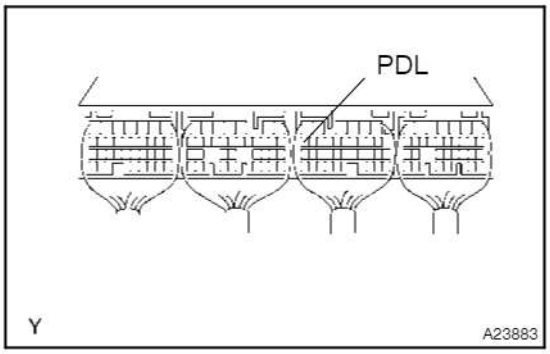
OK:

Terminals	Accelerator pedal	Resistance
1 – 2	Fully closed	10 kΩ or higher
1 – 2	Fully open	0 to 20 Ω

NG → **Replace accelerator pedal closed position switch (See Pub No. RM617E, page ED–9).**

OK

2	Check voltage between terminal PDL of engine ECU and body ground.



PREPARATION:

(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal PDL of the engine ECU and body ground.

OK:

Accelerator pedal	Voltage
Fully closed	9 to 14 V
Fully open	0 to 3 V

OK → **Check and replace engine ECU (See page IN–19).**

NG

Check for open and short in harness and connector between engine ECU and accelerator pedal closed position switch and body ground (See page IN–19).

DI3SA–02

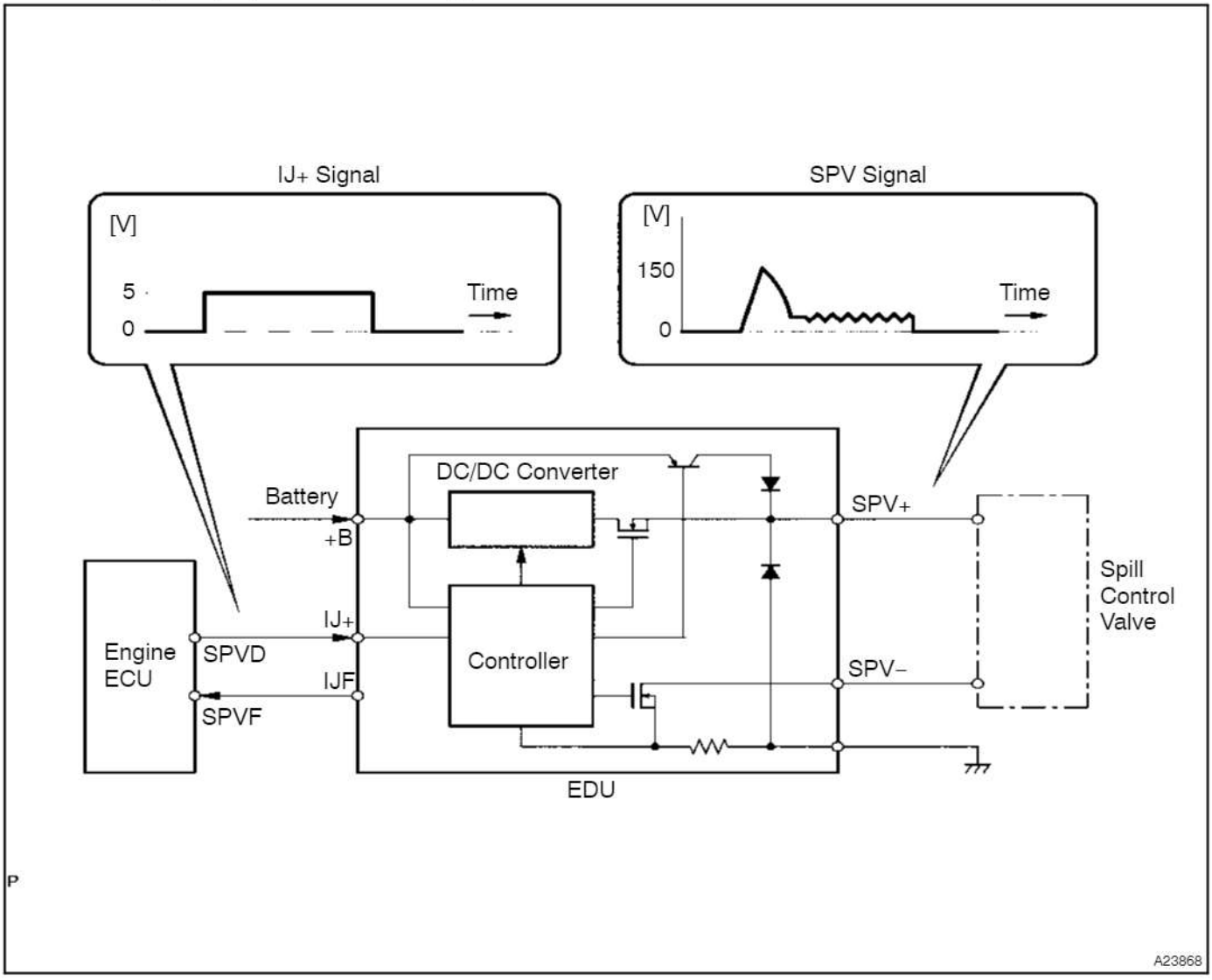
DTC	P1215/97	EDU Circuit

CIRCUIT DESCRIPTION

The EDU drives the spill control valve at high speeds. The EDU's high–speed driving under high fuel pressure conditions is achieved through the use of a DC/DC converter that provides a high–voltage, quick–charging system.

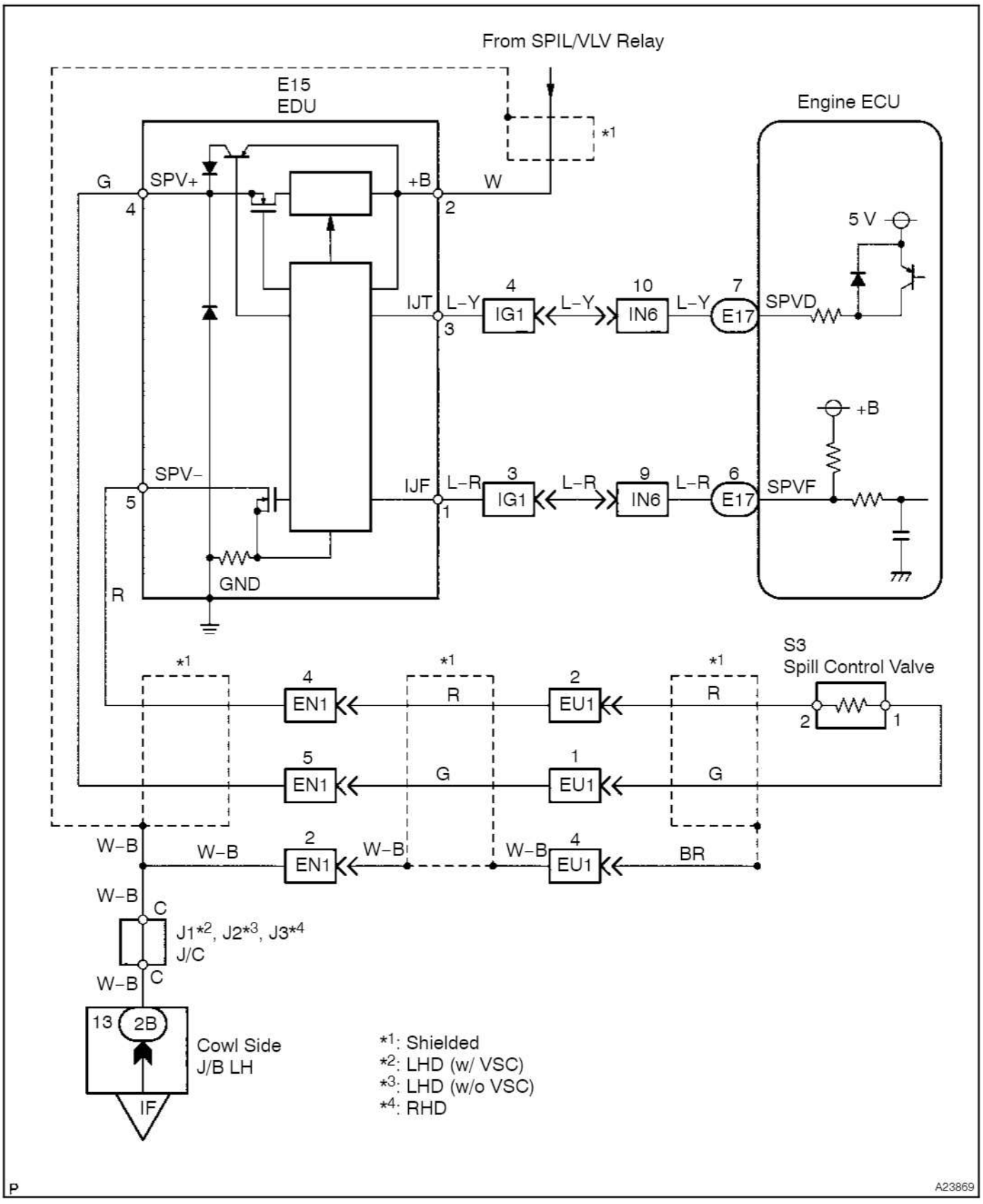
The engine ECU constantly monitors the EDU and stops the engine in case an abnormal condition is detected.

The battery voltage is increased by the DC/DC converter. A voltage of approximately 150 V is applied to the spill control valve in accordance with the IJ+ signal received from the engine ECU. At this time, the injection verification signal (IJF) is sent to the engine ECU.



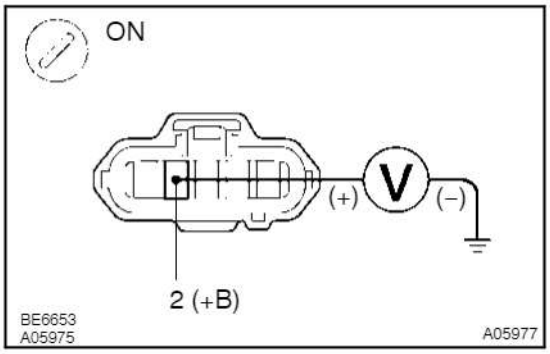
DTC No.	DTC Detection condition	Trouble Area
P1215/97	Although SPVD is output to EDU with engine speed at 500 rpm or more, SPVF is not input continuously 5 times or more	• Open or short in EDU circuit • EDU • Spill control valve

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check voltage between terminal 2 of wire harness side connector and body ground.**



PREPARATION:
(a) Disconnect the EDU connector.
(b) Turn the ignition switch ON.

CHECK:
Measure the voltage between terminal 2 of wire harness side connector and body ground.

OK:
Voltage: 10 to 14 V

NG	**Check Spill valve relay circuit (See page DI–157).**

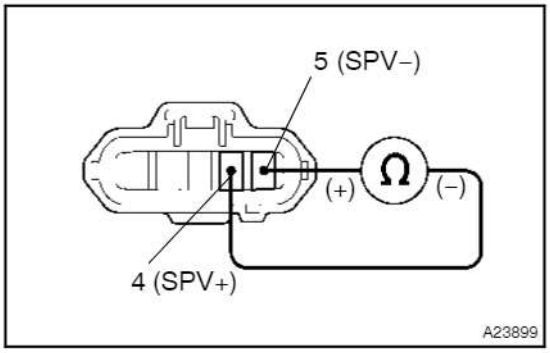
OK

2	**Check resistance EDU ground bolt and body ground.**

NG	**Tighten EDU ground bolt.**

OK

3	**Check resistance between terminals 4 and 5 of wire harness side connector.**



CHECK:
Measure resistance between terminals 4 and 5 of wire harness side connector.

OK:
Resistance: Approx. 1.7 Ω

OK	**Go to step 5.**

NG

4	**Check spill control valve (See Pub No. RM617E, page FU–113).**

NG → **Check and replace injection pump (See Pub No. RM617E, page FU–113).**

OK

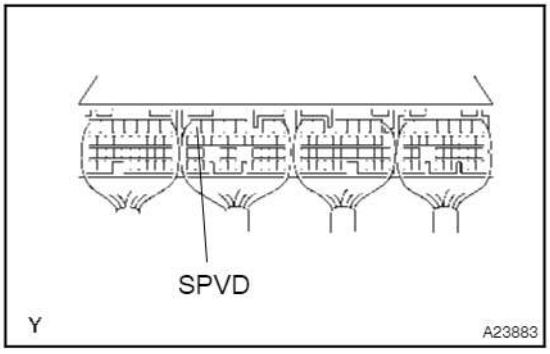
Check for open and short in harness and connector between spill control valve and EDU (See page IN–19).

5	**Check for open and short in harness and connector between engine ECU and EDU (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

6	**Check voltage between terminal SPVD of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

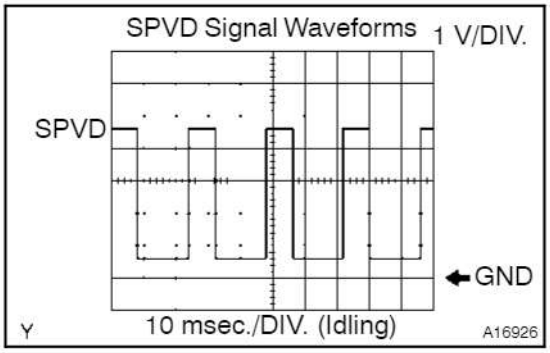
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal SPVD of the engine ECU connector and body ground.

OK:

Voltage: Approx. 0 V



Reference: INSPECTION USING OSCILLOSCOPE

During idling, check the waveform between terminals SPVD and E1 of the engine ECU.

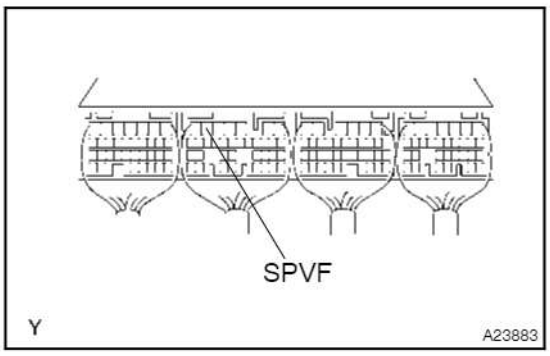
HINT:

The correct waveform is as shown.

NG → **Check and replace engine ECU (See page IN–19).**

OK

7	Check voltage between terminal SPVF of engine ECU and body ground.



PREPARATION:

(a) Remove the glove compartment door.

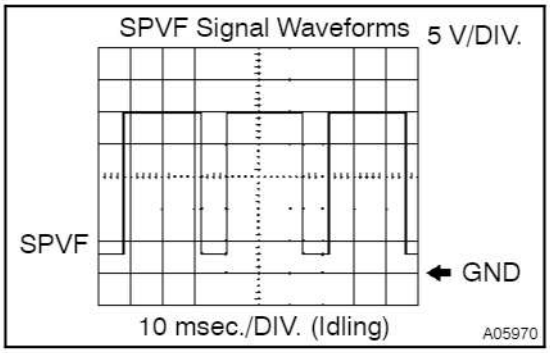
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals SPVF of the engine ECU and body ground.

OK:

Voltage: 9 to 14 V



Reference: INSPECTION USING OSCILLOSCOPE

During idling, check the waveform between terminals SPVF and E1 of the engine ECU.

HINT:

The correct waveform is as shown.

NG → **Check and replace engine ECU (See page IN–19).**

OK

Check and replace EDU (See Pub No. RM617E, page ED–15).

DI31Q-04

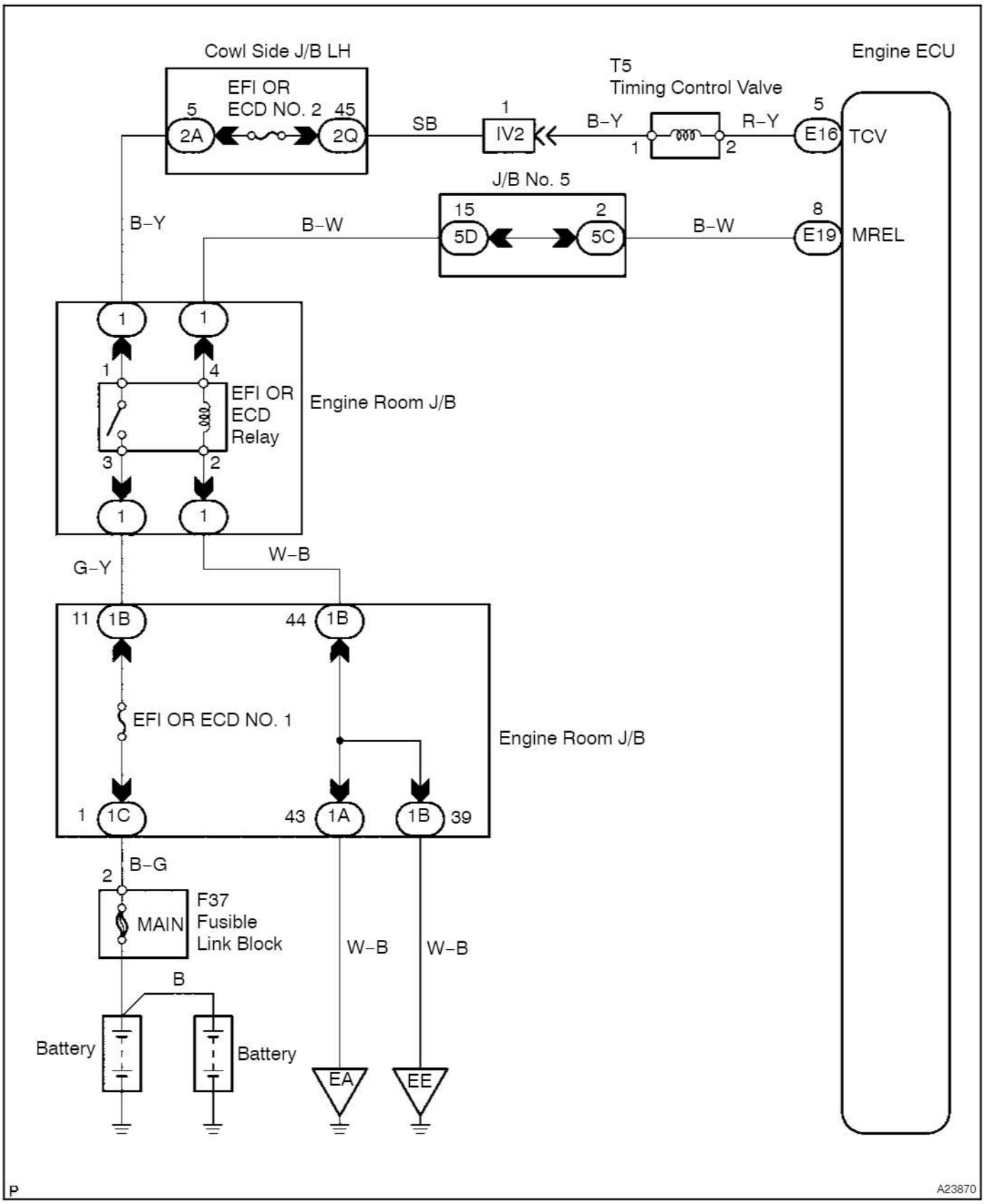
DTC	P1220/14	Timing Control System Malfunction

CIRCUIT DESCRIPTION

The engine ECU control the injection timing by actuating the timing control valve. The timing control valve is mounted on the injection pump and controls the pump internal fuel pressure through duty control.
The engine ECU detects the injection advance angle by TDC and NE signals.

