FOREWORD

TOYOTA MOTOR CORPORATION

This supplement has been prepared to provide information covering general service repairs for the 5L-E Engine equipped on the TOYOTA HILUX.

Applicable models: LN147, 152, 157, 167, 172, 192 series

First Printing: Jul. 21, 2000 01−000721−00

Please note that the publications below have also been prepared as relevant service manuals for the components and system in this engine.

Manual Name	Pub.No.
S 2L, 3L Engine Repair Manual	RM520E
S 2L, 2L−T, 3L, 5L Engine Repair Manual Supplement (Aug., 1997)	RM582E

All information in this manual is based on the latest product information at the time of publication. However, specifications and procedures are subject to change without notice.

CAUTION

This manual does not include all the necessary items about repair and service. This manual is made for the purpose of the use for the persons who have special techniques and certifications. In the cases that non−specialized or uncertified technicians perform repair or service only using this manual or without proper equipment or tool, that may cause severe injury to you or other people around and also cause damage to your customer's vehicle.

In order to prevent dangerous operation and damages to your customer's vehicle, be sure to follow the instruction shown below.

- Must read this manual thoroughly. It is especially important to have good understanding all the contents written in the PRECAUTION of "IN" section.
- The service method written in this manual is very effective to perform repair and service. When performing the operations following the procedures using this manual, be sure to use tools specified and recommended. If using non−specified or recommended tools and service method, be sure to confirm safety of the technicians and any possibility of causing personal injury or damage to the customer's vehicle before starting the operation.
- If part replacement is necessary, must replace the part with the same part number or equivalent part. Do not replace it with inferior quality.
- It is important to note that this manual contains various "Cautions" and "Notices" that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these "Cautions" and "Notices" are not exhaustive, because it is important to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

MAIN INDEX: HILUX.
SUPPLEMENT: 5L-E ENGINES

October 2000

INTRODUCTION

HOW TO USE THIS MANUAL

IN01F-07

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.

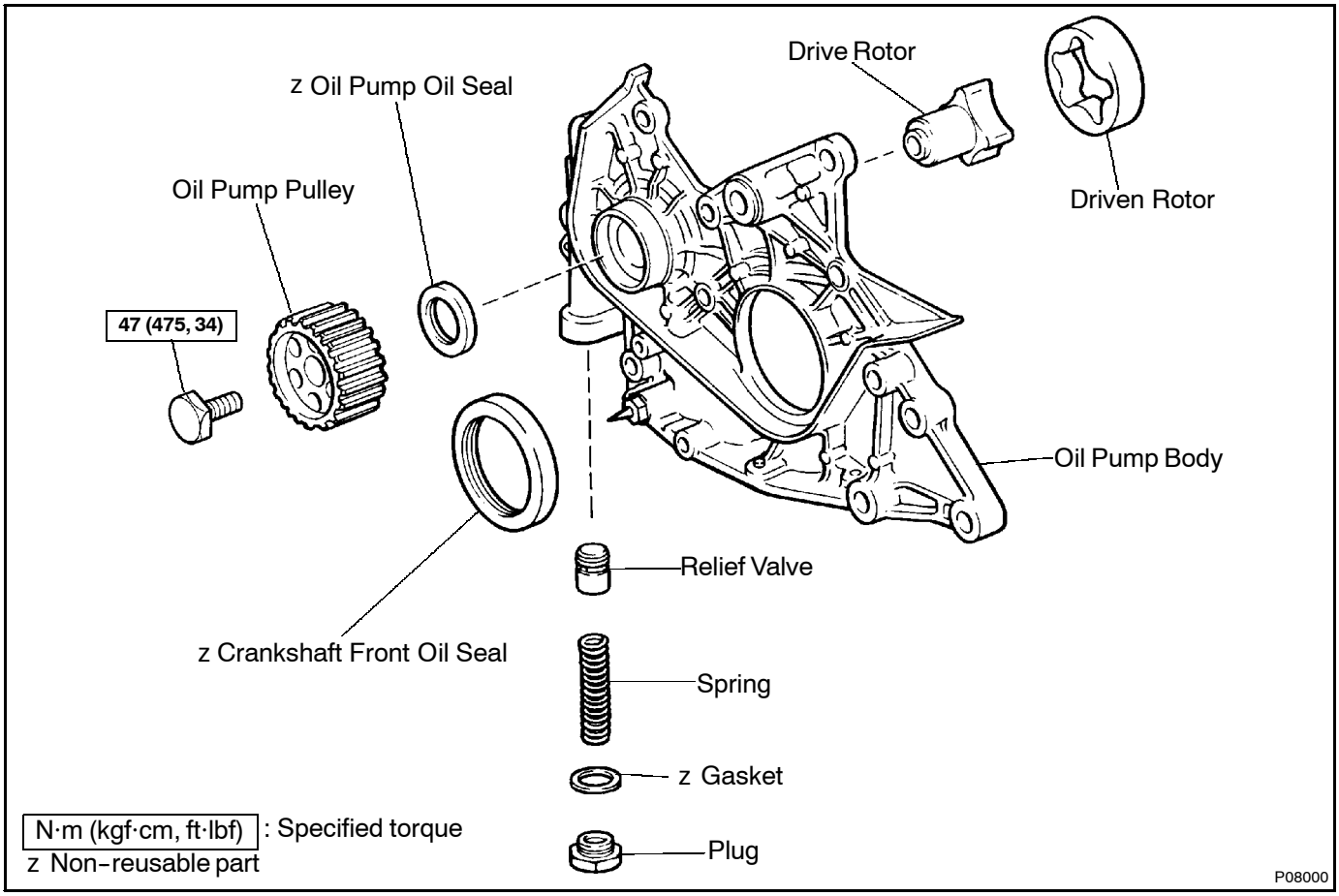
4. PREPARATION

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:



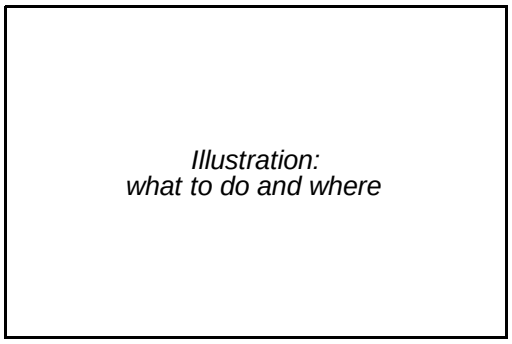
CONTINUED

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

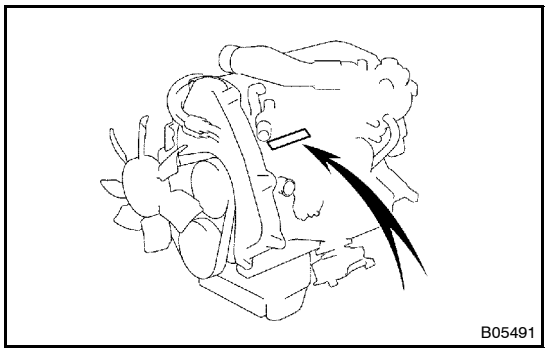
- CAUTIONS are presented in bold type, and indicate there is a possibility of injury to you or other people.
- NOTICES are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- HINTS are separated from the text but do not appear in bold. They provide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

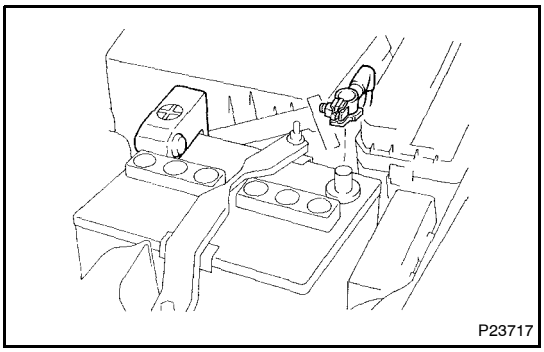


IDENTIFICATION INFORMATION

IN01G-07

ENGINE SERIAL NUMBER

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


P23717

REPAIR INSTRUCTIONS

GENERAL INFORMATION

IN01H-02

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 "z" 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 "L" symbol.

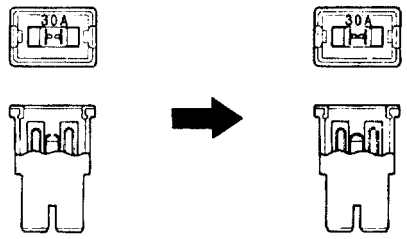
(g) When necessary, use a sealer on gaskets to prevent leaks.

CONTINUED

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

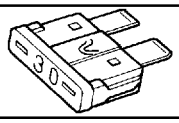
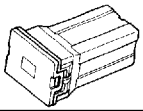
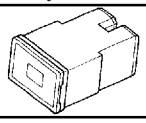
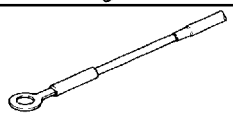
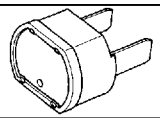
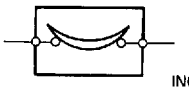
(i) Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found in the preparation part at the front of each section in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

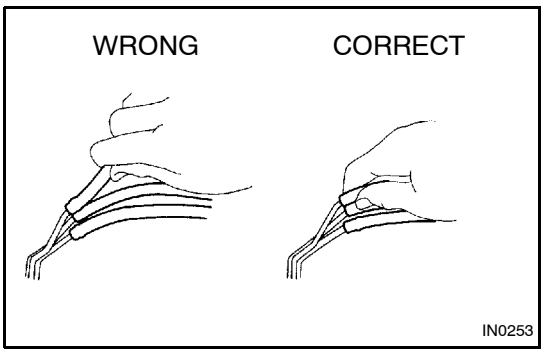
(1) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels at the opposite end in order to ensure safety.

(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.

CONTINUED

(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.)

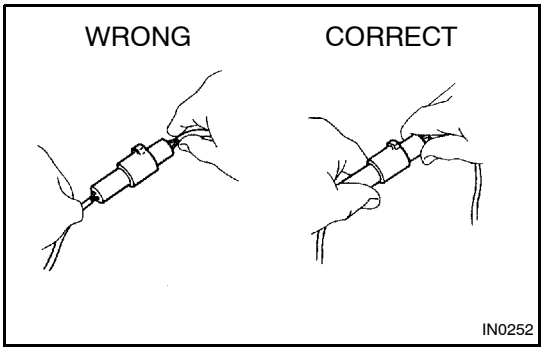


(2) To disconnect vacuum hoses, pull on the end, not the middle of the hose.