DTC No.	DTC Detection Condition	Trouble Area
P1220/14	After engine warm up and during, actual injection timing is different from target value of engine ECU calculated for several sec.	• Open or short in timing control valve circuit • Timing control valve • Fuel filter (Clogging) • Fuel (Freezing, Air in) • Injection pump (Internal pressure and timing control valve) • Engine ECU

WIRING DIAGRAM



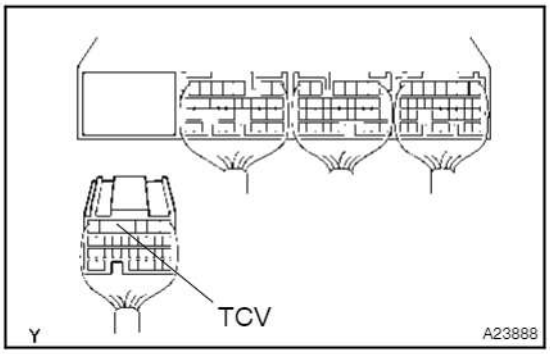
INSPECTION PROCEDURE

1	**Check timing control valve (See Pub No. RM617E, page FU–113).**

NG → **Check and replace injection pump (See Pub No. RM617E, page FU–113).**

OK

2	**Check voltage between terminal TCV of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment door.
(b) Disconnect the E16 connector of the engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal TCV of the engine ECU connector and body ground.

OK:

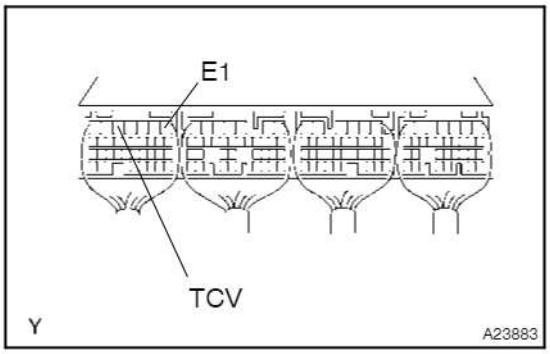
Voltage: 9 to 14 V

OK → **Go to step 3.**

NG

Check for open or short in harness and connector between timing control valve and engine ECU, timing control valve and EFI OR ECD relay (See page IN–19).

3	Check timing control valve operation.



PREPARATION:

(a) Connect the oscilloscope between terminals TCV and E1 of the engine ECU.

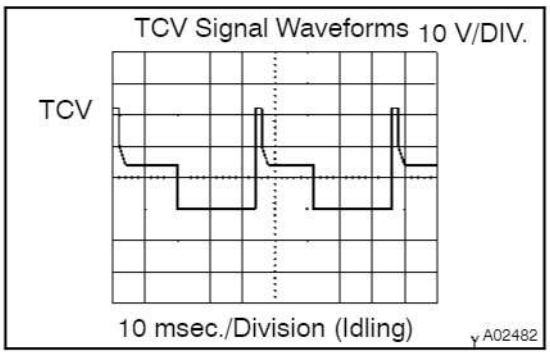
(b) Start the engine.

CHECK:

Check the waveform between terminals TCV and E1 of the engine ECU when the engine is idling.

OK:

The correct waveforms are as shown.



NG → **Check and replace engine ECU (See page IN–19).**

OK

4	Check fuel filter clogging, fuel freezing and fuel air in.

NG → **Replace or repair.**

OK

Check and replace injection pump (See Pub No. RM617E, page FU–113).

DIDYN–01

CIRCUIT INSPECTION

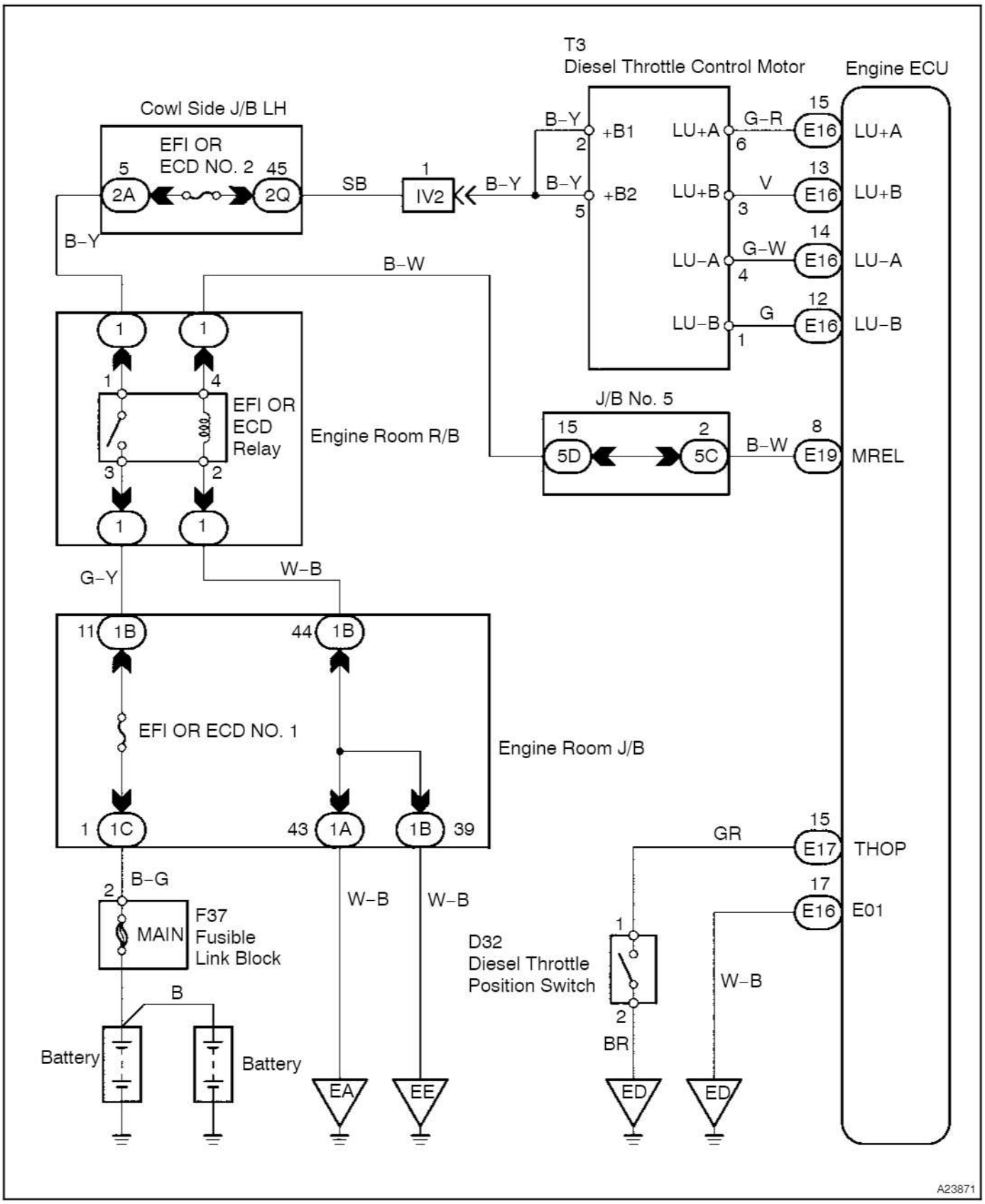
DTC	P1222/15	Throttle Motor Circuit

CIRCUIT DESCRIPTION

The throttle control motor is operated by the engine ECU and it opens and closes the throttle valve.
The fully open condition of the throttle valve is detected by the diesel throttle position switch, which is mounted on the throttle body.
If this DTC is stored, the engine ECU shuts down the power for the throttle control motor.

DTC No.	DTC Detection Condition	Trouble Area
P1222/15	Open or short in throttle control motor circuit	• Open or short in throttle control motor circuit • Open or short in diesel throttle position switch circuit • Throttle control motor • Throttle valve • Throttle drive gear • Diesel throttle body • Diesel throttle position switch • Engine ECU
	Open or short in diesel throttle position switch circuit	

WIRING DIAGRAM

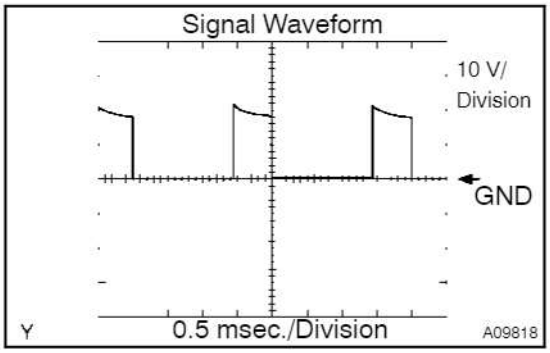


INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

1	**Check throttle control motor circuit.**



PREPARATION:

(a) Connect the oscilloscope between terminals LU+A, LU+B, LU–A, LU–B and E01 of the engine ECU.

(b) Start the engine.

CHECK:

Check the waveform between terminals LU+A, LU+B, LU–A, LU–B and E01 of the engine ECU when the engine is racing.

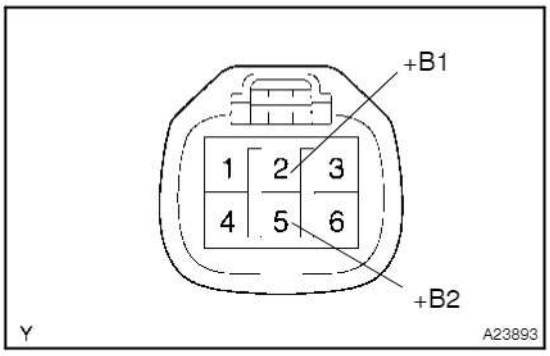
OK:

The correct waveforms are as shown.

OK	**Go to step 5.**

NG

2	**Check voltage of throttle control motor circuit.**



PREPARATION:

(a) Disconnect the throttle control motor.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals 2 and 5 of the throttle control motor connector and body ground.

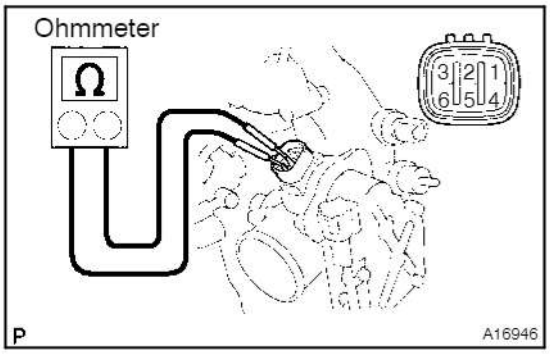
OK:

Voltage: 9 to 14 V

NG	**Check for open in harness and connector between EFI OR ECD relay and throttle control motor (See page IN–19).**

OK

3	Check throttle control motor.



PREPARATION:

Disconnect the throttle control motor connector.

CHECK:

- Measure the resistance between terminals 1, 3 and 2 of the throttle control motor.
- Measure the resistance between terminals 4, 6 and 5 of the throttle control motor.

OK:

Resistance: 18 to 22 Ω at 20°C (68°F)

NG → **Replace diesel throttle body assembly (See Pub No. RM896E, page ED–1).**

OK

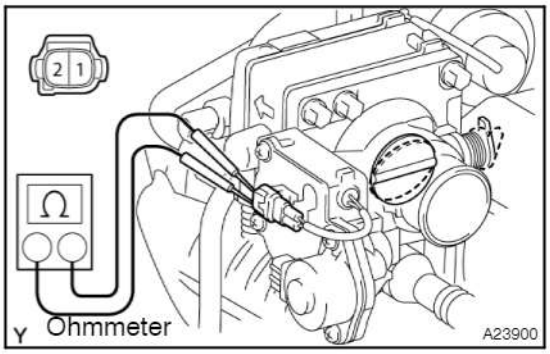
4	Check for open and short in harness and connector between throttle control motor and engine ECU (See page IN–19).

NG → **Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–19).

5	Check diesel throttle position switch.



PREPARATION:
Disconnector the diesel throttle position switch.
CHECK:
Measure the resistance between terminal of the diesel throttle position switch.
OK:

Throttle Valve Position	Diesel throttle position switch signal
Fully closed	10 kΩ or higher
Fully open	Below 1 Ω

NG → **Replace diesel throttle body assembly (See Pub No. RM896E, page ED–1).**

OK

6	Check for open and short in harness and connector between diesel throttle position switch and engine ECU (See page IN–19).

NG → **Repair or replace harness or connector.**

OK

7	Check for open and short in harness and connector between diesel throttle position switch and body ground (See page IN–19).

NG → **Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–19).

DIDY7–01

DTC	P1250/34*	Turbocharger system malfunction

DTC	P1255/34*	Turbocharger stick detected (Close)

DTC	P1256/34*	Turbocharger stick detected (Open)

HINT:
*: Only for Europe

CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
P1250/34	When the condition that the turbocharger pressure exceeds the standard value for 5 sec. or more is detected.	• VNT valve • Turbocharger • EGR valve • Vacuum hose • E–VRV for intake pressure charge • VSV for turbo pressure sensor • Air flow meter • Engine ECU
P1255/34	Condition that turbocharger pressure is high for 20 sec. is detected twice.	
P1256/34	Turbocharger pressure is low for 40 sec. is detected twice.	

WIRING DIAGRAM

Refer to DTC P0105/35 on page DI–32.

INSPECTION PROCEDURE

HINT:
If DTC P0105/35 is output simultaneously, first troubleshoot DTC P0105/35.

When using intelligent tester II:

1	**Check connection of vacuum hose.**

NG → **Repair or replace.**

OK

2	Check vacuum between turbocharger and E–VRV for intake pressure change at 900 rpm.

PREPARATION:

(a) Using a 3–way connector, connect a vacuum gauge to the hose between the E–VRV and turbocharger.

(b) Warm up the engine to above 80°C (176°F).

CHECK:

Check the vacuum at 900 rpm.

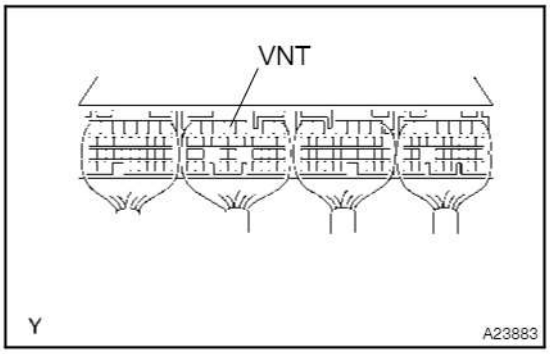
RESULT:

Type	Vacuum
I	0 kPa (0 mmHg, 0 in.Hg) to 50 kPa (375 mmHg, 14.8 in.Hg)
II	Above 50 kPa (375 mmHg, 14.8 in.Hg)

Type II → **Go to step 7.**

Type I

3	Check voltage between terminal VNT of engine ECU connector and body ground.



PREPARATION:

(a) Remove the glove compartment door.

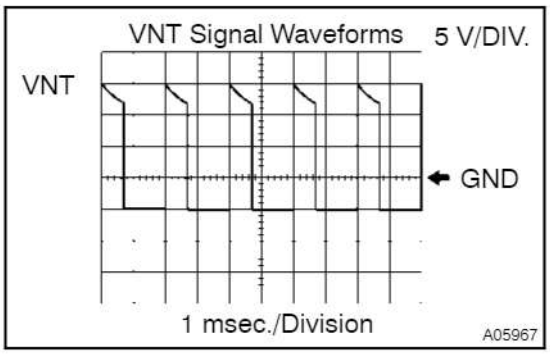
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal VNT of the engine ECU connector and body ground.

OK:

Voltage: 9 to 14 V



Reference: INSPECTION USING OSCILLOSCOPE

During EGR system is ON (engine speed 900 rpm), check the waveform between terminals VNT and E1 of the engine ECU connector.

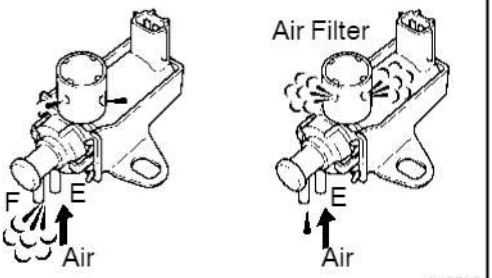
HINT:

The correct waveform is as shown.

NG → **Go to step 5.**

OK

4	Check operation of E–VRV for intake pressure change.



PREPARATION:

(a) Disconnect the vacuum hoses from the E–VRV.
(b) Connect the intelligent tester II to the DLC3.
(c) Turn the ignition switch ON and push the intelligent tester II main switch ON.
(d) Select the Active Test mode on the intelligent tester II.

CHECK:

Check the operation of the E–VRV when it is operated by the intelligent tester II.

OK:

E–VRV ON:
Air from port E flows out through port F.
E–VRV OFF:
Air from port E flows out through air filter.

OK	Go to step 7.

NG

5	Check E–VRV for intake pressure change (See Pub No. RM 896E, page TC–15).

NG	Replace E–VRV.

OK

6	Check for open and short in harness and connector between E–VRV and engine ECU, and E–VRV and EFI OR ECD relay (See page IN–19).

NG	Repair or replace harness or connector.