(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.

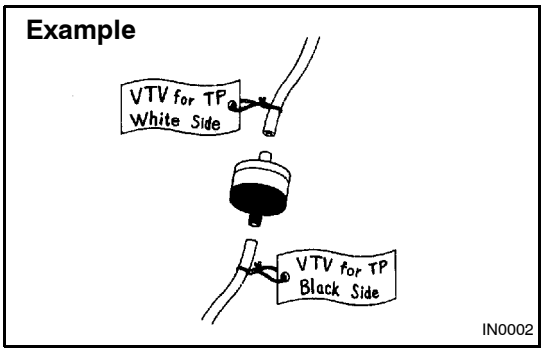
(5) When steam cleaning an engine, protect the electronic components, air filter and emissions-related components from water.



(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

IN01I-01

PRECAUTION

1. FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

CAUTION:

If large amounts of unburned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this, observe the following precautions and explain them to your customer.

(a) Use only unleaded gasoline

(b) Avoid prolonged idling
Avoid running the engine at idle speed for more than 20 minutes.

(c) Avoid spark jump test
  (1) Perform spark jump test only when absolutely necessary. Perform this test as rapidly as possible.
  (2) While testing, never race the engine.

(d) Avoid prolonged engine compression measurement
Engine compression tests must be done as rapidly as possible.

(e) Do not run engine when fuel tank is nearly empty
This may cause the engine to misfire and create an extra load on the converter.

(f) Avoid coasting with ignition turned off and prolonged braking

(g) Do not dispose of used catalyst along with parts contaminated with gasoline or oil

2. 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.

3. FOR USING HAND-HELD TESTER

CAUTION:

Observe the following for safety reasons:

- **Before using the hand-held tester, the hand-held tester's operator manual should be read throughly.**
- **Be sure to route all cables securely when driving with the hand-held tester 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 hand-held tester, one person to drive the vehicle and one person to operate the hand-held tester.**

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

IN01J-06

GENERAL INFORMATION

A large number of ECU controlled systems are used in the HILUX. 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.

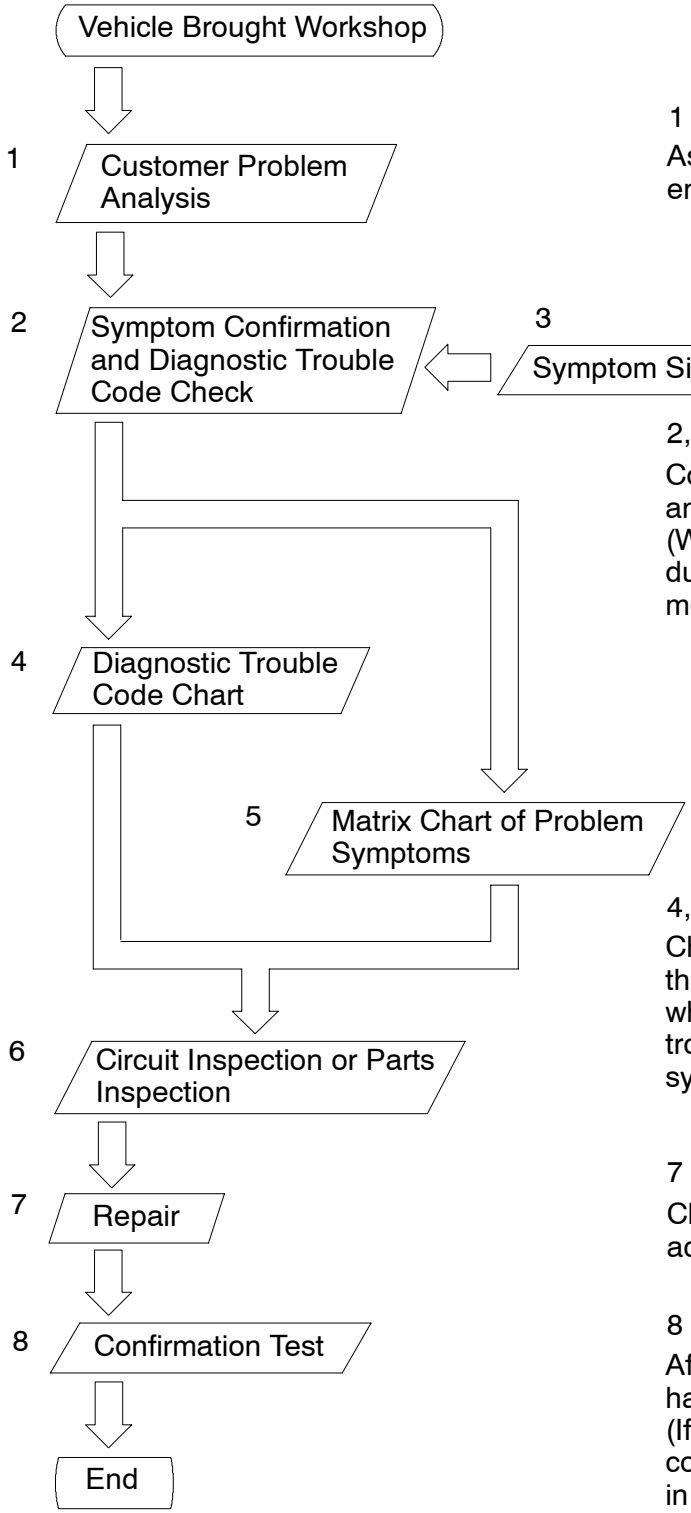
FOR USING HAND-HELD TESTER

- Before using the hand-held tester, the hand-held tester's operator manual should be read throughly.
- If the hand-held tester cannot communicate with ECU controlled systems when you have connected the cable of the hand-held tester 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-07

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.)

CONTINUED

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	

☐ Constant ☐ Sometimes (times per day/month)

CONTINUED

2. SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE CHECK

The diagnostic system in the HILUX 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 HILUX.

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

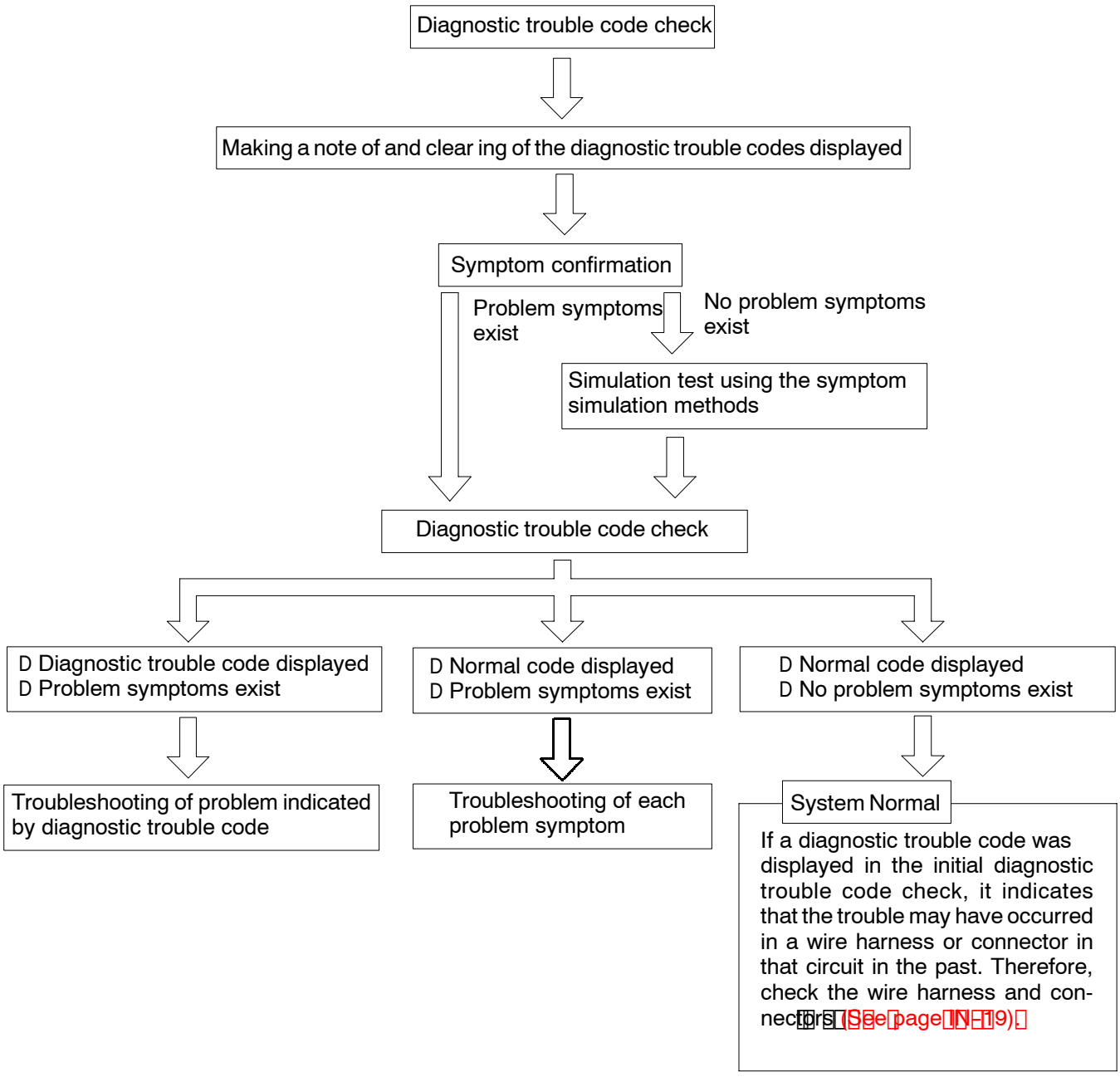
In diagnostic trouble code check, it is very important to determine whether the problem indicated by the diagnostic trouble code is still occurring or occurred in the past but returned to normal at present. In addition, it must be checked in the problem symptom check whether the malfunction indicated 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.

CONTINUED

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.



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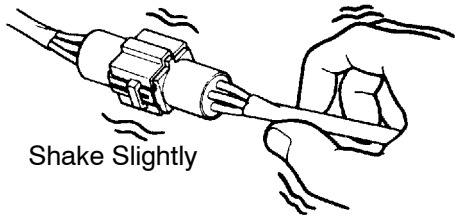
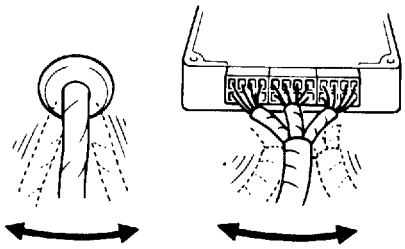
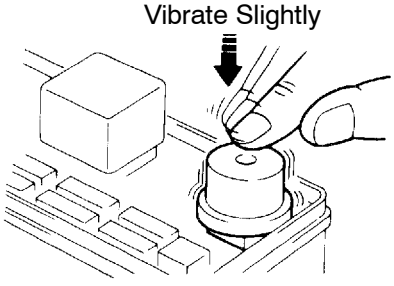
3. SYMPTOM SIMULATION

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.	  FI2331 FI2332
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.	 FI2330

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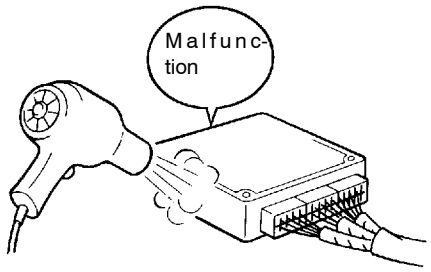
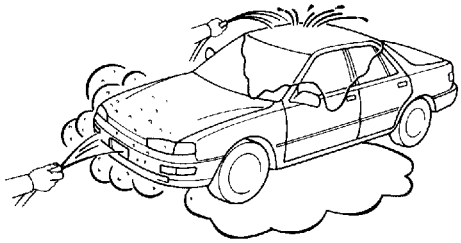
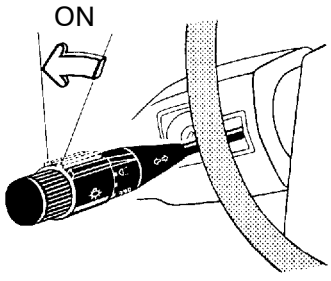
CONTINUED

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.**	 FI2334
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.	 FI2336

V07469

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.

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

D Trouble Area
Indicates the suspect area of the problem.

D 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 Check Engine Warming Light Nomal Mode/ Test Node	*Memory
12*3 (DI-12)	G, NE Signal Circuit	D Open or short in NE, G circuit D IIA D Open or short in STA circuit D Engine ECU	ON / N.A	○
12*4 (DI-28)	NE Signal Circuit	D Open or short in NE circuit D IIA D Open or short in STA circuit D Engine ECU	ON / N.A	○
13 (DI-31)	NE Signal Circuit	D Open or short in NE circuit D IIA D Engine ECU	ON / N.A	○
14 (DI-32)	Ignition Signal Circuit	D Open or short in IGF or IGT circuit from IIA to engine ECU D Igniter D Engine ECU	ON / N.A	○
		D Oxygen sensor circuit D Oxygen sensor		

CONTINUED

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.

D Page
Indicates the page where the flow chart for each circuit is located.

D Circuit Inspection, Inspection Order
Indicates the circuit which needs to be checked for each problem symptom. Check in the order indicated by the numbers.

D Problem Symptom

D Circuit or Part Name
Indicates the circuit or part which needs to be checked.

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	See page
Engine does not crank (Does not start)	1. Starter and starter relay	ST-12, 13
No initial combustion (Does not start)	1. Engine ECU power source circuit 2. Fuel pump control circuit 3. Engine ECU	DI-124 DI-127 IN-30
No complete combustion (Does not start)	1. Fuel pump control circuit	DI-127
Engine cranks normally (Difficult to start)	1. Starter signal circuit 2. Fuel pump control circuit 3. Compression	DI-121 DI-127 EM-3
Cold engine (Difficult to start)	1. Starter signal circuit 2. Fuel pump control circuit	DI-121 DI-127
Hot engine	1. Starter signal circuit 2. Fuel pump control circuit	DI-121 DI-127
High engine idle speed (Poor idling)	1. A/C signal circuit (Compressor circuit) 2. Engine ECU power source circuit	AC-54 DI-124
lling)	1. A/C signal circuit 2. Fuel pump control circuit	
	1. Compression 2. Fuel pump control circuit	

CONTINUED

6. CIRCUIT INSPECTION

How to read and use each page is shown below.

D Diagnostic Trouble Code No. and Detection Item

D Circuit Description
The major role and operation, etc. of the circuit and its component parts are explained.

DTC	52	Knock Sensor Circuit

CIRCUIT DESCRIPTION

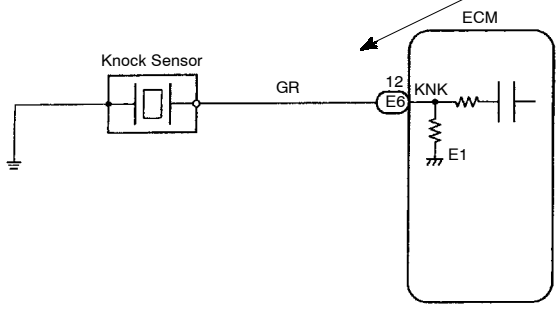
Knock sensor is fitted to the cylinder block to detect engine knocking. This sensor contains a piezoelectric element which generates a voltage when it becomes deformed, which occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, ignition timing is retarded to suppress it.

DTC No.	Detection Item	Trouble Area
52	No knock sensor signal to ECM with engine speed, 1,200 rpm or more.	D Open or short in knock sensor1 circuit D Knock sensor 1 (looseness) D ECM

If the ECM detects the above diagnosis conditions, it operates the fail safe function in which the corrective retard angle value is set to the maximum value.

D Indicates the diagnostic trouble code, diagnostic trouble code set parameter and suspect area of the problem.

WIRING DIAGRAM



D Wiring Diagram
This shows a wiring diagram of the circuit.
Use this diagram together with ELECTRICAL WIRING DIAGRAM to thoroughly understand the circuit.
Wire colors are indicated by an alphabetical code.
B = Black, L = Blue, R = Red, BR = Brown, LG = Light Green, V = Violet, G = Green, O = Orange, W = White, GR = Gray, P = Pink, Y = Yellow
The first letter indicates the basic wire color and the second letter indicates the color of the stripe.

CONTINUED

V08423

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

LOCK
Ignition Switch LOCK (OFF)

ON
Ignition Switch ON

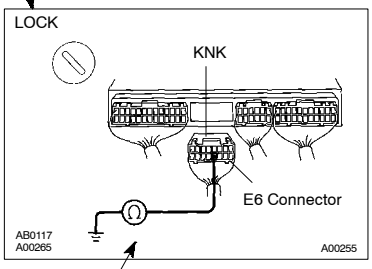
START
Ignition Switch START

ACC
Ignition Switch ACC

D 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.

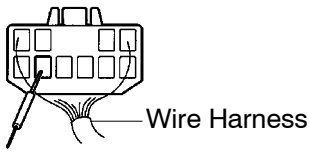
OK:
Resistance: 1 MΩ or higher

OK	**Go to step 3.**
NG	

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

OK	**Replace knock sensor.**

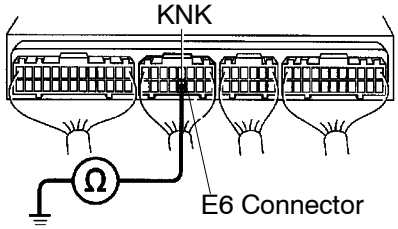
D Indicates the place to check the voltage or resistance.
D Indicates the connector position to checked, from the front or back side.



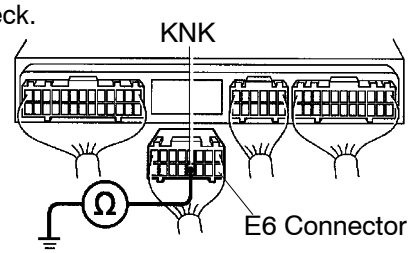
Check from the connector back side. (with harness)

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

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

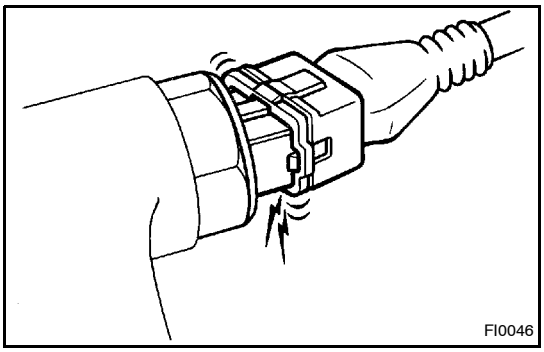


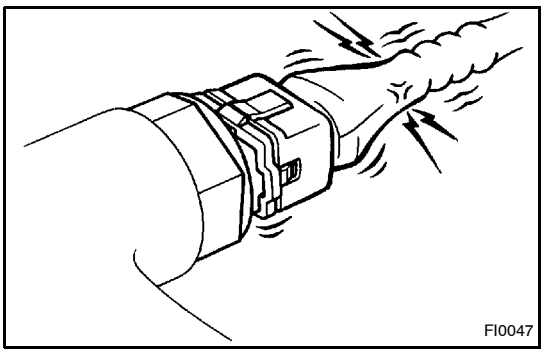
Connector being checked is connected.

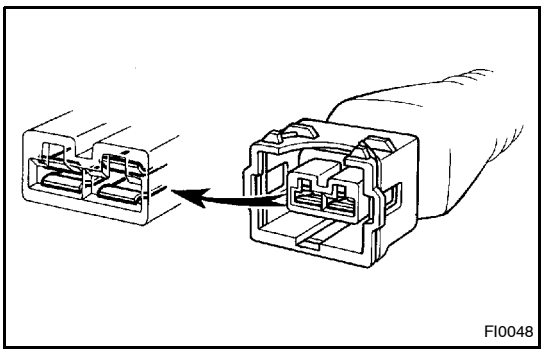


Connector being checked is disconnected.

V08425


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.

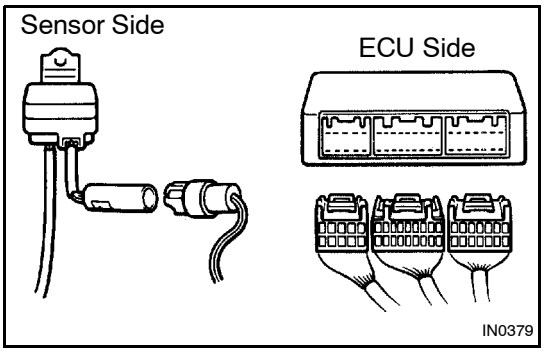
SHORT CIRCUIT:

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.