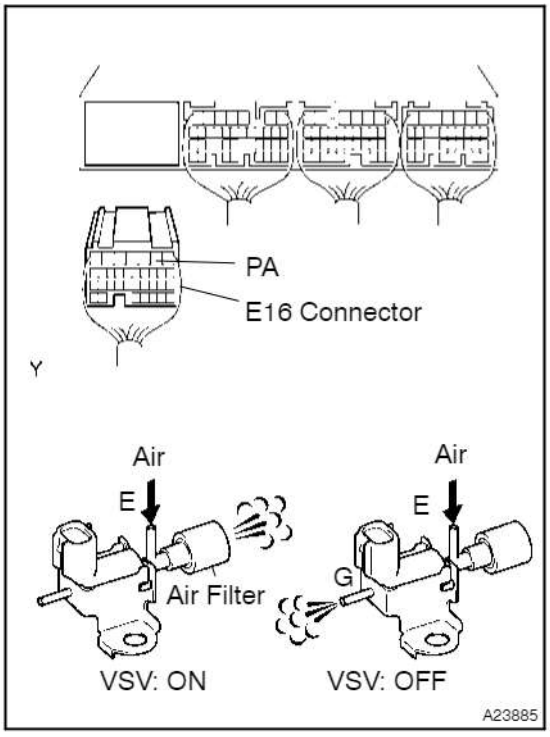
OK

7	**Check resistance of VSV for turbo pressure sensor (See Pub No. RM617E, page TC–19).**

NG → **Replace VSV for turbo pressure sensor.**

OK

8	**Check VSV for turbo pressure sensor.**



PREPARATION:

(a) Remove the glove compartment door.
(b) Disconnect the E16 connector of the engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Check VSV function.

(a) Connect between terminal PA of the engine ECU and body ground (VSV is ON).
(b) Disconnect between terminal PA of the engine ECU and body ground (VSV is OFF).

OK:

VSV is ON:
Air from pipe E flows out through air filter.
VSV is OFF:
Air from pipe E flows out through pipe G.

OK → **Check and replace engine ECU (See page IN–19).**

NG

9	**Check for open and short in harness and connector between engine ECU and VSV for turbo pressure sensor, VSV for turbo pressure sensor and EFI OR ECD relay (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

10	Check turbocharger assembly (See Pub No. RM896E, page TC–1).

NG → Replace turbocharger.

OK

11	Check EGR valve (See Pub No. RM896E, page EC–2).

NG → Replace EGR valve.

OK

12	Check air flow meter (See page DI–64).

NG → Replace air flow meter.

OK

Check and replace engine ECU (See page IN–19).

When not using intelligent tester II:

1	Check connection of vacuum hose.

NG → Repair or replace.

OK

2	Check vacuum between turbocharger and E–VRV for intake pressure change at 900 rpm.

PREPARATION:

(a) Using a 3–way connector, connect a vacuum gauge to the hose between the E–VRV and trubocharger.

(b) Warm up the engine to above 80°C (176°F).

CHECK:

Check the vacuum at 900 rpm.

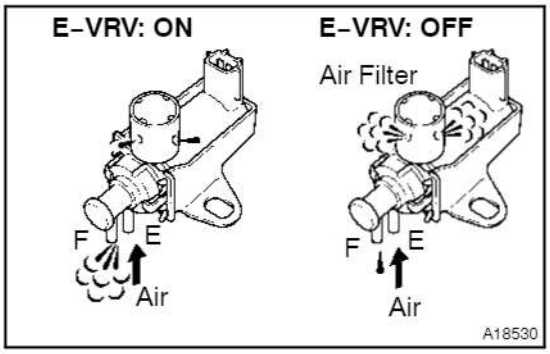
RESULT:

Type	Vacuum
I	0 kPa (0 mmHg, 0 in.Hg) to 50 kPa (375 mmHg, 14.8 in.Hg)
II	Above 50 kPa (375 mmHg, 14.8 in.Hg)

Type II → **Go to step 6.**

Type I

3	Check operation of E–VRV.



PREPARATION:

(a) Remove the glove compartment door.

(b) Disconnect the V14 connector from the engine ECU.

(c) Turn the ignition switch ON.

CHECK:

Check the E–VRV operation.

(1) Connect between terminal VNT of the engine ECU connector and body ground (ON).

(2) Disconnect between terminal VNT of the engine ECU connector and body ground (OFF).

OK:

E–VRV ON:
Air from port E flows out through port F.
E–VRV OFF:
Air from port E flows out through air filter.

OK → **Go to step 6.**

NG

4	Check E–VRV for intake pressure change (See Pub No. RM896E, page TC–15).

NG → Replace E–VRV.

OK

5	Check for open and short in harness and connector between E–VRV and engine ECU, and E–VRV and EFI OR ECD relay (See page IN–19).

NG → Repair or replace harness or connector.

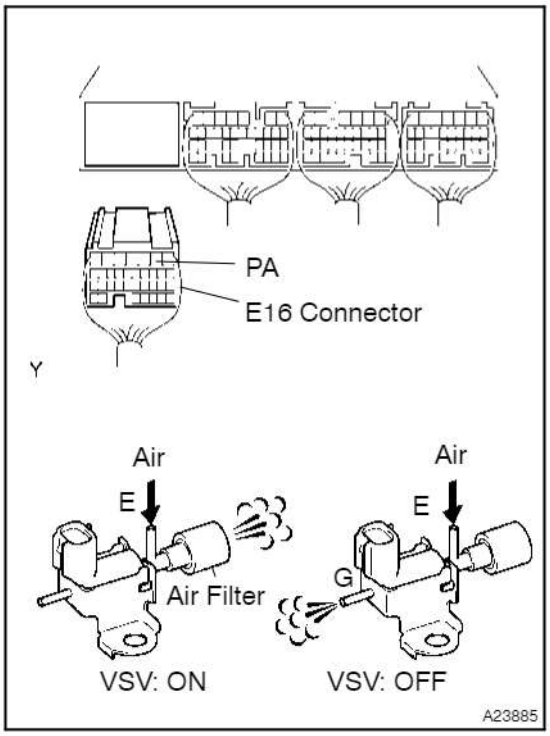
OK

6	Check resistance of VSV for turbo pressure sensor (See Pub No. RM617E, page TC–19).

NG → Replace VSV for turbo pressure sensor.

OK

7	Check VSV for turbo pressure sensor.



PREPARATION:

(a) Remove the glove compartment door.
(b) Disconnect the E16 connector of the engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Check VSV function.

(a) Connect between terminal PA of the engine ECU and body ground (VSV is ON).
(b) Disconnect between terminal PA of the engine ECU and body ground (VSV is OFF).

OK:

VSV is ON:
Air from pipe E flows out through air filter.
VSV is OFF:
Air from pipe E flows out through pipe G.

OK	Check and replace engine ECU (See page IN–19).

NG

8	Check for open and short in harness and connector between engine ECU and VSV for turbo pressure sensor, VSV for turbo pressure sensor and EFI OR ECD relay (See page IN–19).

NG	Repair or replace harness or connector.

OK

9	Check turbocharger assembly (See Pub No. RM896E, page TC–1).

NG	Replace turbocharger.

OK

10	Check EGR valve (See Pub No. RM896E, page EC–2).

NG → Replace EGR valve.

OK

11	Check air flow meter (See page DI–64).

NG → Replace air flow meter.

OK

Check and replace engine ECU (See page IN–19).

DIDY9–01

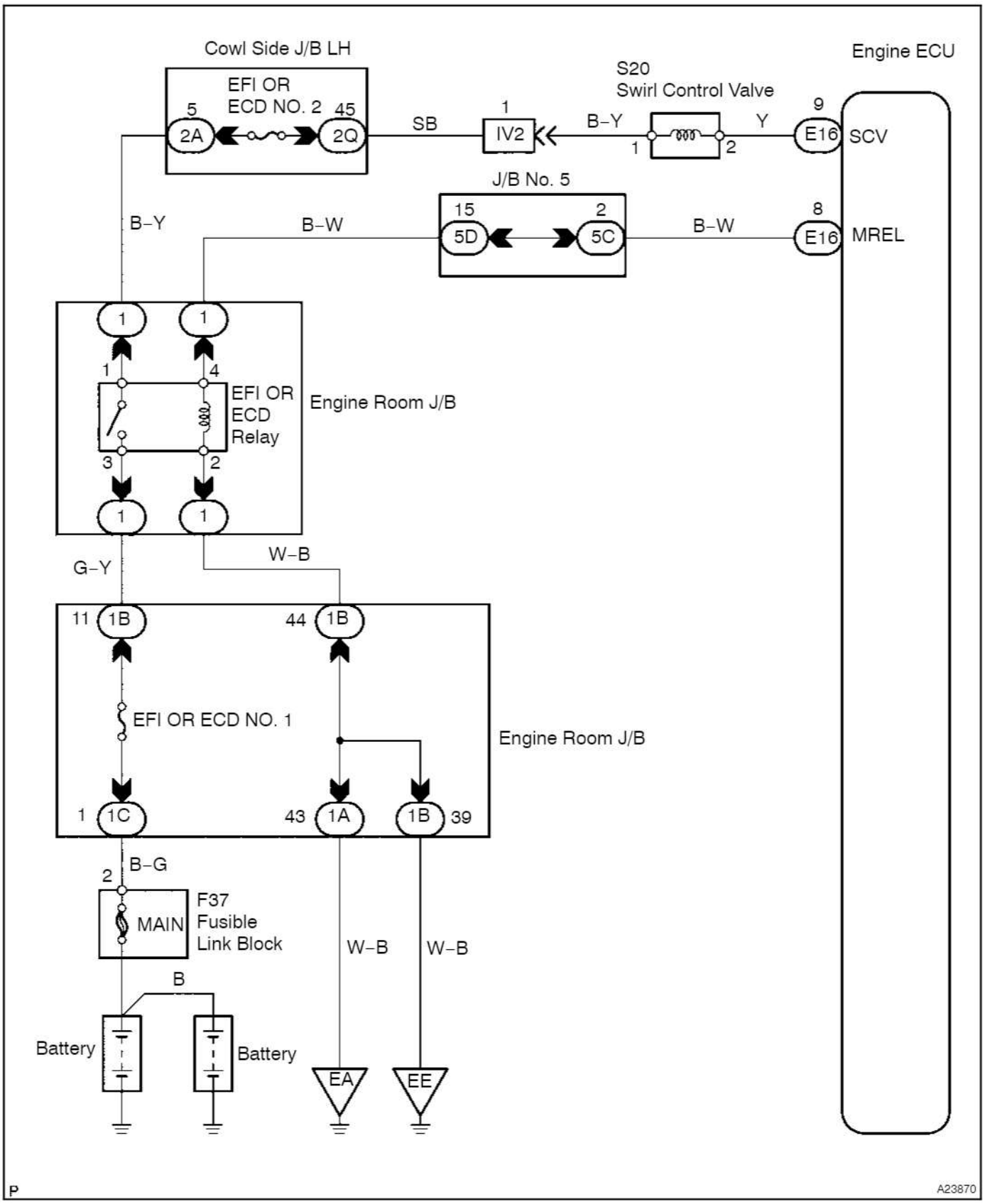
DTC	P1416/58*	SCV Control Circuit

HINT:
*: Only for Europe

CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
P1416/58	Condition that intake air volume is at standard value or less for 15 sec. is detected 3 times	• SCV valve • VSV for SCV • Air flow meter • Vacuum hose • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

When using intelligent tester II:

1	**Check connection of vacuum hose.**

NG → **Repair or replace.**

OK

2	**Check vacuum between SCV and VSV for SCV at 900 rpm.**

PREPARATION:

(a) Using a 3–way connector, connect a vacuum gauge to the hose between the VSV and SCV.

(b) Warm up the engine to above 80°C (176°F).

CHECK:

Check the vacuum at 900 rpm.

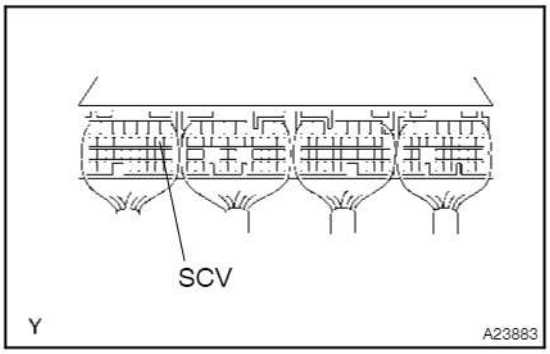
RESULT:

Type	Vacuum
I	0 kPa (0 mmHg, 0 in.Hg) to 50 kPa (375 mmHg, 14.8 in.Hg)
II	Above 50 kPa (375 mmHg, 14.8 in.Hg)

Type II → **Go to step 7.**

Type I

3	Check voltage between terminal SCV of engine ECU connector and body ground.



PREPARATION:

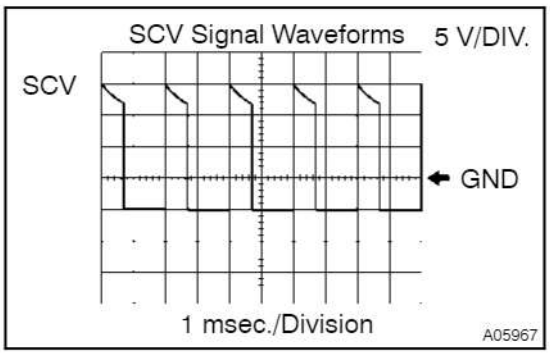
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal SCV of the engine ECU connector and body ground.

OK:

Voltage: 9 to 14 V



Reference: INSPECTION USING OSCILLOSCOPE

While the SCV system is ON (engine speed 900 rpm), check the waveform between terminals SCV and E1 of the engine ECU connector.

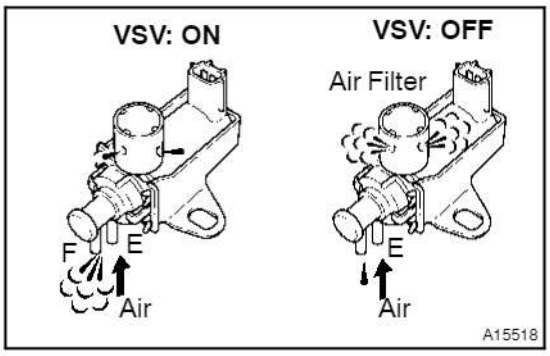
HINT:

The correct waveform is as shown.

NG	Go to step 5.

OK

4	Check operation of VSV for SCV.



PREPARATION:

(a) Disconnect the vacuum hoses from the VSV.
(b) Connect the intelligent tester II to the DLC3.
(c) Turn the ignition switch ON and push the intelligent tester II main switch ON.
(d) Select the Active Test mode on the intelligent tester II.

CHECK:

Check the operation of the VSV when it is operated by the intelligent tester II.

OK:

VSV ON:
Air from port E flows out through port F.
VSV OFF:
Air from port E flows out through air filter.

OK	Go to step 7.

NG

5	Check VSV for SCV (See Pub No. RM896E, page ED–10).

NG → Replace VSV.

OK

6	Check for open and short in harness and connector between VSV and engine ECU, and VSV and EFI OR ECD relay (See page IN–19).

NG → Repair or replace harness or connector.

OK

7	Check SCV assembly (See Pub No. RM896E, page ED–7).

NG → Replace SCV assembly.

OK

Check and replace engine ECU (See page IN–19).

When not using intelligent tester II:

1	**Check connection of vacuum hose.**

NG → **Repair or replace.**

OK

2	**Check vacuum between SCV and VSV for SCV at 900 rpm.**

PREPARATION:

(a) Using a 3–way connector, connect a vacuum gauge to the hose between the VSV and SCV.

(b) Warm up the engine to above 80°C (176°F).

CHECK:

Check the vacuum at 900 rpm.

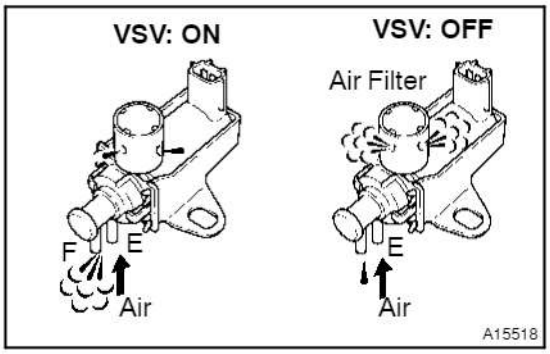
RESULT:

Type	Vacuum
I	0 kPa (0 mmHg, 0 in.Hg) to 50 kPa (375 mmHg, 14.8 in.Hg)
II	Above 50 kPa (375 mmHg, 14.8 in.Hg)

Type II → **Go to step 6.**

Type I

3	Check operation of VSV.



PREPARATION:

(a) Remove the glove compartment door.
(b) Disconnect the S20 connector from the engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Check the VSV operation.

(1) Connect between terminal SCV of the engine ECU connector and body ground (ON).
(2) Disconnect between terminal SCV of the engine ECU connector and body ground (OFF).

OK:

VSV ON:
Air from port E flows out through port F.
VSV OFF:
Air from port E flows out through air filter.

OK	Go to step 6.

NG

4	Check VSV for SCV (See Pub No. RM896E, page ED–10).

NG	Replace VSV.

OK

5	Check for open and short in harness and connector between VSV and engine ECU, and VSV and EFI OR ECD relay (See page IN–19).

NG	Repair or replace harness or connector.

OK

6	Check SCV assembly (See Pub No. RM896E, page ED–7).

NG → Replace SCV assembly.

OK →

Check and replace engine ECU (See page IN–19).

DI9FZ-02

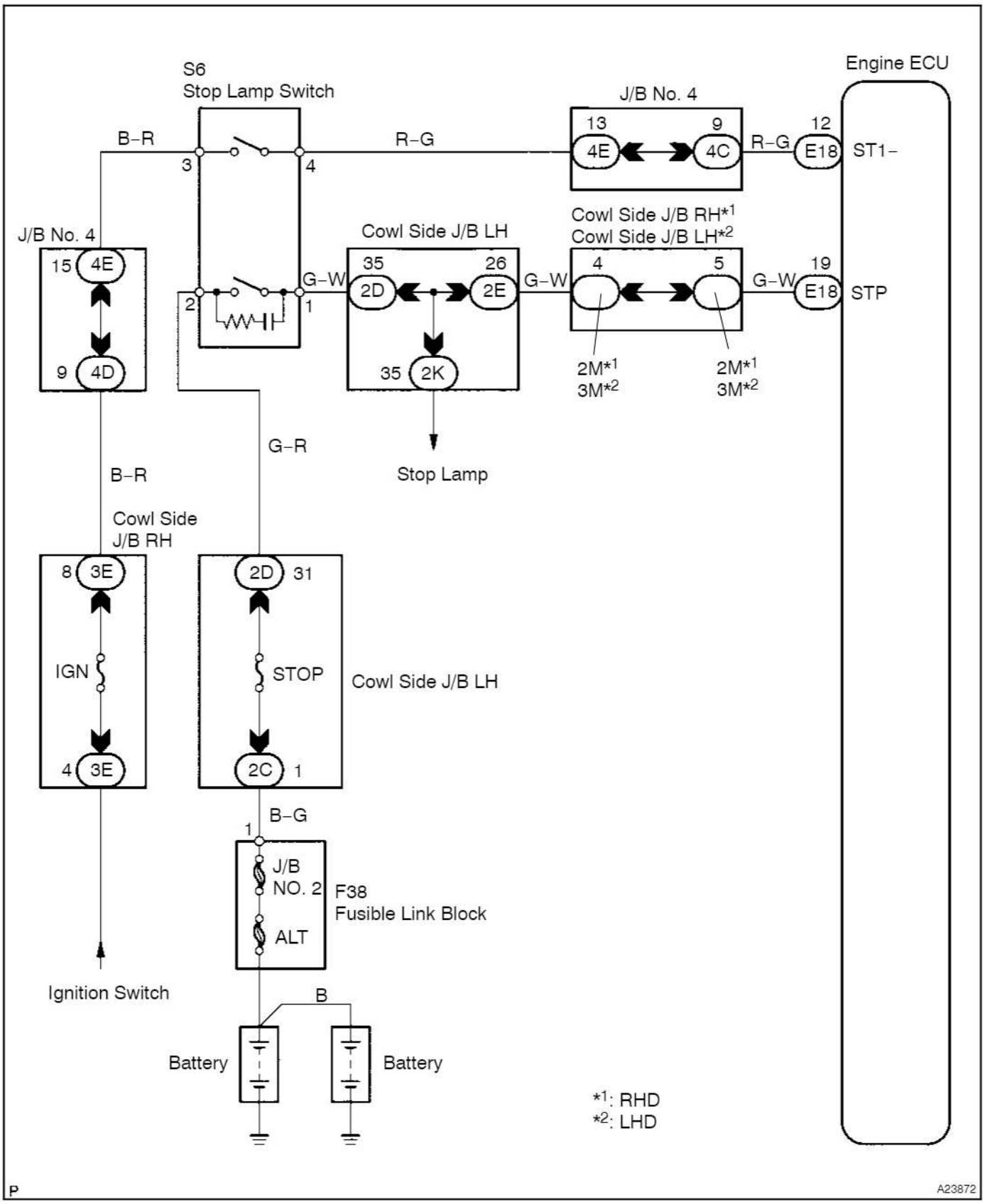
DTC	P1520/52	Stop Light Switch Signal Malfunction

CIRCUIT DESCRIPTION

This signal is used to detect when the brakes have been applied. The STP signal voltage is the same as the voltage supplied to the stop lamps.
The STP signal is used mainly to control the fuel cut–off engine speed (the fuel cut–off engine speed is reduced slightly when the vehicle is braking).

DTC No.	DTC Detection Condition	Trouble Area
P1520/52	The STP signal does not turn off even once the vehicle is driven (1 trip detection logic)	• Short in stop lamp switch signal circuit • Stop lamp switch • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

1	**Check operation of stop lamp.**

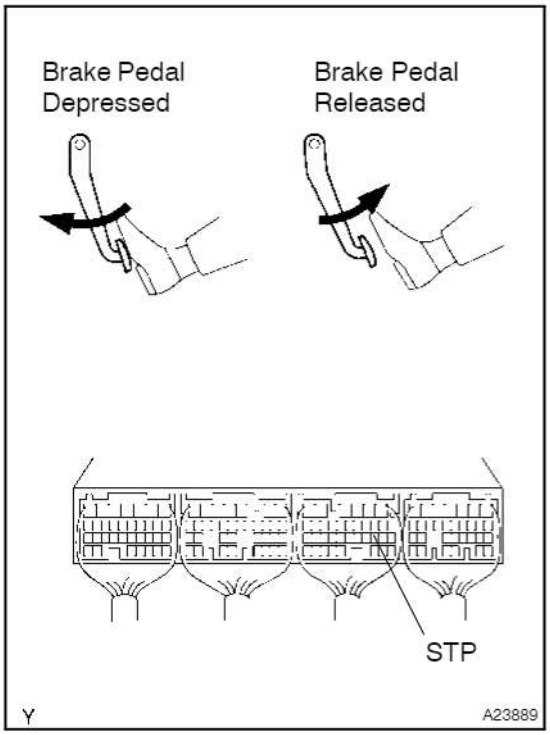
CHECK:

Check if the stop lamps go on and off normally when the brake pedal is depressed and released.

NG → **Check and repair stop lamp circuit.**

OK

2	**Check STP signal.**



When using intelligent tester II:

PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

CHECK:

Read the STP signal on the intelligent tester II.

OK:

Brake Pedal	STP Signal
Depressed	ON
Released	OFF

When not using intelligent tester II:

PREPARATION:

Turn the ignition switch ON.

CHECK:

Check the voltage between terminal STP of the engine ECU connector and body ground.

OK:

Brake Pedal	Voltage
Depressed	7.5 to 14 V
Released	Below 1.5 V

OK → **Check for intermittent problems (See page DI–4).**

NG

3	Check stop lamp switch (See Pub No. RM616E2, page BE–58)

NG → Replace or replace stop lamp switch.

OK

4	Check harness and connector between engine ECU and stop lamp switch (See page IN–19).

NG → Repair or replace harness or connector.

OK

Check and replace engine ECU (See page IN–19).

DIDY8–01

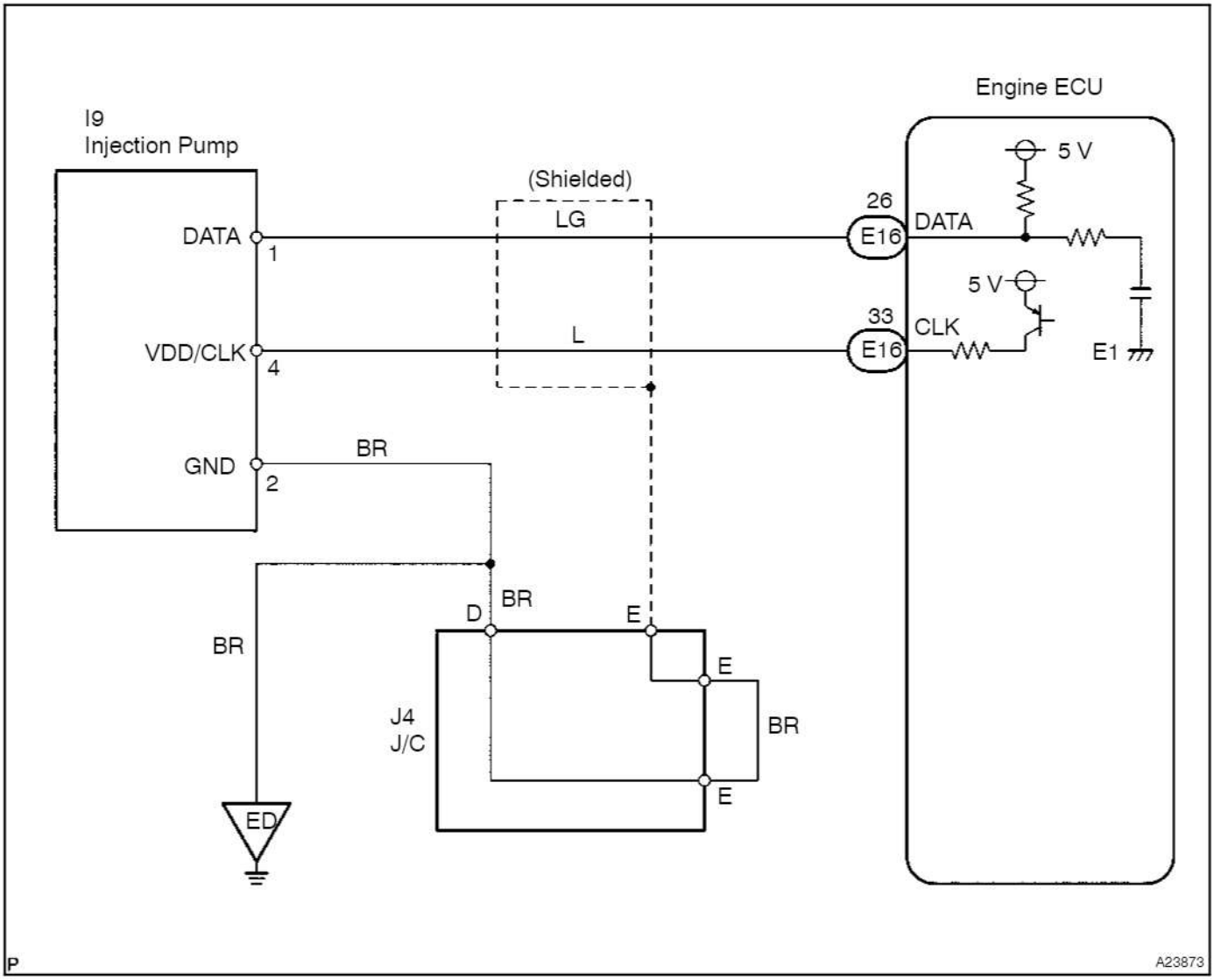
DTC	P1670/32	Injection Pump System Malfunction

CIRCUIT DESCRIPTION

The correction system correct variations between each injection pump.

DTC No.	DTC Detection Condition	Trouble Area
P1670/32	Open or short in injection pump correction unit circuit	• Injection pump correction unit circuit • Injection pump correction unit • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

1	Check for open and short in harness and connector between DATA of engine ECU and DATA of injection pump correction unit (See page IN–19).

NG → Repair or replace harness or connector.

OK

2	Check for open and short in harness and connector between CLK of engine ECU and VDD/CLK of injection pump correction unit (See page IN–19).

NG → Repair or replace harness or connector.

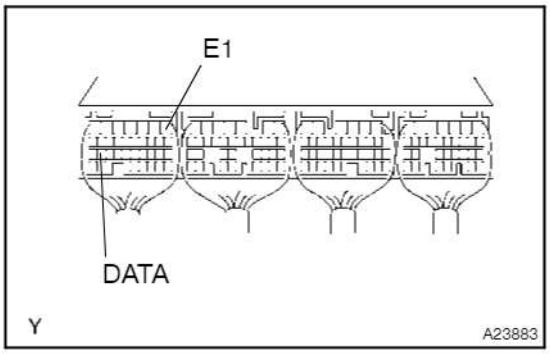
OK

3	Check for open in harness in injection pump correction unit terminal GND and body ground (See page IN–19).

NG → Repair or replace harness or connector.

OK

4	Check waveform between terminal DATA of engine ECU connector.



PREPARATION:

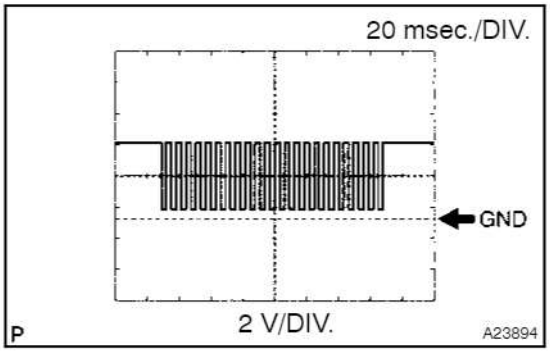
(a) Remove the glove compartment door.
(b) Connect an oscilloscope between terminals DATA and E1 of the engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Within 0.5 seconds after the ignition switch is turned ON, check the waveform between terminals DATA and E1 of the engine ECU.

OK:

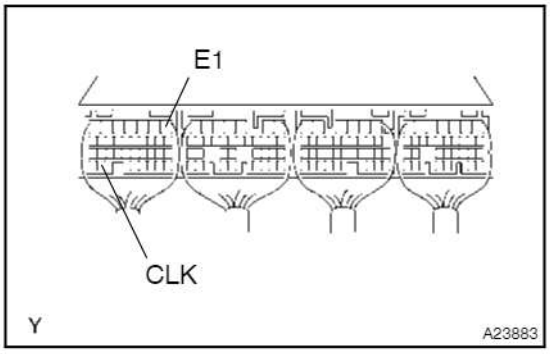
The correct waveforms are as shown.



OK	Check and replace engine ECU

NG

5	Check waveform between terminal CLK of engine ECU connector.



PREPARATION:

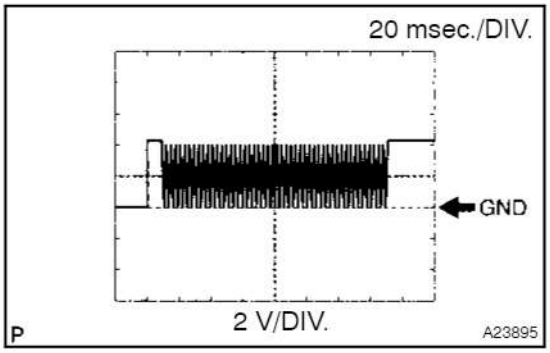
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.
(c) Connect an oscilloscope between terminals CLK and E1 of the engine ECU.

CHECK:

Within 0.5 seconds after the ignition switch is turned ON, check the waveform between terminals CLK and E1 of the engine ECU.

OK:

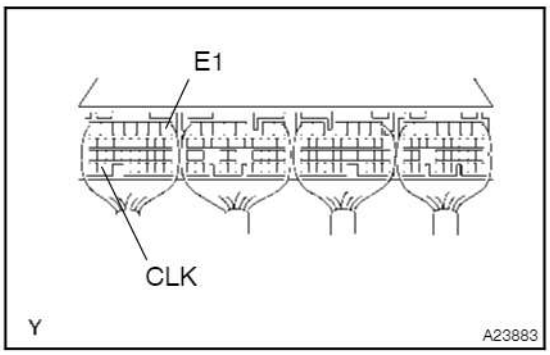
The correct waveforms are as shown.



OK	Go to step 7.

NG

6	Check waveform between terminal CLK of engine ECU connector.



PREPARATION:

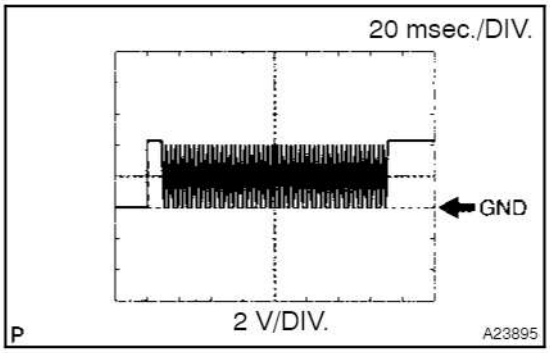
(a) Remove the glove compartment door.
(b) Disconnect the injection pump correction unit connector.
(c) Turn the ignition switch ON.
(d) Connect an oscilloscope between terminals CLK and E1 of the engine ECU.

CHECK:

Within 0.5 seconds after the ignition switch is turned ON, check the waveform between terminals CLK and E1 of the engine ECU.

OK:

The correct waveforms are as shown.

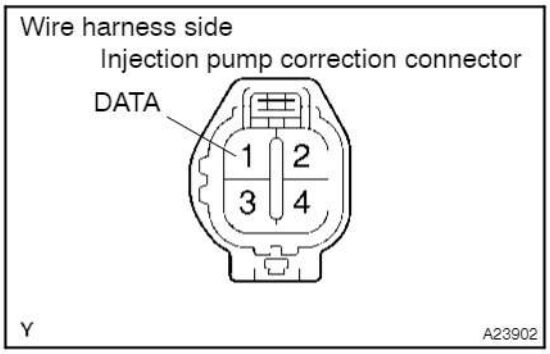


NG → **Check and replace engine ECU.**

OK

Check and replace injection pump (See Pub No. RM617E, page FU–113).

7	Check voltage between DATA of wire harness and body ground.



PREPARATION:

(a) Disconnect the injection pump correction unit connector.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal DATA of the injection pump correction unit connector and body ground.

OK:

Voltage: 4.5 to 5.5V

NG → **Check and replace engine ECU.**

OK →

Check and replace injection pump (See Pub No. RM617E, page FU–113).