CONTINUED



2. CONTINUITY CHECK (OPEN CIRCUIT CHECK)

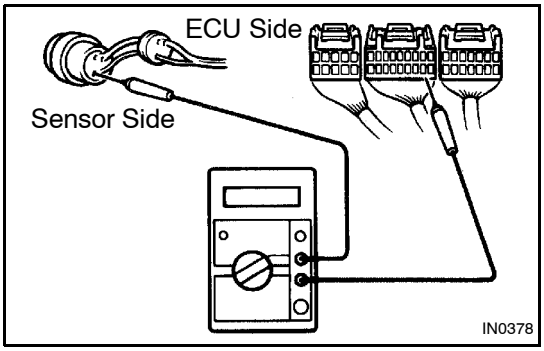
(a) Disconnect the connectors at both ECU and sensor sides.

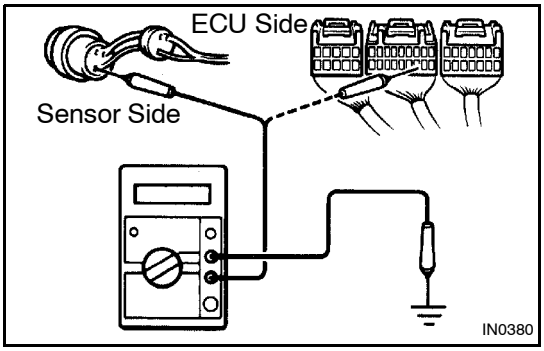
(b) Measure the resistance between the applicable terminals of the connectors.

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)

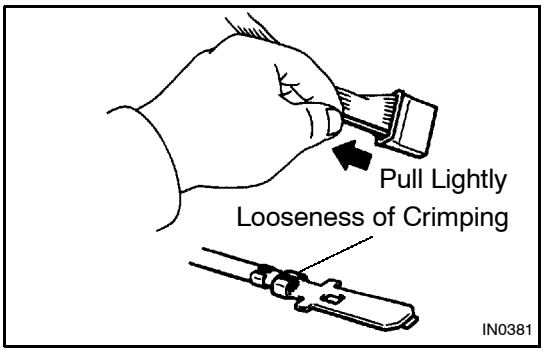
(a) Disconnect the connectors at both ends.

(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.

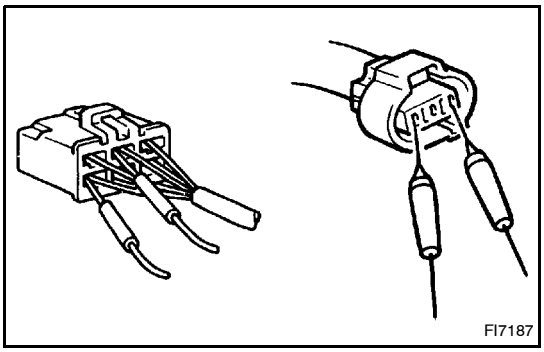
NOTICE:

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

HINT:

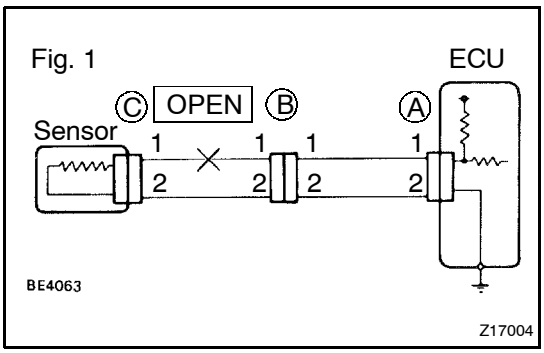
When the test terminal is pulled out more easily than others, there may be poor contact in that section.

CONTINUED



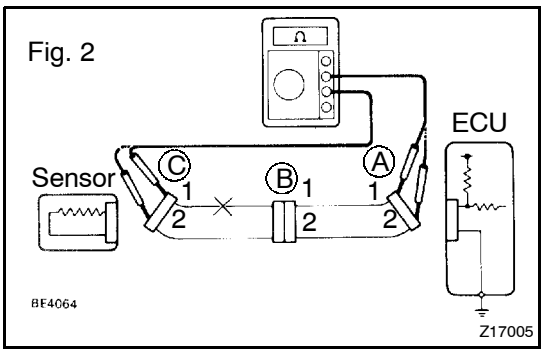
5. CONNECTOR HANDLING

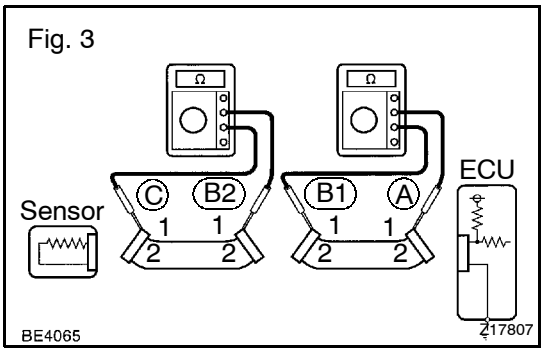
When inserting tester probes into a connector, insert them from the rear of the connector. When necessary, use mini test leads. For water resistant connectors which cannot be accessed from behind, take good care not to deform the connector terminals.



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.





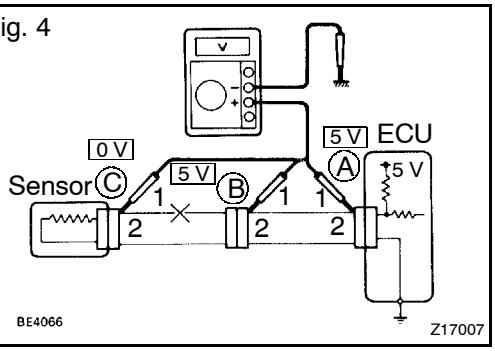
(a) Check the continuity.

(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".

CONTINUED

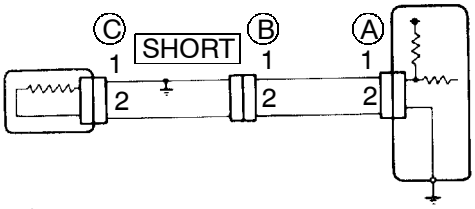
Fig. 4



(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".

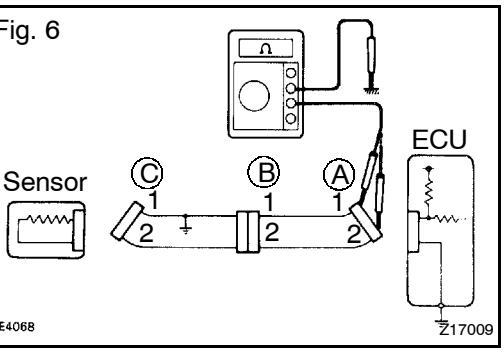
Fig. 5



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

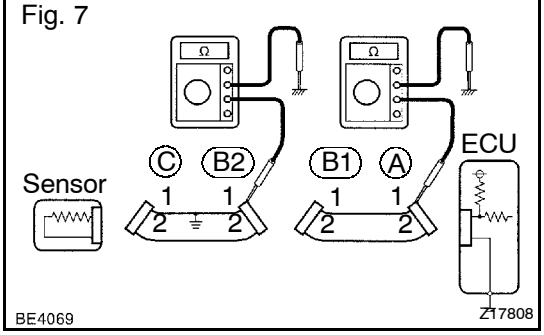


Check the continuity with ground.

(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".

CONTINUED

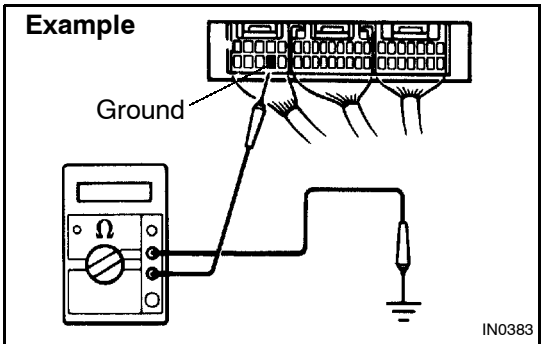
Fig. 7



(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".

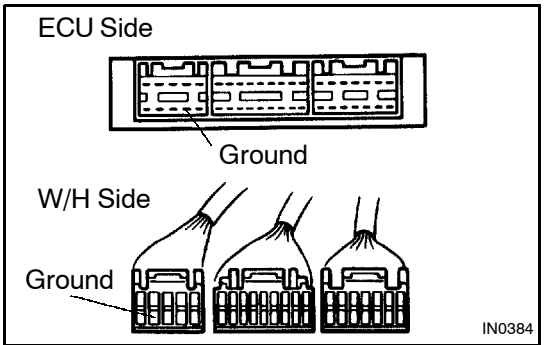
8. CHECK AND REPLACE ECU

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-06

Abbreviations	Meaning
A/C	Air Conditioning
AC	Alternating Current
ACC	Accessory
ACIS	Acoustic Control Induction System
ACSD	Automatic Cold Start Device
ALT	Alternator
AMP	Amplifier
APPROX.	Approximately
A/T	Automatic Transmission (Transaxle)
BACS	Boost Altitude Compensation System
BAT	Battery
BTDC	Before Top Dead Center
BVSV	Bimetallic Vacuum Switching Valve
CB	Circuit Breaker
CCO	Catalytic Converter for Oxidation
DC	Direct Current
DLC	Data Link Connector
DTC	Diagnostic Trouble Code
ECD	Electronic Control Diesel
ECT	Electronic Control Transmission
ECU	Electronic Control Unit
EDU	Electronic Driving Unit
EFI	Electronic Fuel Injection
E/G	Engine
EGR	Exhaust Gas Recirculation
EVAP	Evaporative Emission Control
E-VRV	Electronic Vacuum Regulating Valve
EX	Exhaust
FIPG	Formed In Place Gasket
FL	Fusible Link
Fr	Front
GND	Ground
HAC	High Altitude Compensator
IG	Ignition
IIA	Integrated Ignition Assembly
IN	Intake
ISC	Idle Speed Control
J/B	Junction Block
J/C	Junction Connector
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	Left-Hand

CONTINUED

LHD	Left-Hand Drive
LO	Low
MAP	Manifold Absolute Pressure
MAX.	Maximum
MIL	Malfunction Indicator Lamp
MIN.	Minimum
MP	Multipurpose
M/T	Manual Transmission
N	Neutral
O2S	Oxygen Sensor
O/D	Overdrive
O/S	Oversize
PKB	Parking Brake
PS	Power Steering
RAM	Random Access Memory
R/B	Relay Block
RH	Right-Hand
RHD	Right-Hand Drive
ROM	Read Only Memory
Rr	Rear
SICS	Starting Injection Control System
SPEC	Specification
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TACH	Tachometer
TDC	Top Dead Center
TEMP.	Temperature
TM	Transmission
TMC	TOYOTA Motor Corporation
TWC	Three-Way Catalyst
U/D	Underdrive
VCV	Vacuum Control Valve
VIN	Vehicle Identification Number
VSV	Vacuum Switching Valve
w/	With
W/H	Wire Harness
w/o	Without
WU-TWC	Warm Up Three-Way Catalytic Converter
2WD	Two Wheel Drive Vehicle (4x2)
4WD	For Wheel Drive Vehicle (4x4)

PREPARATION

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
2L, 3L Engine Repair Manual	RM520E
2L, 2L–T, 3L, 5L Engine Repair Manual Supplement (Aug., 1997)	RM582E

NOTE: The above pages contain only the points which differ from the above listed manuals.