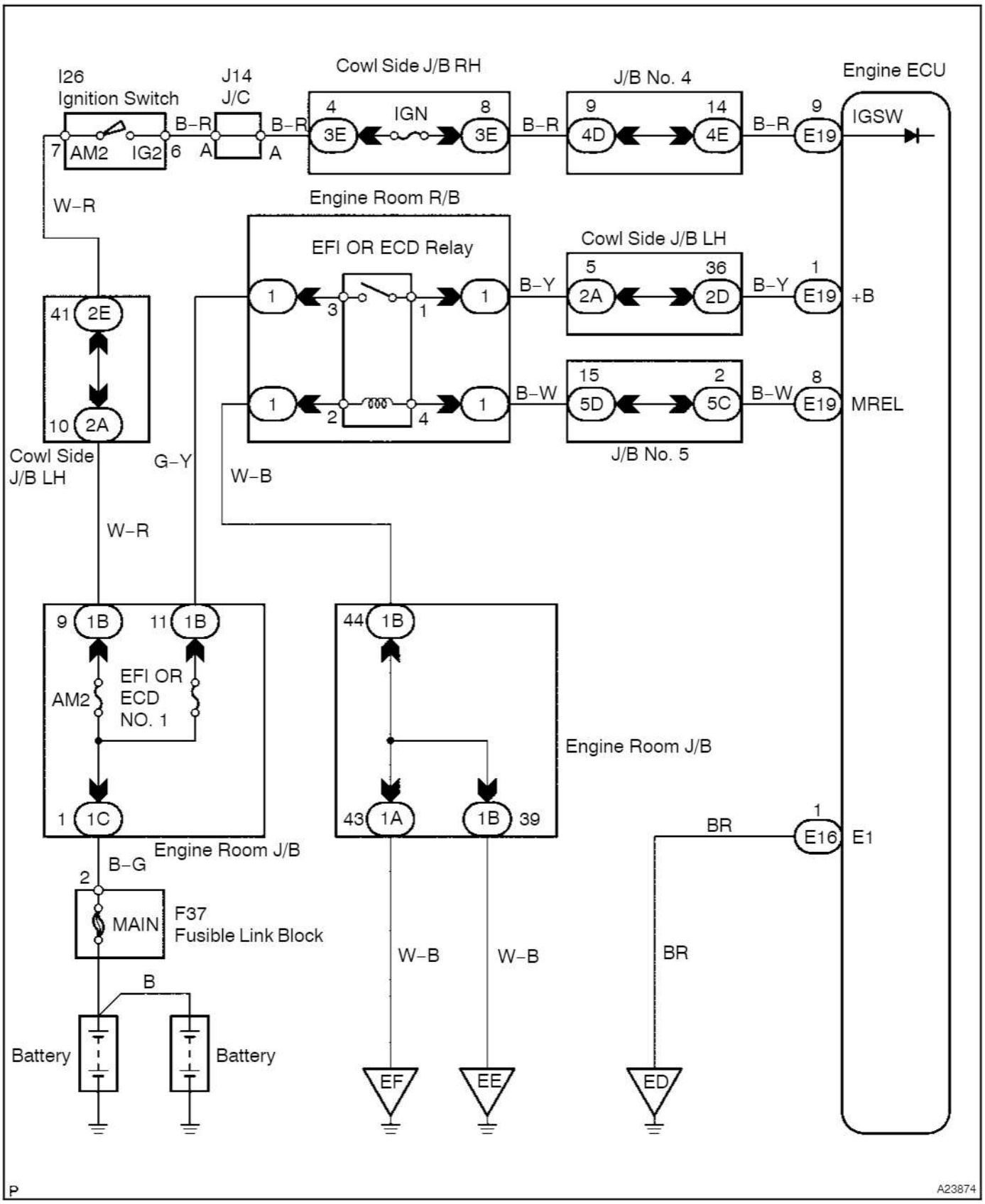
DIDYC–01

ECU Power Source Circuit

CIRCUIT DESCRIPTION

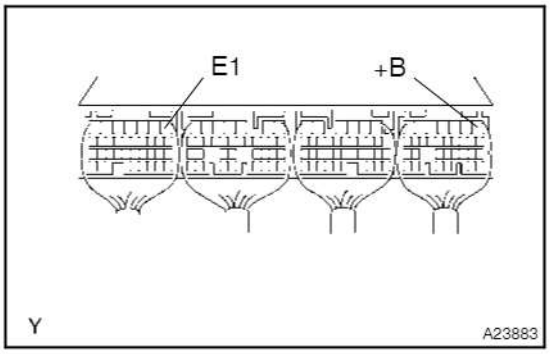
When the ignition switch is turned ON, battery positive voltage is applied to the coil, closing the contacts of the EFI OR ECD relay and supplying power to the terminal +B of the engine ECU.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check voltage between terminals +B and E1 of engine ECU.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals +B and E1 of the engine ECU.

OK:

Voltage: 9 to 14 V

OK	**Proceed to next circuit inspection shown on problem symptoms table (See page DI–16).**

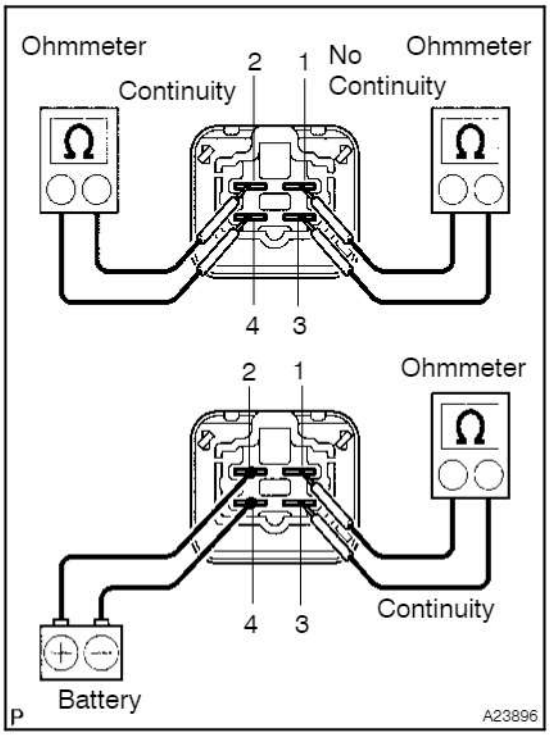
NG

2	**Check for open in harness and connector between terminal E1 of engine ECU and body ground (See page IN–19).**

NG	**Repair or replace harness or connector.**

OK

3	Check EFI OR ECD relay.



PREPARATION:
Remove the EFI OR ECD relay from the engine room R/B.
CHECK:
Inspect the EFI OR ECD relay.
OK:

Condition	Tester connection	Specified condition
Constant	2 – 4	Below 1 Ω
	1 – 3	10 kΩ or higher
Apply B+ between terminals 2 and 4.	1 – 3	Below 1 Ω

NG → **Replace EFI OR ECD relay.**

OK

4	Check EFI OR ECD NO. 1 fuse.

PREPARATION:
Remove the EFI OR ECD NO. 1 fuse from the engine room J/B.
CHECK:
Check the resistance of the EFI OR ECD NO. 1 fuse.
OK:

Below 1 Ω

NG → **Check for short in all harness and components connected to EFI OR ECD fuse.**

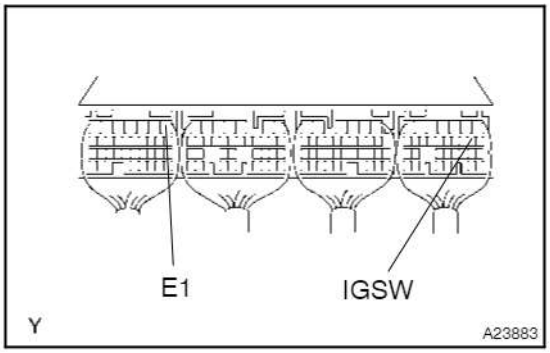
OK

5	**Check for open in harness and connector between engine ECU and EFI OR ECD relay, EFI OR ECD relay and battery (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

6	**Check voltage between terminals IGSW and E1 of engine ECU.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals IGSW and E1 of the engine ECU.

OK:

Voltage: 9 to 14 V

OK → **Go to step 9.**

NG

7	**Check ignition switch (See Pub. No. RM616E2, page BE–20).**

NG → **Replace ignition switch.**

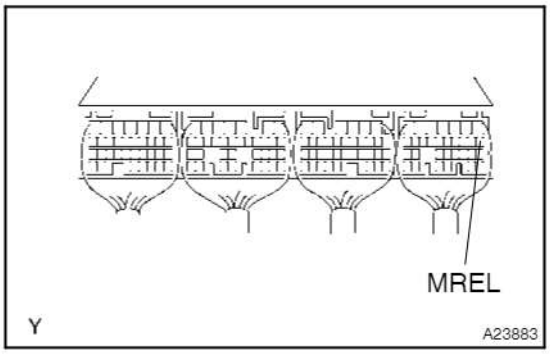
OK

8	**Check for open in harness and connector between ignition switch and engine ECU (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

9	Check voltage between terminal MREL of engine ECU and body ground.



PREPARATION:

(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal MREL of the engine ECU and body ground.

OK:

Voltage: 9 to 14 V

OK → **Check and replace engine ECU (See page IN–19).**

NG

Check for open in harness and connector between engine ECU and EFI OR ECD relay, EFI OR ECD relay and body ground (See page IN–19).

DIDYE–01

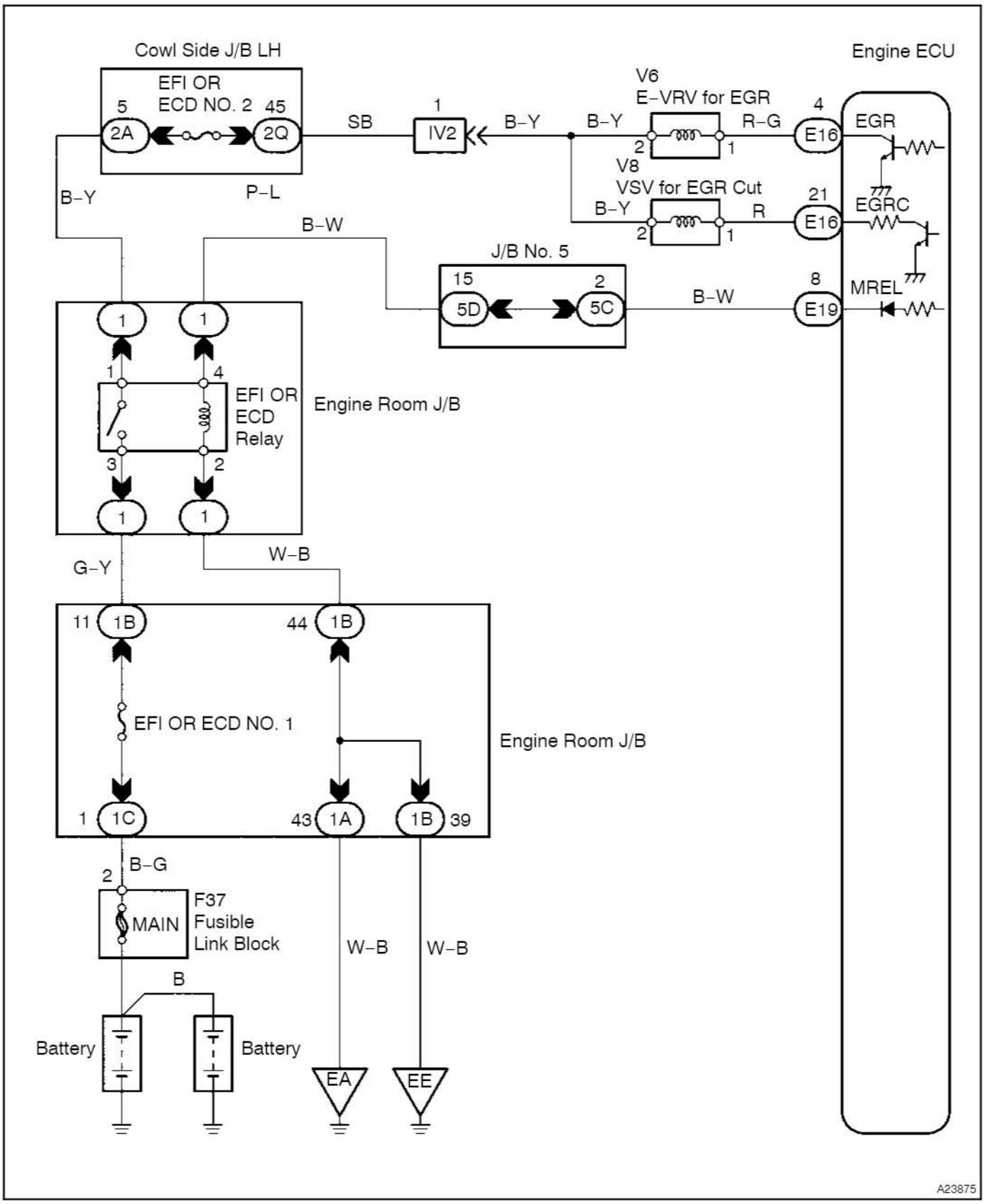
EGR Control Circuit

CIRCUIT DESCRIPTION

The EGR system recirculates exhaust gas, which is controlled to the proper quantity to suit the driving conditions into the intake air mixture to slow down combustion, reduce the combustion temperature and reduce NOx emissions.
The lift amount of the EGR valve is controlled by the vacuum regulated by the VRV for EGR, which is operated by the engine ECU.
If even one of the following conditions is fulfilled, the VSV is turned ON by a signal from the ECU. This results in atmospheric air acting on the EGR valve, closing the EGR valve and shutting off the exhaust gas (EGR cut–off).
Under the following conditions, the EGR is cut to maintain driveability.

- Before the engine is warmed up
- During deceleration (Diesel throttle valve closed)
- Light engine load (amount of intake air very small)
- Engine speed over 3,000 rpm

WIRING DIAGRAM



INSPECTION PROCEDURE

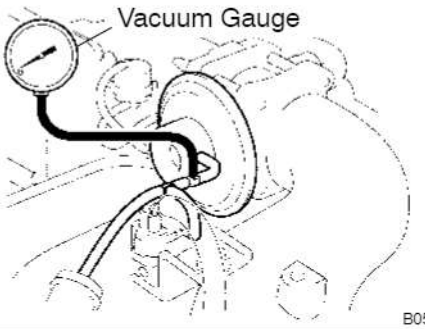
When using intelligent tester II:

1	**Check connection of vacuum hose.**

NG → **Repair or replace.**

OK

2	**Check the vacuum between EGR valve and VSV for EGR Cut at 1,500 rpm.**



PREPARATION:

(a) Using a 3–way connector, connect a vacuum gauge to the hose between the VSV and EGR valve.

(b) Warm up the engine to above 80°C (176°F).

CHECK:

Check the vacuum at 1,500 rpm.

RESULT:

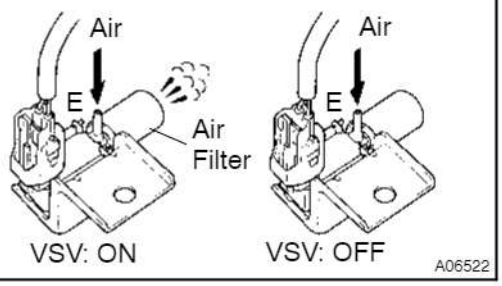
Type	Vacuum
I	0 kPa (0 mmHg, 0 in.Hg)
II	0 kPa (0 mmHg, 0 in.Hg) to 28 kPa (210 mmHg, 8.3 in.Hg)
III	Above 28 kPa (210 mmHg, 8.3 in.Hg)

Type I → **Go to step 7.**

Type III → **Go to step 10.**

Type II

3	Check the VSV for EGR Cut operation.



PREPARATION:

(a) Disconnect the vacuum hose from the VSV for EGR Cut.
(b) Connect the intelligent tester II to the DLC3.
(c) Turn the ignition switch ON and push the intelligent tester II main switch ON.
(d) Select the Active Test mode on the intelligent tester II.

CHECK:

Check operation of VSV for EGR Cut when it is operated by the intelligent tester II.

OK:

VSV is ON:
Air from pipe E flows out through air filter.
VSV is OFF:
Air does not flow from pipe E to air filter.

OK	Check connection, damage and blockage of vacuum hose.

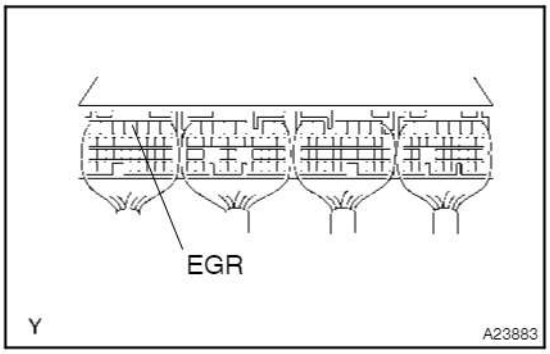
NG

4	Check VSV for EGR Cut (See Pub No. RM617E, page EC–9).

NG	Replace VSV for EGR Cut.

OK

5	Check voltage between terminal EGR of engine ECU and body ground.



PREPARATION:

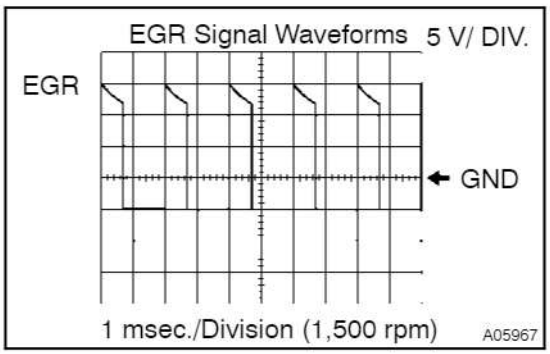
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal EGR of the engine ECU and body ground.

OK:

Voltage: 9 to 14 V



Reference: INSPECTION USING OSCILLOSCOPE

During EGR system is ON (engine speed 1,500 rpm), check the waveform between terminals EGR and E1 of the engine ECU.

HINT:

The correct waveform is as shown.

NG → **Check and replace engine ECU (See page IN–19).**

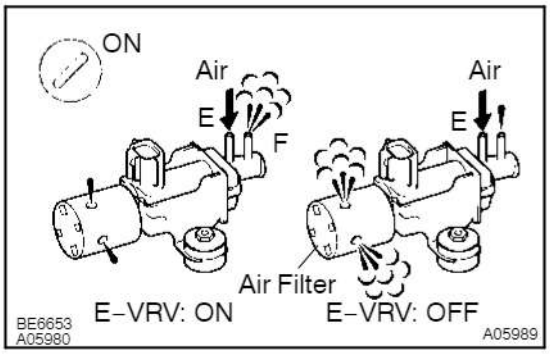
OK

6	Check for open and short in harness and connector between E–VRV for EGR and engine ECU (See page IN–19).

NG → **Repair or replace harness or connector.**

OK

7	Check operation of E–VRV.



PREPARATION:

(a) Disconnect the vacuum hoses from the E–VRV.
(b) Connect the intelligent tester II to the DLC3.
(c) Turn the ignition switch ON and push the intelligent tester II main switch ON.
(d) Select the Active Test mode on the intelligent tester II.

CHECK:

Check operation of E–VRV when it is operated by the intelligent tester II.

OK:

E–VRV ON:
Air from pipe E flows out through pipe F.
E–VRV OFF:
Air from pipe E flows out through air filter.

OK	Go to step 10.

NG

8	Check E–VRV for EGR (See Pub No. RM617E, page EC–9).

NG	Replace E–VRV.

OK

9	Check for open and short in harness and connector between E–VRV and engine ECU, E–VRV and EFI OR ECD relay (See page IN–19).

NG	Repair or replace harness or connector.

OK

10	**Check EGR valve (See Pub No. RM617E, page EC–9).**

NG → **Replace the EGR valve.**

OK

Check and replace engine ECU (See page IN–19).

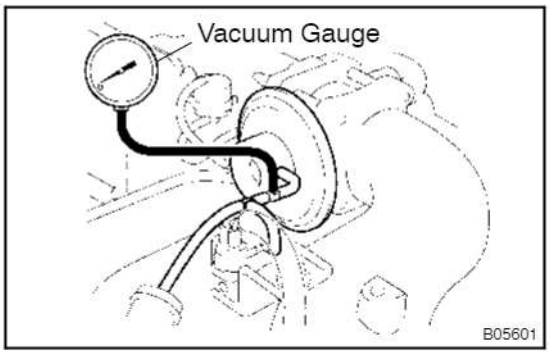
When not using intelligent tester II:

1	**Check connection of vacuum hose.**

NG → **Repair or replace.**

OK

2	**Check vacuum between EGR valve and VSV for EGR at 1,500 rpm.**



PREPARATION:

(a) Using a 3–way connector, connect a vacuum gauge to the hose between the VSV and EGR valve.

(b) Warm up the engine to above 80°C (176°F).

CHECK:

Check the vacuum at 1,500 rpm.

RESULT:

Type	Vacuum
I	0 kPa (0 mmHg, 0 in.Hg)
II	0 kPa (0 mmHg, 0 in.Hg) to 28 kPa (210 mmHg, 8.3 in.Hg)
III	Above 28 kPa (210 mmHg, 8.3 in.Hg)

Type I → **Go to step 6.**

Type III → **Go to step 9.**

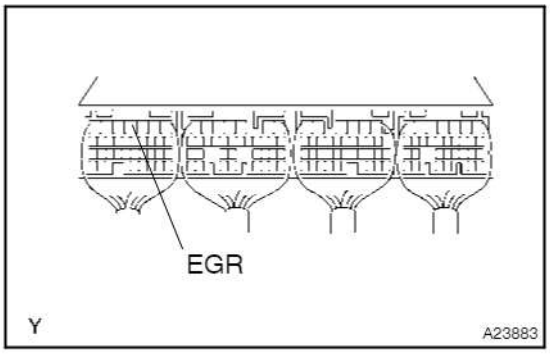
Type II

3	**Check VSV for EGR (See Pub No. RM617E, page EC–9).**

NG → **Replace VSV for EGR.**

OK

4	**Check voltage between terminal EGR of engine ECU and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

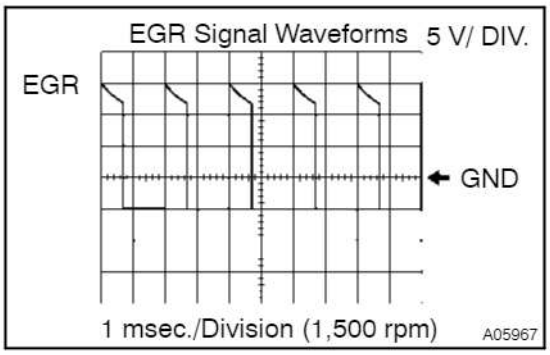
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal EGR of the engine ECU and body ground.

OK:

Voltage: 9 to 14 V



Reference: INSPECTION USING OSCILLOSCOPE

During EGR system is ON (engine speed 1,500 rpm), check the waveform between terminals EGR and E1 of the engine ECU.

HINT:

The correct waveform is as shown.

NG → **Check and replace engine ECU (See page IN–19).**

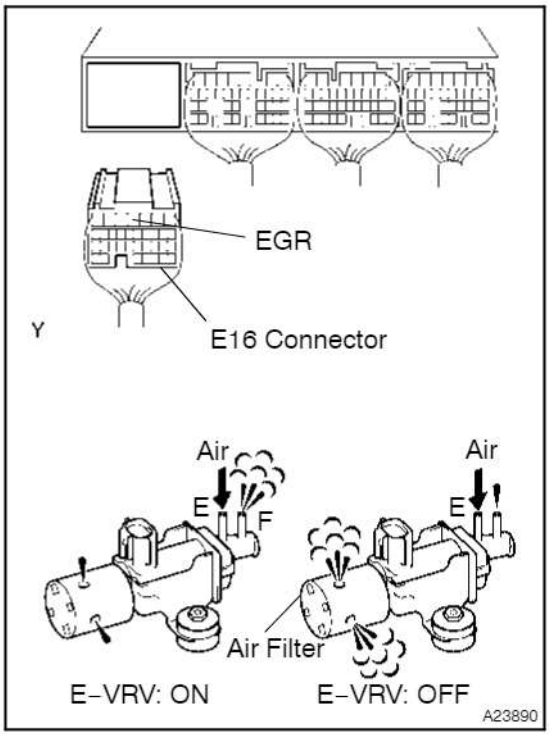
OK

5	**Check for open and short in harness and connector between VSV for EGR and engine ECU (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

6	Check operation of E–VRV.



PREPARATION:

(a) Remove the glove compartment door.
(b) Disconnect the E16 connector of the engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Check E–VRV operation.

(1) Connect between terminal EGR of the engine ECU connector and body ground (ON).
(2) Disconnect between terminal EGR of the engine ECU connector and body ground (OFF).

OK:

E–VRV ON:
Air from pipe E flows out through pipe F.
E–VRV OFF:
Air from pipe E flows out through air filter.

OK	Go to step 9.

NG

7	Check E–VRV for EGR (See Pub No. RM617E, page EC–9).

NG	Replace E–VRV.

OK

8	Check for open and short in harness and connector between E–VRV and engine ECU, E–VRV and EFI OR ECD relay (See page IN–19).

NG	Repair or replace harness or connector.

OK

9	Check EGR valve (See Pub No. RM617E, page EC–9).

NG → Replace EGR valve.

OK →

Check and replace engine ECU (See page IN–19).

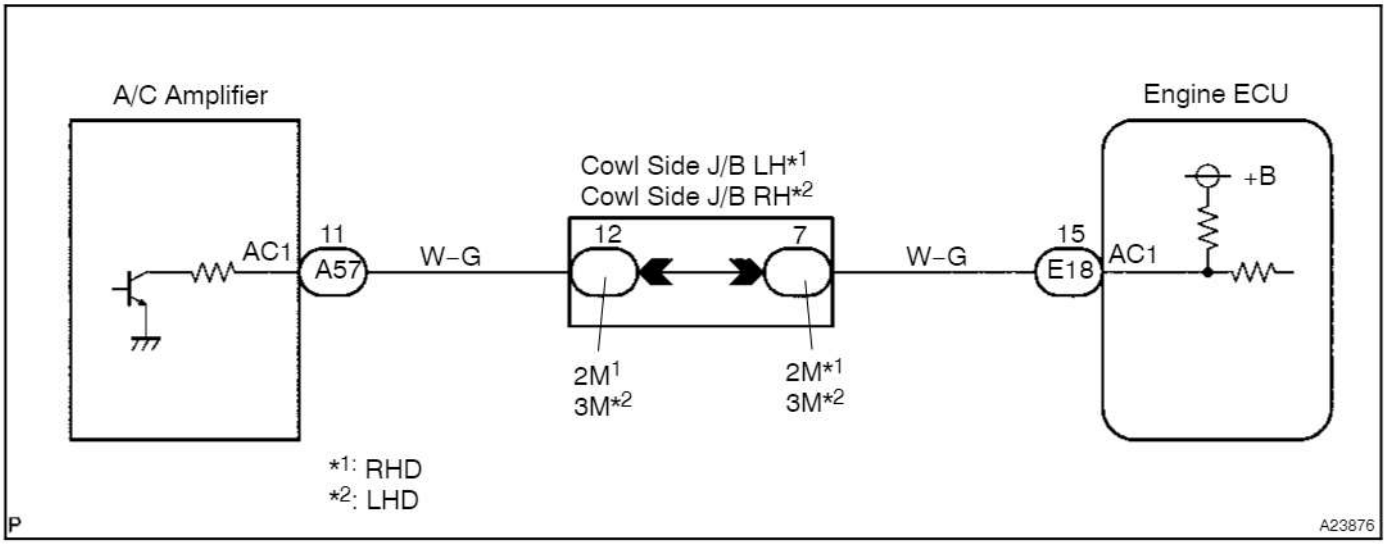
DI326-09

A/C Signal Circuit

CIRCUIT DESCRIPTION

When the A/C compressor is ON, the A/C amplifier sends the A/C signal to the engine ECU, then engine ECU increases the fuel injection volume to improve driveability during engine idling.

WIRING DIAGRAM



INSPECTION PROCEDURE

When using intelligent tester II:

1	**Connect intelligent tester II and check A/C signal.**

PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

CHECK:

Read the A/C signal on the intelligent tester II while the A/C compressor is ON.

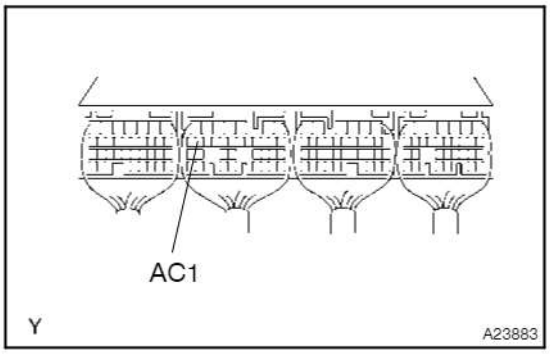
OK:

A/C switch condition	OFF	ON
A/C signal	OFF	ON

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–16).**

NG

2	Check voltage between terminal AC1 of engine ECU and body ground.



PREPARATION:

(a) Remove the glove compartment door.
(b) Start the engine.

CHECK:

Measure the voltage between terminal AC1 of the engine ECU and body ground when the A/C switch is turned to ON and OFF.

OK:

A/C switch condition	Voltage
ON	Below 1.5 V
OFF	9 to 14 V

OK → **Check and replace engine ECU (See page IN–19).**

NG

3	Check for open and short in harness and connector between engine ECU and A/C amplifier (See page IN–19).

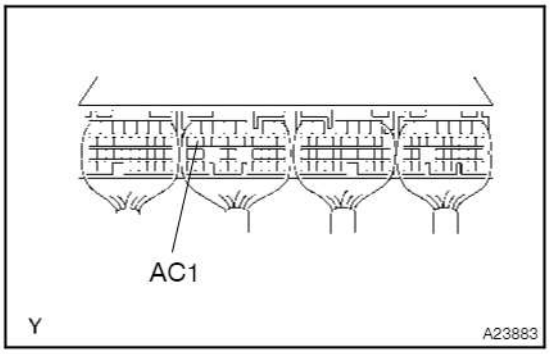
NG → **Repair or replace harness or connector.**

OK

Check and replace A/C amplifier.

When not using intelligent tester II:

1	**Check voltage between terminal AC1 of engine ECU and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Start the engine.

CHECK:

Measure the voltage between terminal AC1 of the engine ECU and body ground when the A/C switch is turned to ON and OFF.

OK:

A/C switch condition	Voltage
ON	Below 1.5 V
OFF	9 to 14 V

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–16).**

NG

2	**Check for open and short in harness and connector between engine ECU and A/C amplifier (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

Check and replace A/C amplifier.

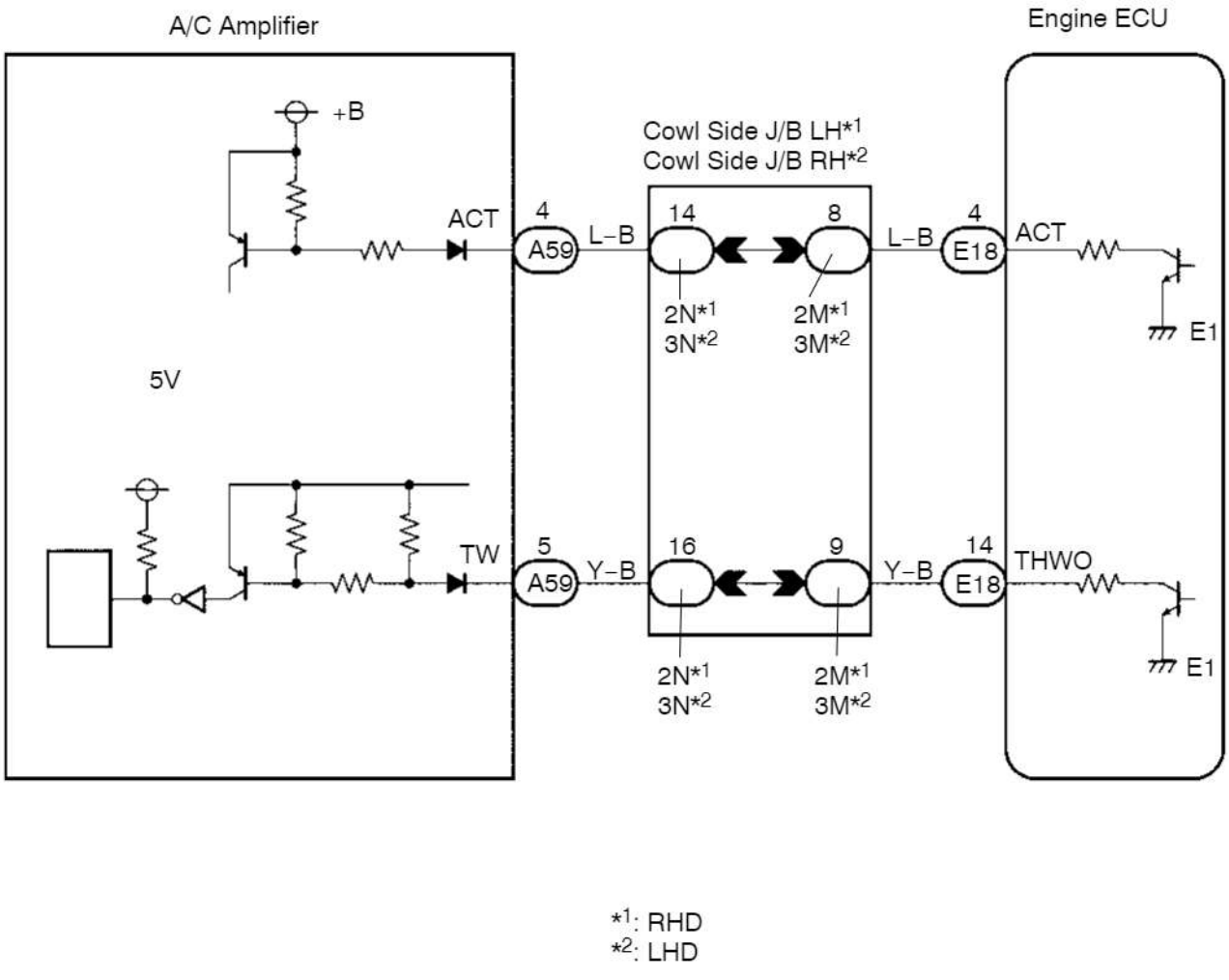
DIDYH–01

A/C Cut Control Circuit

CIRCUIT DESCRIPTION

This circuit cuts air conditioning operation during vehicle acceleration in order to increase acceleration performance. During acceleration with the vehicle speed at 30 km/h (19 mph) or less and accelerator pedal opening angle at 45° or more, the A/C magnetic switch is turned OFF for several seconds.
The air conditioning is also controlled by the ECU outputting the engine coolant temperature to the A/C amplifier.

WIRING DIAGRAM



INSPECTION PROCEDURE

When using intelligent tester II:

1	**Connect intelligent tester II and check operation of air conditioning cut control.**

PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

(c) Start the engine and air conditioning switch ON.

HINT:

A/C magnetic clutch is turned ON.

(d) Select the Active Test mode on the intelligent tester II.

CHECK:

Check the A/C magnetic clutch cut operation when the air conditioning cut control is operated by the intelligent tester II.

OK:

A/C magnet clutch is turned OFF.

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–16).**

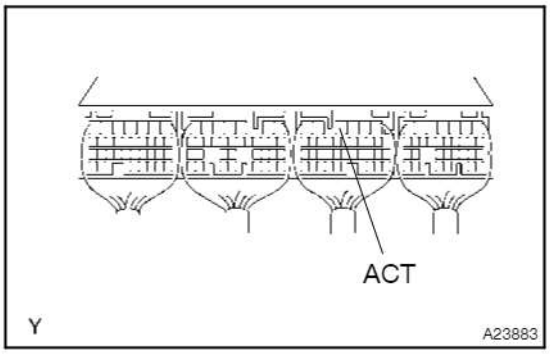
NG

2	**Check for open and short in harness and connector between engine ECU and A/C amplifier (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

3	Check voltage between terminal ACT of engine ECU and body ground.



PREPARATION:

(a) Remove the glove compartment door.
(b) Start the engine.

CHECK:

Measure the voltage between terminal ACT of the engine ECU connector and body ground when the A/C switch is turned to ON and OFF.

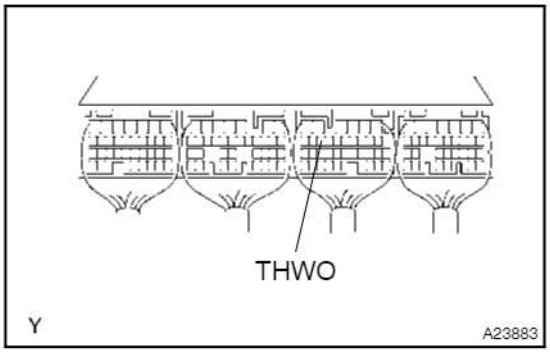
OK:

A/C switch condition	Voltage
ON	9 to 14 V
OFF	0 to 3 V

NG → **Check and replace A/C amplifier.**

OK

4	Check voltage between terminal THWO of engine ECU and body ground.



PREPARATION:

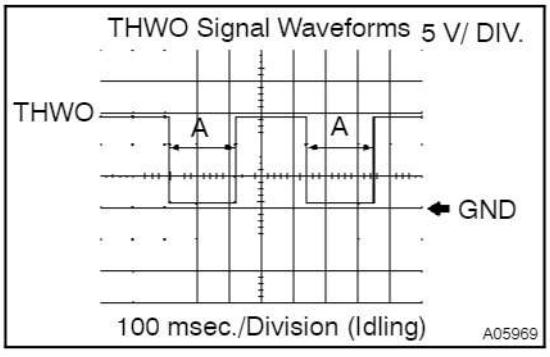
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal THWO of the engine ECU and body ground.

OK:

Voltage is generated intermittently.



Reference: INSPECTION USING OSCILLOSCOPE

During idling, check the waveform between terminals THWO and E1 of the engine ECU.

HINT:

The correct waveform is as shown.

Water temp.	30°C (86°F) or less	Approx. 75°C (167°F)	90°C (194°F) or more
A	65 msec.	335.8 msec.	393 msec.