ENGINE MECHANICAL

EQUIPMENT

PP12U-05

Micrometer	
Torque wrench	

EMISSION CONTROL

EQUIPMENT

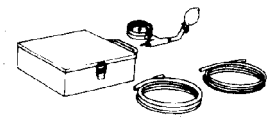
PP130-02

Torque wrench	
Vacuum gauge	

ELECTRONIC CONTROL DIESEL

PP3GI-01

SST (Special Service Tools)

	09843-18020 Diagnosis Check Wire	
	09992-00242 Turbocharger Pressure Gauge	

PP131-02

RECOMMENDED TOOLS

	09082-00040 TOYOTA Electrical Tester.	

PP132-02

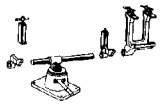
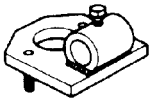
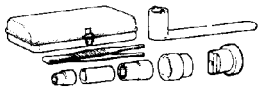
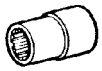
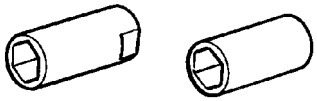
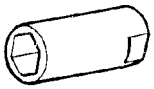
EQUIPMENT

Hand-held tester	
19 mm deep socket wrench	
Thermometer	
Vacuum gauge	
Voltmeter	
Ohmmeter	
Torque wrench	

ENGINE FUEL

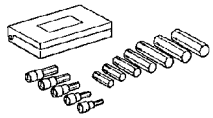
SST (Special Service Tools)

PP3GJ-01

	09241-76022	Injection Pump Stand Set	
	09245-54010	Injection Pump Stand Arm	
	09260-54012	Injection Pump Tool Set	
	(09262-54010)	Distributor Head Plug Wrench	
	(09269-54020)	Socket 14 mm	
	09268-64010	Injection Nozzle Wrench Set	
	(09268-64020)	Injection Nozzle Holder Retaining Nut Wrench	

PP3GK-01

RECOMMENDED TOOLS

	09040-00011 Hexagon Wrench Set .	

PP135-02

EQUIPMENT

19 mm deep socket wrench	Fuel temp. sensor
Injection nozzle tester	
Torque wrench	

SERVICE SPECIFICATIONS

REFER TO FOLLOWING REPAIR MANUALS:

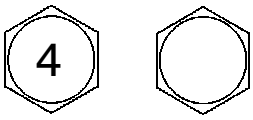
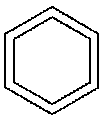
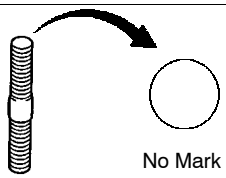
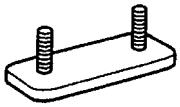
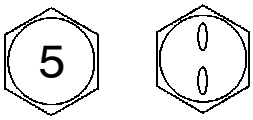
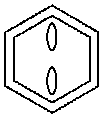
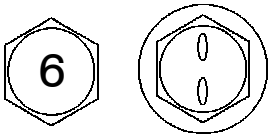
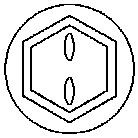
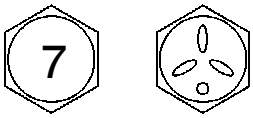
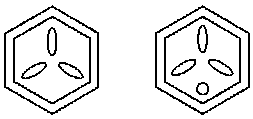
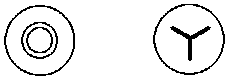
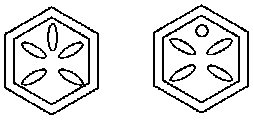
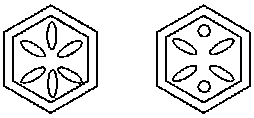
Manual Name	Pub. No.
2L, 3L Engine Repair Manual	RM520E
2L, 2L–T, 3L, 5L Engine Repair Manual Supplement (Aug., 1997)	RM582E

NOTE: The above pages contain only the points which differ from the above listed manuals.

STANDARD BOLT

HOW TO DETERMINE BOLT STRENGTH

SS0ZS-01

Bolt Type				Class
Hexagon Head Bolt		Stud Bolt	Weld Bolt	
Normal Recess Bolt	Deep Recess Bolt			
 No Mark	 No Mark	 No Mark		4T
				5T
 w/ Washer	 w/ Washer			6T
				7T
				8T
				9T
				10T
				11T

B06431

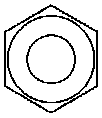
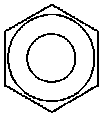
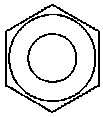
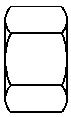
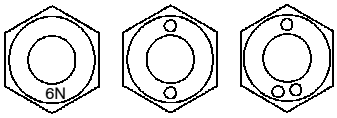
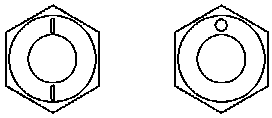
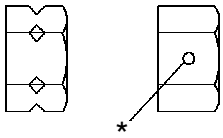
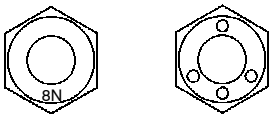
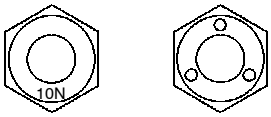
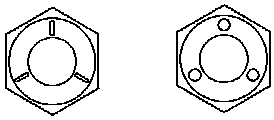
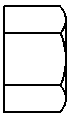
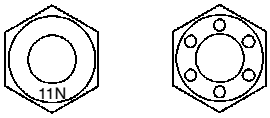
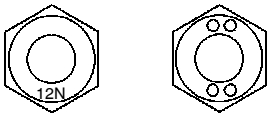
SS0ZT-01

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N·m	kgf·cm	ft·lbf	N·m	kgf·cm	ft·lbf
4T	6	1	5	55	48 in.·lbf	6	60	52 in.·lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	-	-	-
5T	6	1	6.5	65	56 in.·lbf	7.5	75	65 in.·lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	-	-	-
6T	6	1	8	80	69 in.·lbf	9	90	78 in.·lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	-	-	-
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	-	-	-
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

SS0ZU-01

HOW TO DETERMINE NUT STRENGTH

Nut Type			Class
Present Standard Hexagon Nut	Old Standard Hexagon Nut		
	Cold Forging Nut	Cutting Processed Nut	
 No Mark			4N
 No Mark (w/ Washer)	 No Mark (w/ Washer)	 No Mark	5N (4T)
 6N			6N
		 *	7N (5T)
 8N			8N
 10N		 No Mark	10N (7T)
 11N			11N
 12N			12N

*: Nut with 1 or more marks on one side surface of the nut.

B06432

HINT:

Use the nut with the same number of the nut strength classification or the greater than the bolt strength classification number when tightening parts with a bolt and nut.

Example: Bolt = 4T

Nut = 4N or more

ENGINE MECHANICAL

SERVICE DATA

SS0JM-05

Idle speed			720 - 820 rpm
Maximum speed			4,770 - 5,030 rpm
Camshaft	Cam lobe height	STD Intake	54.890 - 54.910 mm (2.1610 - 2.1618 in.)
		Exhaust	54.990 - 55.010 mm (2.1650 - 2.1657 in.)
		Minimum Intake	54.39 mm (2.1413 in.)
		Exhaust	54.49 mm (2.1453 in.)

SS0JN-05

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
Injection pump x Timing belt case	20.5	210	15
Injection pump x Injection pump stay	26	270	19
Intake manifold x EGR valve	13	130	9
EGR adapter x Intake manifold	19	195	14
EGR valve x EGR pipe	108	1100	79
Crank position sensor x Cylinder block	5	51	4

EMISSION CONTROL

TORQUE SPECIFICATION

SS1IC-01

Part tightened	N·m	kgf·cm	ft·lbf
Intake manifold x EGR valve	13	130	14
EGR adptor x EGR valve	19	195	14
EGR adptor x Intake manifold	19	195	14
EGR pipe x EGR valve	108	1,100	80

ELECTRONIC CONTROL DIESEL

SERVICE DATA

SS0JR-02

Throttle full switch	Continuity	Fully closed Fully open	No continuity Continuity
Throttle control motor	Resistance	at 20°C (68°F)	18 - 22 Ω
Timing control valve	Resistance	at 20°C (68°F)	10 - 14 Ω
Spill control valve	Resistance	at 20°C (68°F)	1 - 2 Ω
E-VRV for EGR	Resistance	at 20°C (68°F)	46 - 50 Ω
Water temperature sensor	Resistance	at -20°C (-4°F) at 0°C (32°F) at 20°C (68°F) at 40°C (104°F) at 60°C (140°F) at 80°C (176°F)	10 - 20 kΩ 4 - 7 kΩ 2 - 3 kΩ 0.9 - 1.4 kΩ 0.4 - 0.7 kΩ 0.2 - 0.4 kΩ
Fuel temperature sensor	Resistance	at -20°C (-4°F) at 0°C (32°F) at 20°C (68°F) at 40°C (104°F) at 60°C (140°F) at 80°C (176°F)	10 - 20 kΩ 4 - 7 kΩ 2 - 3 kΩ 0.9 - 1.3 kΩ 0.4 - 0.7 kΩ 0.2 - 0.4 kΩ
Intake air temperature sensor	Resistance	at -20°C (-4°F) at 0°C (32°F) at 20°C (68°F) at 40°C (104°F) at 60°C (140°F) at 80°C (176°F)	10 - 20 kΩ 4 - 7 kΩ 2 - 3 kΩ 0.9 - 1.3 kΩ 0.4 - 0.7 kΩ 0.2 - 0.4 kΩ
Turbo pressure sensor	Power source voltage		4.75 - 5.25 V
Engine speed sensor	Resistance	at 20°C (68°F)	205 - 255 Ω
Crankshaft position sensor	Resistance	at Cold at Hot	19 - 32 Ω 24 - 37 Ω
Accelerator pedal closed position sensor	Continuity Fully open	Fully closed	No continuity Continuity (0 - 20 Ω)