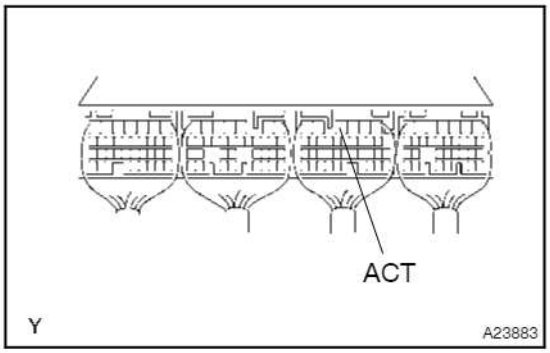
NG → **Check and replace A/C amplifier.**

OK

Check and replace engine ECU (See page IN–19).

When not using intelligent tester II:

1	**Check voltage between terminal ACT of engine ECU and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Start the engine.

CHECK:

Measure voltage between terminal ACT of engine ECU connector and body ground when A/C switch is turned to ON and OFF.

OK:

A/C switch condition	Voltage
ON	9 to 14 V
OFF	0 to 3 V

OK → **Check and replace engine ECU (See page IN–19).**

NG

2	**Check voltage between terminal THWO of engine ECU and body ground (See page DI–141 Step 4).**

OK → **Check and replace engine ECU (See page IN–19).**

NG

3	**Check for open and short in harness and connector between engine ECU and A/C amplifier (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

Check and replace A/C amplifier.

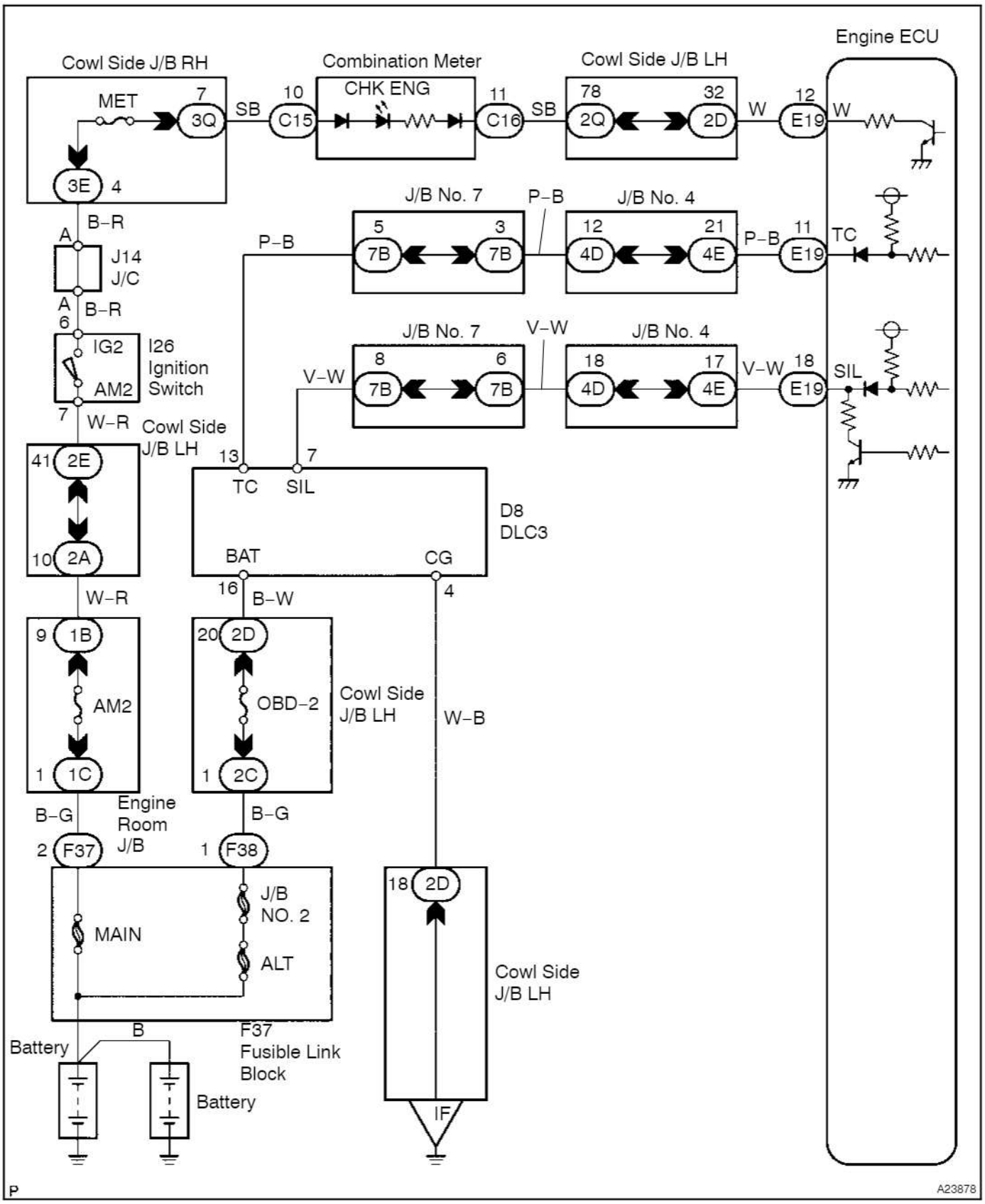
DIDYI–01

Diagnostic Connector (DLC3) Circuit

CIRCUIT DESCRIPTION

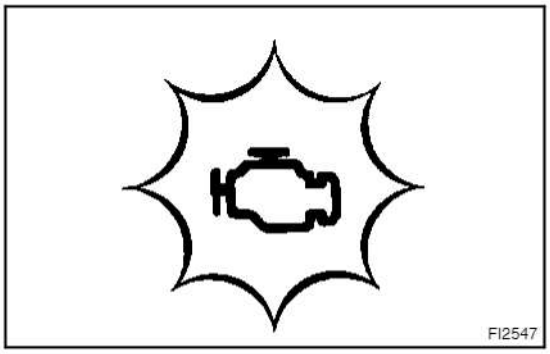
Terminals TC and CG are located in the DLC3.
The DLC3 is located under the finish lower panel. When terminals TC and CG are connected, DTCs in normal mode or test mode can be read from the check engine warning light in the combination meter.
Also, terminal SIL is located in the DLC3. This terminal is used by the M–OBD communication with the intelligent tester II.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check condition of check engine warning light.**



PREPARATION:

(a) Turn the ignition switch ON.

(b) Using SST, connect the terminals TC and CG of the DLC3.

SST 09843–18040

CHECK:

Check the check engine warning light condition.

OK:

Check engine warning light: Blinking

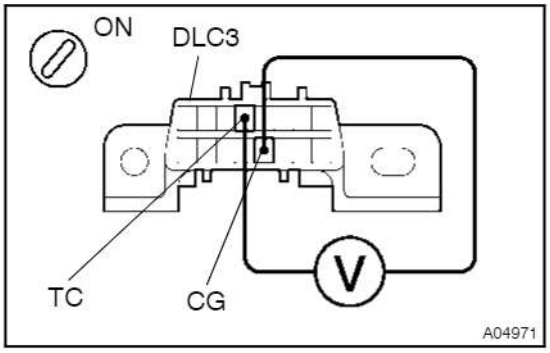
HINT:

If this inspection is OK and there is no intelligent tester II, you do not need to do the following steps and this circuit is OK. Proceed to the next circuit inspection shown on problem symptom table (see page DI–16).

OK	**Go to step 7.**

NG

2	**Check voltage between terminals TC and CG of DLC3.**



PREPARATION:

Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals TC and CG of the DLC3.

OK:

Voltage: 9 to 14 V

OK	**Go to step 5.**

NG

3	**Check resistance between terminal CG of DLC3 and body ground.**

NG → **Repair or replace harness or connector.**

OK

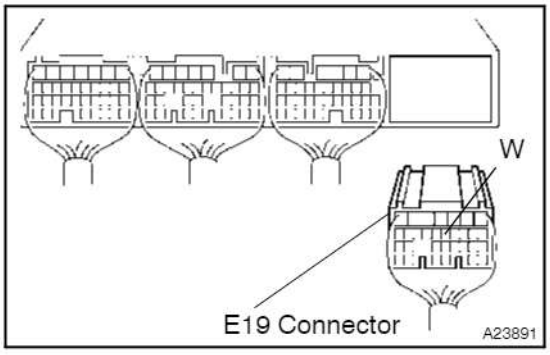
4	**Check for open and short in harness and connector between terminal TC of DLC3 and terminal TC of engine ECU (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–19).

5	**Check voltage between terminal W of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment door.
(b) Disconnect the E19 connector of the engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal W of the engine ECU connector and body ground.

OK:

Voltage: 9 to 14 V

OK → **Check and replace engine ECU (See page IN–19).**

NG

6	**Check bulb of check engine warning light.**

NG → **Replace bulb.**

OK

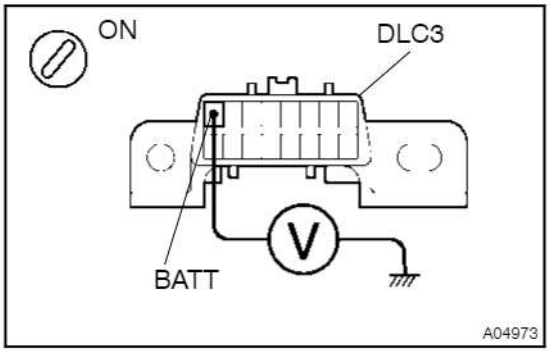
Check for open in harness and connector between terminal W of engine ECU and combination meter (See page IN–19).

7	**Can you read DTC (including normal DTC) using intelligent tester II?**

YES → **Proceed to next circuit inspection shown on problem symptom table (See page DI–16).**

NO

8	**Check voltage between terminal BATT of DLC3 and body ground.**



CHECK:
Measure the voltage between terminal BATT of the DLC3 and body ground.
OK:
Voltage: 9 to 14 V

NG → **Check for open and short in harness and connector between terminal BATT of DLC3 and fusible link block (See page IN–19).**

OK

Check for open and short in harness and connector between terminal SIL of DLC3 and terminal SIL of engine ECU (See page IN–19).

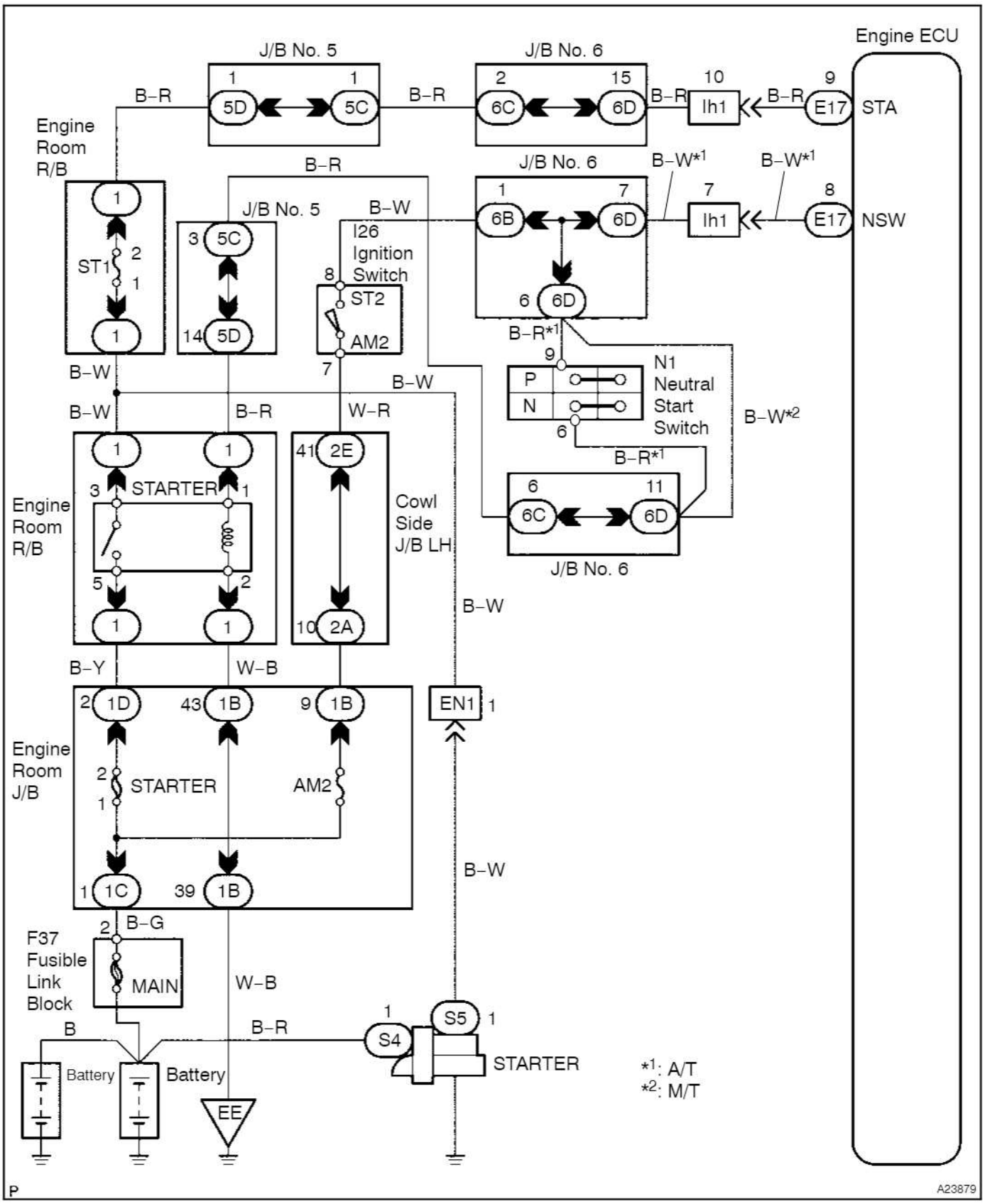
DI325-10

Starter Signal Circuit

CIRCUIT DESCRIPTION

When the engine is being cranked, the intake air flow is slow, so fuel vaporization is poor. A rich mixture is therefore necessary in order to achieve good startability. While the engine is being cranked, the battery positive voltage is applied to terminal STA of the engine ECU. The starter signal is mainly used to increase the fuel injection volume for the starting injection control and after–start injection control.

WIRING DIAGRAM



INSPECTION PROCEDURE

When using intelligent tester II:

HINT:

This diagnostic chart is based on the premise that the engine is being cranked under normal conditions. If the engine does not crank, proceed to the problem symptoms table on page DI–16.

1	**Connect intelligent tester II and check Starter signal.**

PREPARATION:

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

(b) Turn the ignition switch ON and push the intelligent tester II main switch ON.

CHECK:

Read the starter signal on the intelligent tester II while the starter operates.

OK:

Ignition switch position	ON	STA
Starter signal	OFF	ON

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–16).**

NG

2	**Check for open in harness and connector between engine ECU and starter relay (Marking: STARTER) (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

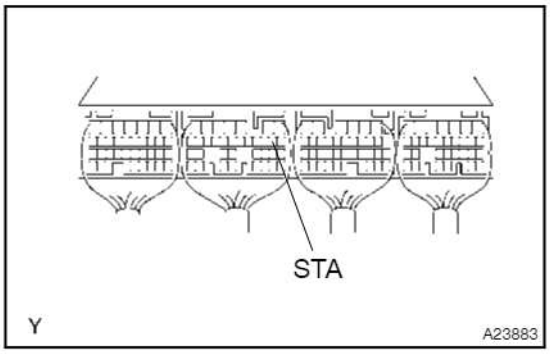
Check and replace engine ECU (See page IN–19).

When not using intelligent tester II:

HINT:

This diagnostic chart is based on the premise that the engine is being cranked under normal conditions. If the engine does not crank, proceed to the problem symptoms table on page DI–16.

1	**Check the starter signal.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal STA of the engine ECU connector and body ground during cranking.

OK:

Voltage: 6.0 V or more

OK	**Proceed to next circuit inspection shown on problem symptoms table (See page DI–16).**

NG

2	**Check for open in harness and connector between engine ECU and starter relay (Marking : STARTER) (See page IN–19).**

NG	**Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–19).

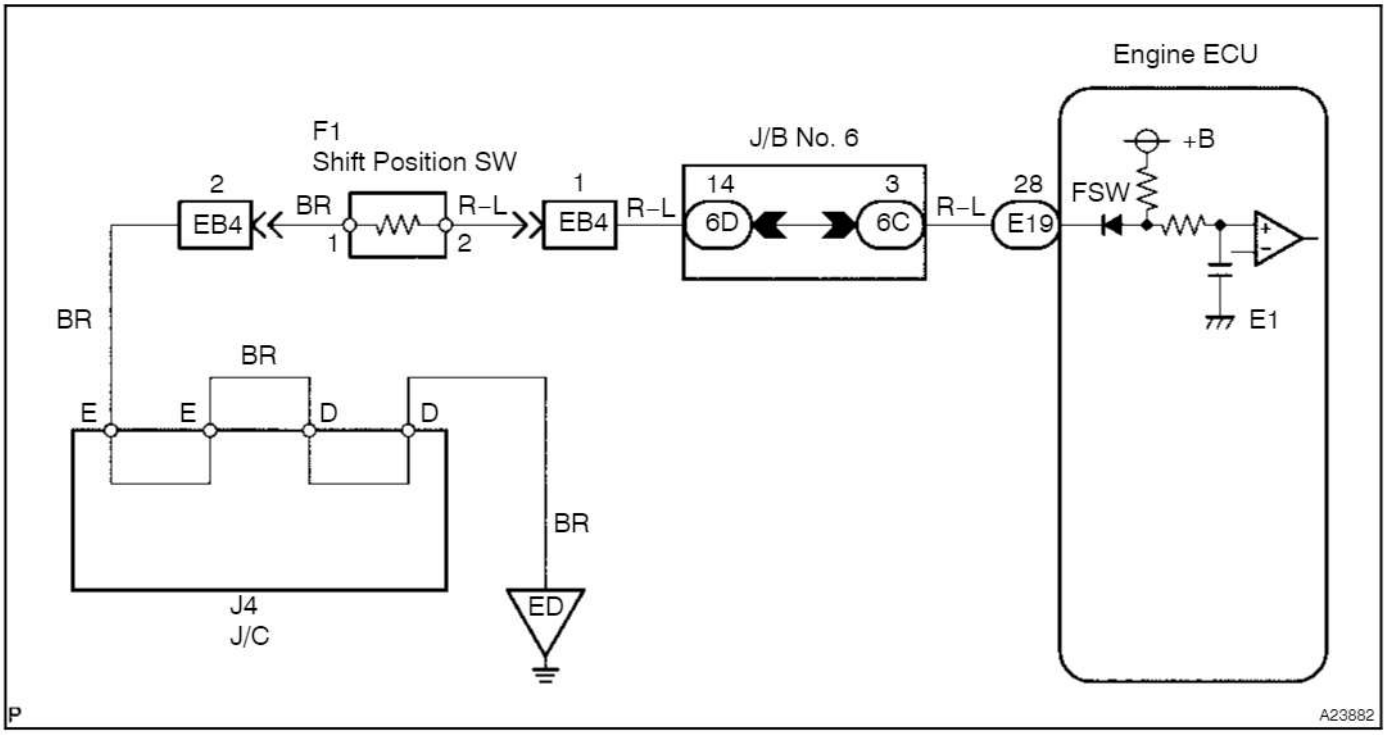
DIDYK–01

Shift Position Switch Circuit (only for vehicles with M/T)

CIRCUIT DESCRIPTION

The shift position switch on the side of the transmission detects the 1st gear and limits the engine output when the high load is applied during running in the 1st gear.