SS0JS-02

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
Throttle body x Intake manifold	12	120	9
Water temperature sensor x Cylinder block	25	250	18
Fuel temperature sensor x Injection pump	22.1	250	16
Crankshaft position sensor x Cylinder block	5.0	50	43 in.·lbf
Accelerator pedal assembly x Body	5.0	50	43 in.·lbf

ENGINE FUEL

SERVICE DATA

SS0JT-02

Injection nozzles	Nozzle opening pressure	New nozzle	15,790 - 16,570 kPa (161 - 169 kgf/cm^2, 2,290 - 2,404 psi)
		Reused nozzle	15,200 - 16,180 kPa (155 - 165kgf/cm^2, 2,205 - 2,347 psi)
	Adjusting shim thickness		0.900 mm (0.0354 in.) 0.950 mm (0.0374 in.) 1.000 mm (0.0394 in.) 1.050 mm (0.0413 in.) 1.100 mm (0.0433 in.) 1.150 mm (0.0453 in.) 1.200 mm (0.0472 in.) 1.250 mm (0.0492 in.) 1.300 mm (0.0512 in.) 1.350 mm (0.0531 in.) 1.400 mm (0.0551 in.) 1.450 mm (0.0571 in.) 1.500 mm (0.0591 in.) 1.550 mm (0.0610 in.) 1.600 mm (0.0630 in.) 1.650 mm (0.0650 in.) 1.700 mm (0.0669 in.) 1.750 mm (0.0689 in.) 1.800 mm (0.0709 in.) 1.850 mm (0.0728 in.) 1.900 mm (0.0748 in.) 1.950 mm (0.0768 in.)

SS0JU-02

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Injection nozzle x Cylinder head		64	650	47
Nozzle leakage pipe x Injection nozzle		27.0	275	20
Injection pipe x Injection nozzle		29.5	300	22
Injection pipe x Injection pump		24.5	250	18
Fuel inlet hollow screw x Injection pump body		36.8	375	27
Delivery valve holder x Distributive head		58.85	600	43
Distributive head plug x Distributive head		88	900	65
Fuel inlet pipe x injection pump	Nut (A)	26.55	271	20
	Bolt (B)	24.5	250	18
Fuel outlet pipe x Injection pump		26.55	271	20
Injection pump x Timing belt case		20.5	210	15
Fuel temp. sensor x Injection pump		21.6	220	16.5
Pump stay x Injection pump		26	270	19.6
Pump stay x Cylinder block		26	270	19.6

DIAGNOSTICS

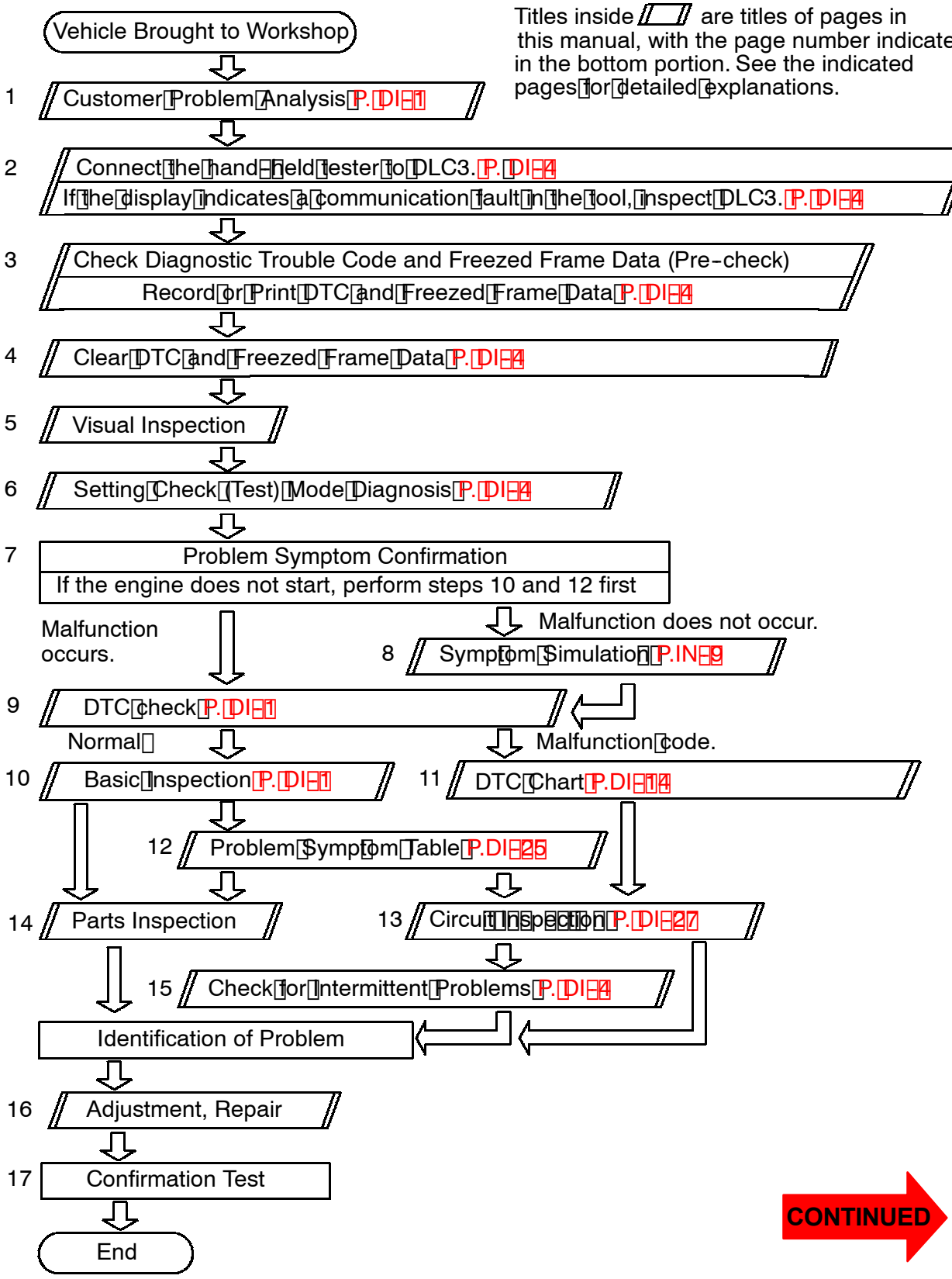
ENGINE

DI0Z7-04

HOW TO PROCEED WITH TROUBLESHOOTING

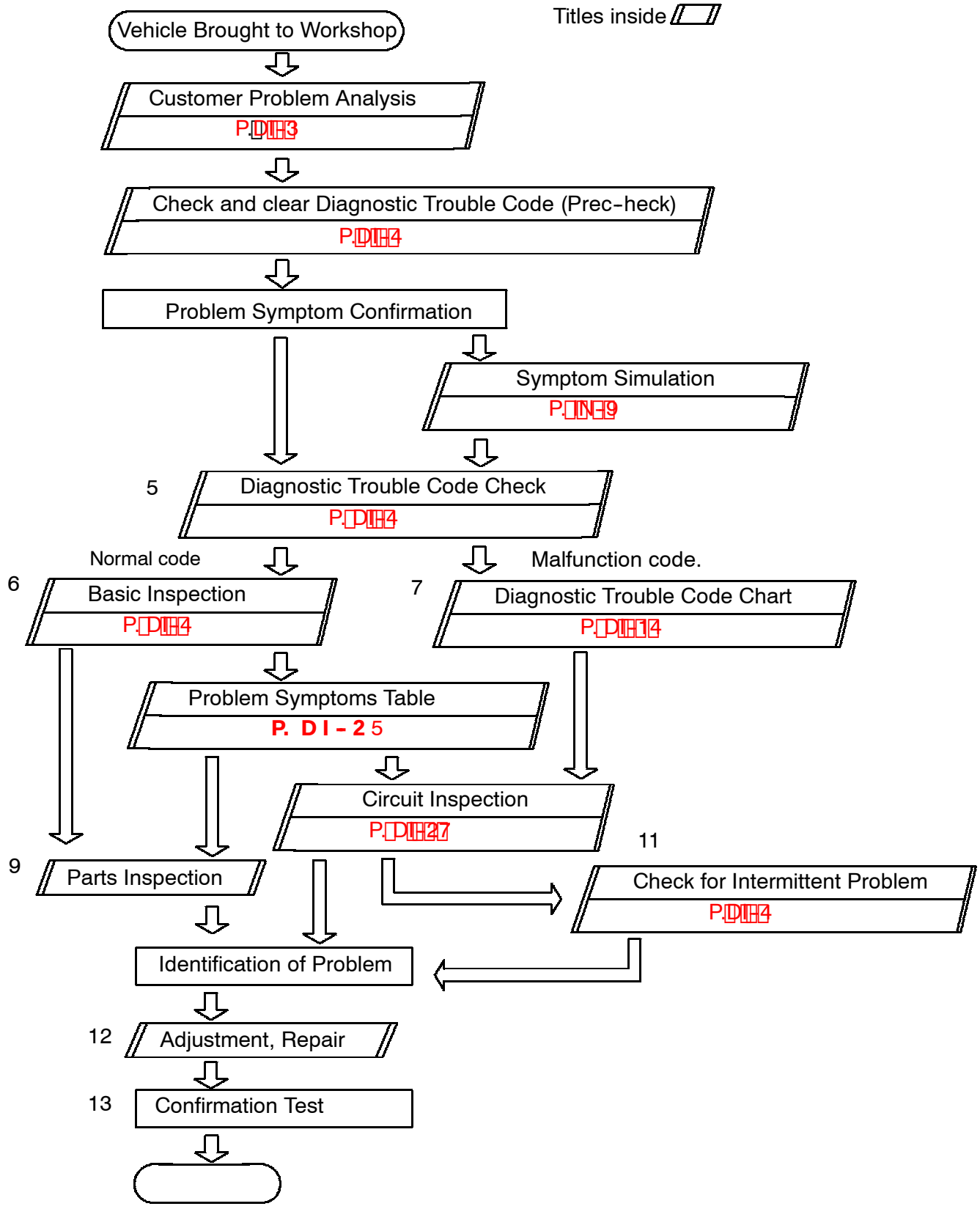
When using hand-held tester, troubleshoot in accordance with the procedure on the following pages.

Titles inside // are titles of pages in this manual, with the page number indicated in the bottom portion. See the indicated pages for detailed explanations.



CONTINUED

When not using hand-held tester, troubleshoot in accordance with the procedure on the following pages.



DI0Z9-03

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

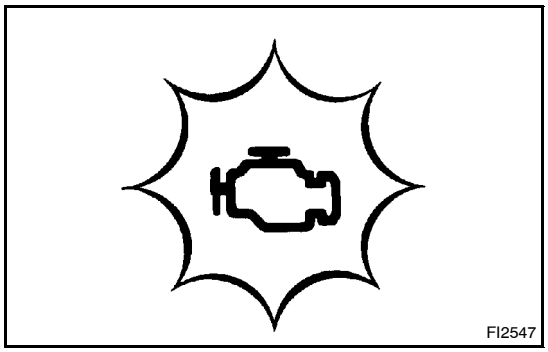
Problem Symptoms	☐ Engine does not Start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion
	☐ Difficult to Start	☐ Engine cranks slowly ☐ Other _____
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal ☐ High (rpm) ☐ Low (rpm) ☐ Rough idling ☐ Other _____
	☐ Poor Driveability	☐ 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	

Dates 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. ____°F/____°C)
	Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other _____
	Engine Temp.	☐ Cold ☐ Warming up ☐ After Warming up ☐ Any temp. ☐ Other _____
	Engine Operation	☐ Starting ☐ Just after starting (min.) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other _____

Condition of Malfunction indicator Lamp		☐ Remains on	☐ Sometimes light up ☐ Does not light up
Diagnostic Trouble Code Inspection	Normal mode (Precheck)	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )
	Check Mode	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )

DIAGNOSTICS:

PRE CHECK:



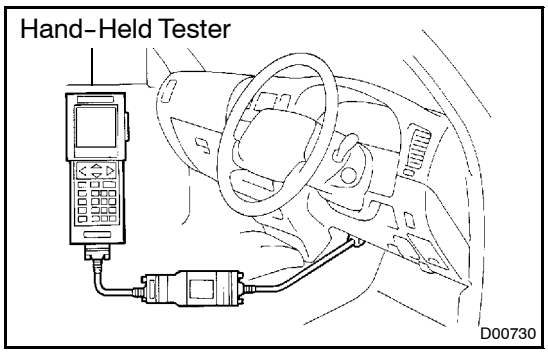
PRE-CHECK

1. DIAGNOSIS SYSTEM

(a) Description

- When troubleshooting Multiplex OBD (M-OBD) vehicles, the only difference from the usual troubleshooting procedure is that you need to connect the vehicle to the hand-held tester, 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 on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition to the check engine warning light lighting up when a malfunction is detected, the applicable diagnostic trouble codes are recorded in the engine ECU memory. (See page DI-14)

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



- To check the diagnostic trouble codes, connect the hand-held tester to the Data Link Connector 3 (DLC3) on the vehicle or read the number of blinks of the check engine warning light when TC and CG terminals on the DLC3 are connected. The hand-held tester also enables you to erase the diagnostic trouble codes and activate the several actuators and check freeze frame date and various forms of engine data. (For operating instructions, see the hand-held tester instruction book.)
- The diagnosis system operates in the normal mode during a normal vehicle use. It also has a check (test) mode for technicians to simulate malfunction symptoms and troubleshoot. Some diagnostic trouble codes use 2 trip detection logic* to prevent an erroneous detection and ensure thorough the malfunction detection. By switching the engine ECU to the check (test) mode using hand-held tester when troubleshooting, a technician can cause the check engine warning light to light up for a malfunction that is only detected once or momentarily. (hand-held tester only) (See page DI-14)

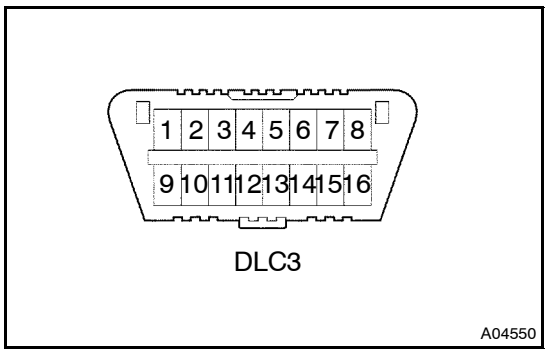
CONTINUED

S *2 trip detection logic:
When a logic malfunction is first detected, the malfunction is temporarily stored in the engine ECU memory.

If the same malfunction is detected again during the second drive test, this second detection causes the check engine warning light to light up. The 2 trip repeats the same mode twice time. (However, the ignition switch must be turned OFF between the 1st trip and 2nd trip).

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

(b) Check the DLC3.
The vehicle's engine ECU uses ISO 14230 for communication. The terminal arrangement of DLC3 complies with SAE J1962 and matches the ISO 14230 format.



DLC3

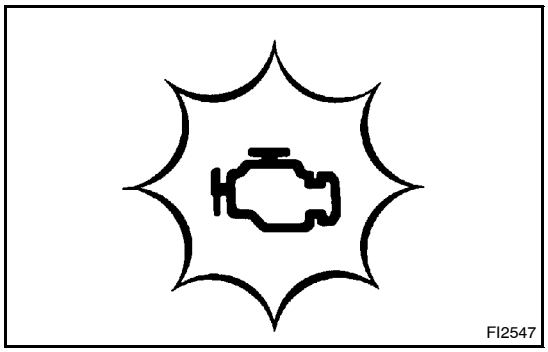
Terminal No.	Connection/Voltage or Resistance	Condition
7	Bus+ Line/Pulse generation	During transmission
4	Chassis Ground - Body Ground/1 Ω or less	Always
16	Battery Positive - Body Ground/9 - 14 V	Always

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

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

S If the communication is still impossible when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service Department listed in the tool's instruction manual.

CONTINUED



2. INSPECT DIAGNOSIS (Normal Mode)

(a) Check the check engine warning light.

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

HINT:

If the check engine warning light does not light up, troubleshoot the combination meter.

(2) when the engine is started, the check engine warning light 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 hand-held tester.

NOTICE:

When the diagnosis system is switched from normal mode to check test mode, it erases all DTCs and freezed frame data recorded in normal mode. So before switching modes, always check the DTCs and freezed frame data, and note them down.

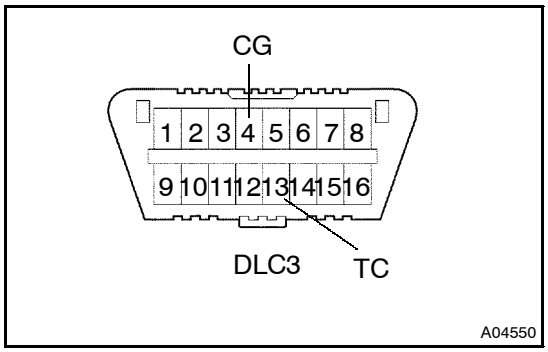
(1) Prepare the hand-held tester.

(2) Connect the hand-held tester to the DLC3.

(3) Turn the ignition switch ON and switch the hand-held tester main switch ON.

(4) Use the hand-held tester to check the DTCs and freezed frame data, note them down. (for operating instructions, see the hand-held tester's instruction book.)

(5) Confirm the details of the DTCs.

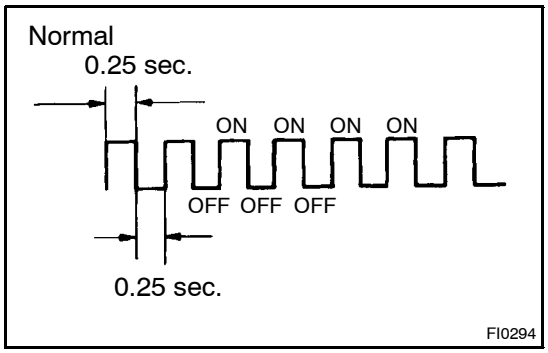


(c) Check the DTC not using hand-held tester.

(1) Turn the ignition switch ON.

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

SST 09843-18020

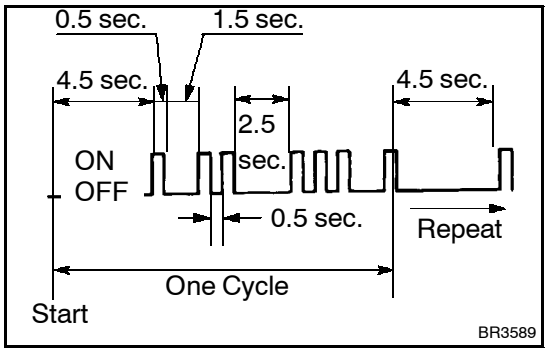


(3) Read the diagnostic trouble code from check engine warning light.

HINT:

- If a diagnostic trouble code is not output, check the diagnostic connector (DLC3) circuit (See page DI-113).

CONTINUED



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

(4) Check the details of the malfunction using the diagnostic trouble code chart on page DI-14.

(5) After completing the check, disconnect terminals 13 (TC) and 4 (CG) and turn off the display.

HINT:

In the event of 2 or more malfunction codes, indication will begin from the smaller numbered code and continue in order to the larger.

NOTICE:

When simulating symptoms without a hand-held tester to check the DTCs, use normal mode. For code on the DTCs chart subject to "2 trip detection logic", turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again. When the problem has been simulated twice, the check engine warning light lights up and the DTCs are recorded in the engine ECU.