WIRING DIAGRAM



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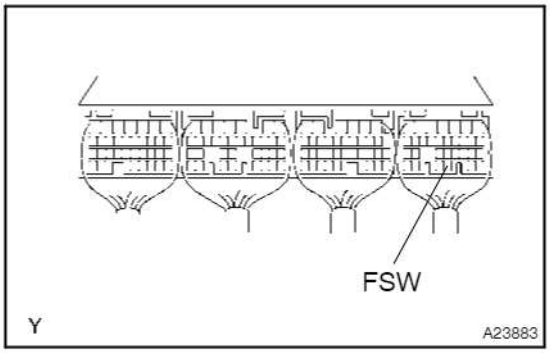
INSPECTION PROCEDURE

1	**Check shift position switch (See Pub No. RM617E, page ED–12).**

NG → **Replace shift position switch.**

OK

2	**Check voltage between terminal FSW of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal FSW of the engine ECU connector and body ground after the shift lever is moved to the following positions.

OK:

Shift lever position	1st gear	Except 1st gear
Voltage	9 to 14 V	0 to 3 V

OK → **Check and replace engine ECU (See page IN–19).**

NG

Check for open and short in harness and connector between shift position switch and engine ECU (See page IN–19).

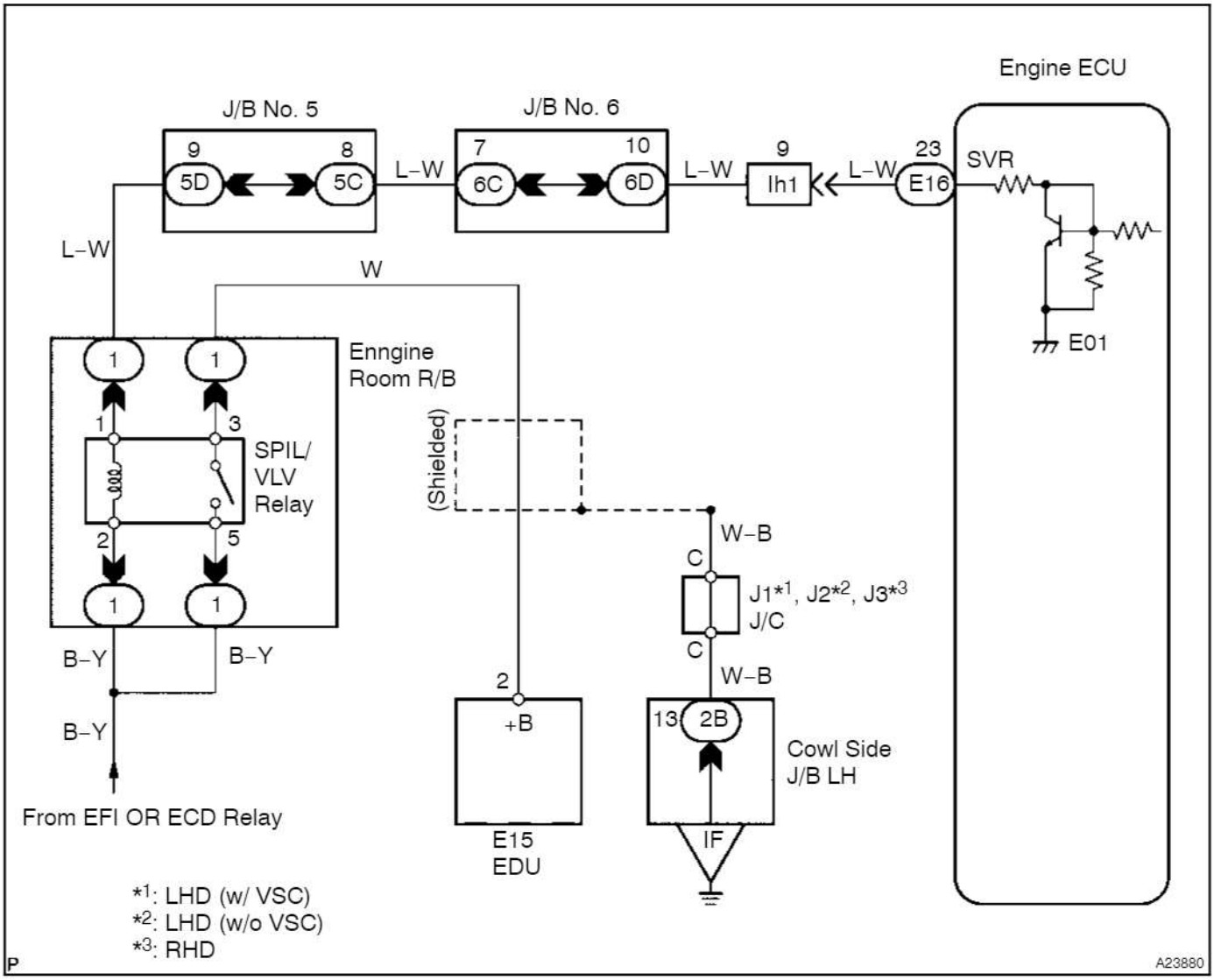
DIDYL–01

Spill Valve Relay Circuit

CIRCUIT DESCRIPTION

When the ignition switch is turned ON, battery positive voltage is applied to the coil, closing the contacts of the spill valve relay (Marking: SPIL/VLV) and supplying power to the terminal +B of the EDU.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	Check spill valve relay (Marking: SPIL/VLV) (See Pub No. RM617E, page ED–4).

NG → Replace spill valve relay.

OK →

2	Check for open and short in harness and connector between engine ECU and spill valve relay (Marking: SPIL/VLV) (See page IN–19).

NG → Repair or replace harness or connector.

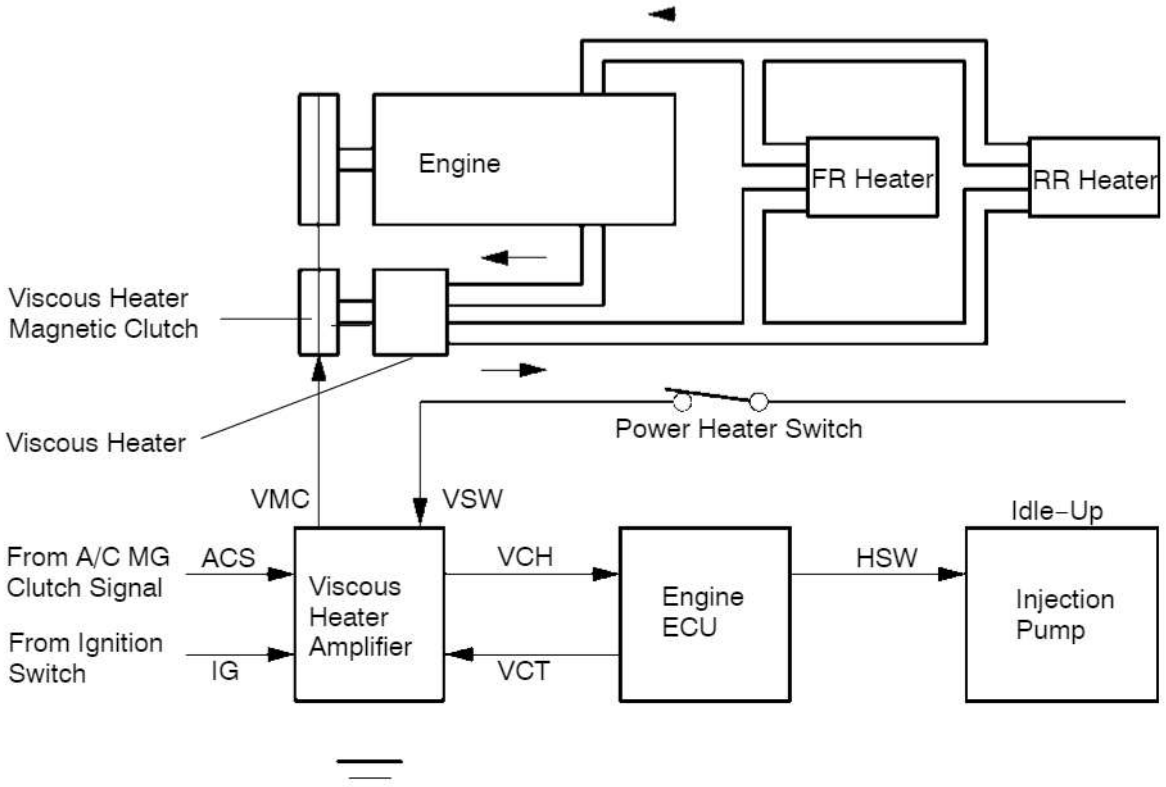
OK →

Check and replace engine ECU (See page IN–19).

Heater Idle–Up Switch Circuit

CIRCUIT DESCRIPTION

When the vehicle is stopped with the power heater switch ON (located on the left side (LHD) or right side (RHD) of the ignition switch), the engine ECU controls the spill control valve to idle–up. However, power heater switch is OFF during engine starting, A/C operating and acceleration (with the vehicle speed at less than 30 km/h (19 mph) and accelerator pedal opening at 45% or more for 5 seconds).



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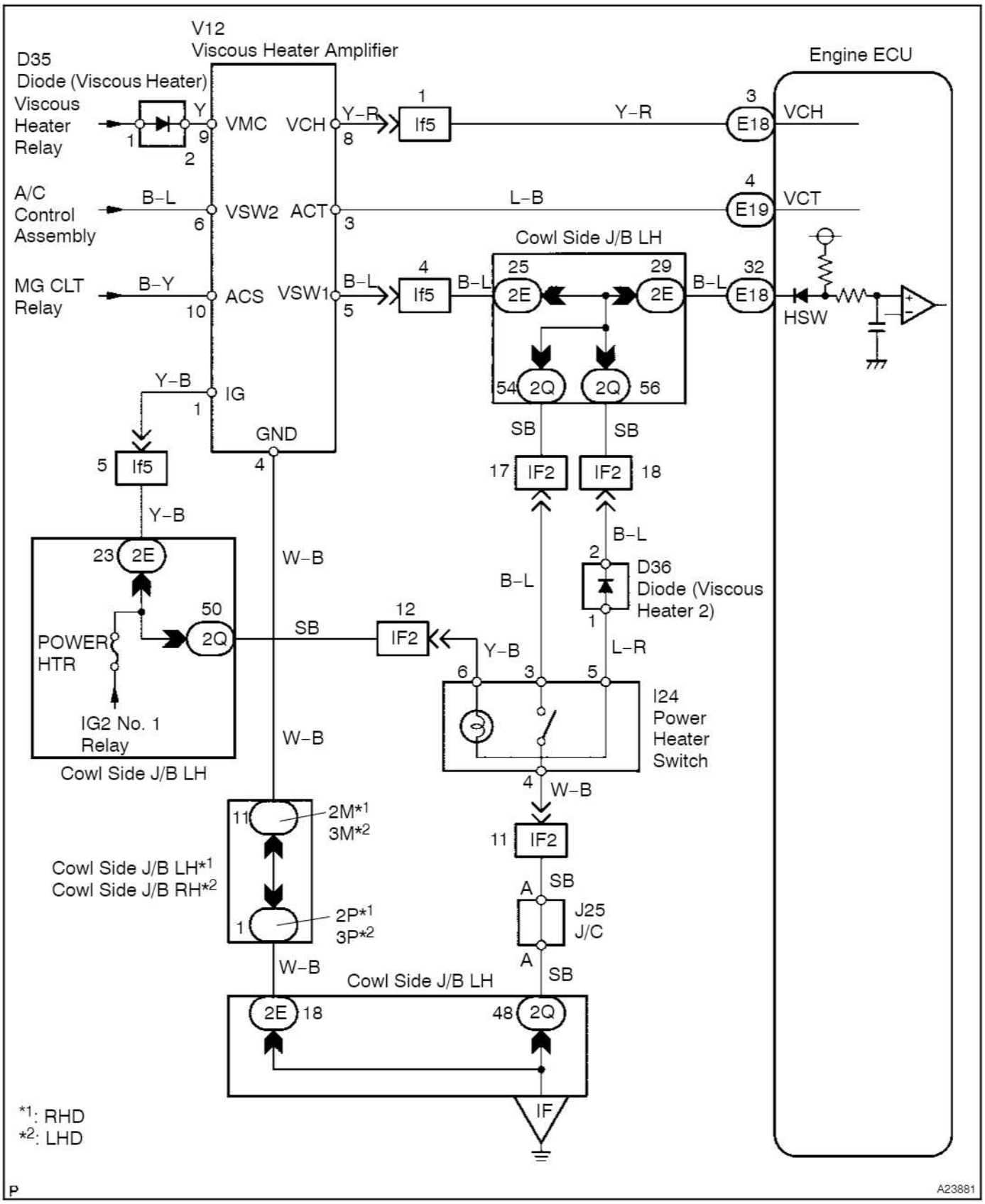
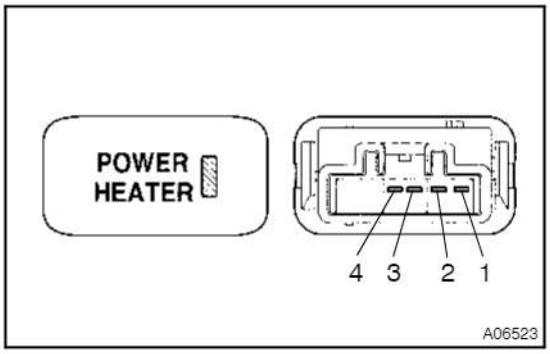
WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check power heater switch.**



PREPARATION:
(a) Remove the lower finish panel.
(b) Remove the power heater switch.

CHECK:
Check the resistance between each terminal.

Switch position	Tester connection	Specified condition
OFF	3 – 4	10 kΩ or higher
ON	3 – 4	Below 1 Ω
Illumination circuit	1 – 2	Below 1 Ω

NG → **Replace power heater switch.**

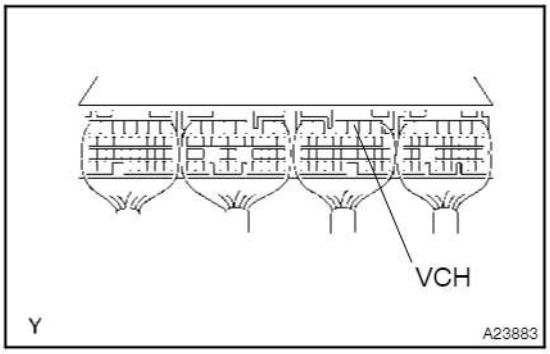
OK

2	**A/C Cut Control Circuit (See page DI–141).**

NG → **Check and replace A/C amplifier.**

OK

3	**Check voltage between terminal VCH of engine ECU and body ground.**



PREPARATION:
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:
Measure the voltage between terminal VCH of the engine ECU connector and body ground when the heater blower switch is turned to OFF and ON.

OK:

Heater blower switch condition	Voltage
OFF	9 to 14 V
ON	0 to 3 V

OK → **Go to step 5.**

NG

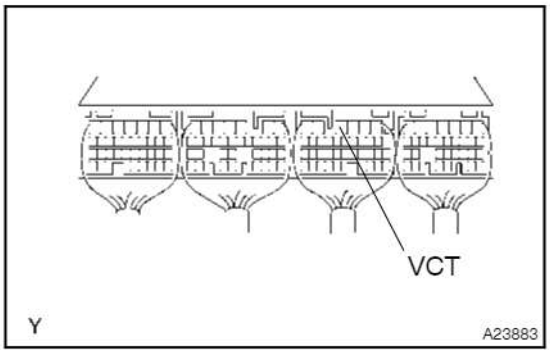
4	**Check for open and short in harness and connector between terminal VCH of engine ECU and terminal VCH of viscous heater amplifier (See page IN–19)**

NG → **Repair or replace harness or connector.**

OK

Check and replace viscous heater amplifier.

5	**Check voltage between terminal VCT of engine ECU and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal VCT of the engine ECU connector and body ground when the heater blower switch is turned to OFF and ON.

OK:

Heater blower switch condition	Voltage
OFF	9 to 14 V
ON	0 to 3 V

OK → **Check and replace engine ECU (See page IN–19).**

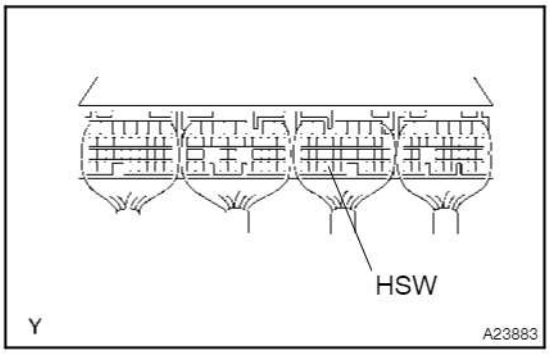
NG

6	**Check for open and short in harness and connector between terminal VCT of engine ECU and terminal VCT of viscous heater amplifier (See page IN–19).**

NG → **Repair or replace harness or connector.**

OK

7	Check voltage between terminal HSW of engine ECU and body ground.



PREPARATION:

(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal HSW of the engine ECU connector and body ground when the power heater switch is pushed to OFF and ON.

OK:

Power heater switch condition	Voltage
OFF	9 to 14 V
ON	0 to 3 V

OK → **Check and replace engine ECU (See page IN–19).**

NG

8	Check for open and short in harness and connector between injection pump and viscous heater amplifier (See page IN–19).

NG → **Repair or replace harness or connector.**

OK

Check and replace injection pump (See Pub No. RM617E, page FU–113).