3. INSPECT DIAGNOSIS (Check (Test) Mode)

HINT:

HAND-HELD TESTER only:

Compared to the normal mode, the check mode has an increased sensitivity to detect malfunctions.

Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check (test) mode.

(a) Check the DTC.

(1) Initial conditions.

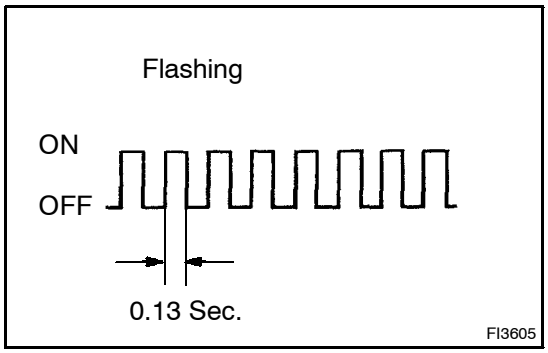
- S Battery positive voltage 11 V or more
- S Throttle valve fully closed.
- S Transmission in neutral position
- S Air conditioning switched OFF.

(2) Turn the ignition switch OFF.

(3) Prepare the hand-held tester.

(4) Connect the hand-held tester to the DLC3.

(5) Turn the ignition switch ON and push the hand-held tester main switch ON.



(6) Switch the hand-held tester normal mode to check (test) mode. (Check that the check engine warning light flashes.).

(7) Start the engine. (The check engine warning light goes out after the engine start.).

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

NOTICE:

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

CONTINUED

(9) After simulating the malfunction conditions, use the hand-held tester diagnosis selector to check the DTCs and freezed frame data, etc.

HINT:

Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check (test) mode to normal mode, so all diagnostic codes, etc. are erased.

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

(b) Clear the DTC.

The following actions will erase the DTCs and freezed frame data.

(1) Operating the hand-held tester to erase the codes. (See the hand-held tester's instruction book for operating instructions.)

(2) Disconnecting the battery terminals or ECD fuse.

NOTICE:

If the hand-held tester switches the engine ECU from normal mode to check (test) mode or vice-versa, or if the ignition switch is turned from ON to ACC or OFF during check (test) mode, the DTCs and freezed frame data will be erased.

CONTINUED

4. FAIL-SAFE CHART

If any of the following codes is recorded, the ECU enters fail-safe mode.

DTC No.	Fail-Safe Operation	Fail-Safe Deactivation Conditions
12	TCV duty is fixed at 30 %	2 of more TDC signals are detected for 4 engine revolution
13	•Fuel cut •TCV duty is fixed at 2 % •Close diesel throttle valve	2 of more NE signals are detected for 0.5 sec.
15	•EGR off •IDL SW ON : Diesel throttle is fixed at idle position IDL SW OFF : Diesel throttle valve is fully open •Accelerator pedal position below 25 %	IG switch OFF
18	•Fuel cut •Close diesel throttle valve	IG switch OFF or starter ON from OFF
19(1)	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 %	IG switch OFF
19(2)	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 %	IG switch OFF
	Accelerator pedal position below 10 %	IG switch OFF
19(3)	Accelerator pedal position below 10 %	IG switch OFF
19(4)	Accelerator pedal position below 10 %	IG switch OFF
22	Engine coolant temp. is fixed at 9 °C (48 F)	Return to normal condition
24	Intake air temp. is fixed at 130 °C (266 F)	Return to normal condition
35	Intake air pressure is fixed at 101.3 kPa (760 mmHg, 30 in.HG)	Return to normal condition
39	Fuel temp. is fixed at 20 °C (68 F)	Return to normal condition
42	Vehicle speed is fixed at 0 km/h (0 mile)	Vehicle speed > 10 km/h (6 mile)

5. CHECK FOR INTERMITTENT PROBLEMS

HINT:

HAND-HELD TESTER only:

By putting the vehicle's engine ECU in check (test) mode, 1 trip detection logic is possible instead of 2 trip detection logic and sensitivity to detect open circuits is increased. This makes it easier to detect intermittent problems.

(a) Clear the DTC (See step 2).

(b) Set the check (test) mode (See step 3).

(c) Perform a simulation test (See page IN-9).

(d) Check the connector and terminal (See page IN-19).

(e) Handle the connector (See page IN-19).

6. BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshooting should be carried out in the order for all possible circuits to be considered as the cases of the problems.
In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, use of this check is essential in engine trouble-shooting.

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-25.

YES

3	Check air filter (Refer to Pub. No. RM520E on EM section).

NG → Repair or replace.

OK

4	Check fuel quality.

CHECK:

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

NG → Replace fuel.

OK

CONTINUED

5	Check engine oil (Refer to Pub. No. RM582E on LU section).

NG → Add or replace.

OK

6	Check coolant (Refer to Pub. No. RM520E on CO section).

NG → Replace coolant.

OK

7	Check injection timing (See page EM-1).

NG → Adjusting injection timing.

OK

8	Check idle speed and maximum speed (See page EM-2).

NG → Repair or replace injection pump.

OK

9	Check diagnostic connector (DLC3) circuit (See page DI-113).

NG → Repair or replace.

OK

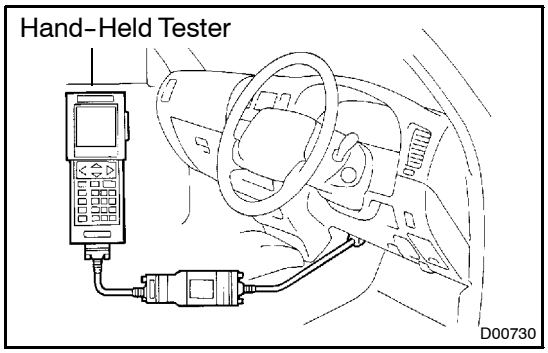
CONTINUED

10	Check vacuum pump (See page EC-3).

NG → Repair or replace.

OK

Proceed to problem symptoms table on page DI-25.



7. REFERENCE VALUE OF ENGINE ECU DATA

NOTICE:

The values given below for "Normal Condition" are representative values, so a vehicle may still be normal even if its values from those listed here. So do not decide whether a part is faulty or not solely according to the "Normal Condition" here.

HINT:

Engine engine ECU data can be monitored by hand-held tester.

(a) Connect the hand-held tester to the DLC3.

(b) Monitor engine ECU data by following the prompts on the tester screen.

Please refer to the hand-held tester operator's manual for further detail.

CONTINUED

(c) Reference Value

Item	Inspection Condition	Reference Value
INJECTION VOLUME	Engine at idling *1	10 mm^3 or less
	Engine racing at 2,000 rpm *1	10 mm^3 or less
	Engine racing at 3,000 rpm *1	5 - 15 mm^3 or less
INJECTION TIMING	Engine at idling *1	17 - 19 °CA
	Engine racing at 2,000 rpm *1	20.6 - 22.6 °CA
	Engine racing at 3,000 rpm *1	24 - 26 °CA
ENGINE SPD	RPM kept stable (Comparison with tachometer)	No great changes
PIM	Engine at idling *1	98-101 kPa (735-758 mmHg, 28.9-29.8 in.Hg)
	Engine racing at 2,000 rpm *1	101 - 111 kPa
	Engine racing at 3,000 rpm *1	126 - 141 kPa
COOLANT TEMP	Engine at normal operating temp.	75-95 °C (185-203 °F) *2
INTAKE AIR	Engine at normal operating temp.	Ambient temp. -100°C
FUEL TEMP	Engine at normal operating temp.	Ambient temp. -90°C
ACCELE POSITION	Accelerator pedal fully closed	0 - 34 %
	Accelerator pedal fully opened	58 - 100 %
	From closed position to wide open accelerator pedal	Gradually increases
VEHICLE SPD	During driving (Comparison with speed meter)	No large differences
A/C SIG	A/C switch ON	ON
Item	Inspection Condition	Reference Value
IDL SIG	Accelerator pedal full closed	ON
STARTER SIG	During cranking	ON
A/C CUT SIG	A/C switch OFF	ON
EGR SYSTEM	Idling	OFF

*1: All accessories and A/C are switched OFF.

*2: If the water temp. sensor circuit is open or shorted, the engine ECU.

DI0ZD-04

DIAGNOSTIC TROUBLE CODE CHART

HINT:

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

If a malfunction code is displayed during the DTC check in check(test) 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 Check Engine Warning Light Normal Mode/ Test Node)	*2 Memory
12 (DI-27)	Crankshaft Position Sensor Circuit Malfunction	S Open or short in crankshaft position sensor circuit S Crankshaft position sensor S Engine ECU	ON/ON	f
13 (DI-29)	Engine Speed Sensor Circuit Malcunction	S Open or short in engine speed sensor circuit S Engine speed sensor S Engine ECU	ON/ON	f
14 (DI-30)	Timing Control System Malfunction	S Open or short in timing control valve circuit S Fuel filter (Clogging) S Fuel (Freezing, Air in) S Injection pump (Internal pressure and timing control valve) S Engine ECU	ON/N.A.	f
15 (DI-35)	Throttle Control Motor Circuit Malfunction	S Open or short in throttle control motor circuit S Throttle control motor S Throttle valve S Throttle body S Engione ECU	ON/N.A.	f
17	Interior IC Malfunction	S Engine ECU	ON/N.A.	f
18 (DI-37)	Spill Control Circuit Malfunction	S Open or short in spill control valve circuit S Spill control valve S Engine ECU	ON/N.A.	f
19(1) (DI-40)	Accelerator Pedal Position Sensor Circuit Malfunction (Open/ Short)	S Open or short in accelerator pedal position sensor circuit S Accelerator pedal position sensor S Engine ECU	ON/ON	f
19(2) (DI-48)	Accelerator Pedal Position Sensor Circuit Malfunction (IDL Switch / Range)	S Open or short in accelerator pedal position sensor circuit S Accelerator pedal position sensor S Engine ECU	ON/N.A.	f
19(3) (DI-53)	Accelerator Pedal Closed Position Switch Circuit Malfunction (Short)	S Short in accelerator pedal closed position switch circuit S Accelerator pedal closed position switch S Engine ECU	ON/N.A.	f
19(4) (DI-53)	Accelerator Pedal Closed Position Switch Circuit Malfunction (Open)	S Open in accelerator pedal closed position switch circuit S Accelerator pedal closed position switch S Engine ECU	ON/N.A.	f

*1: "ON" displayed in the diagnosis mode column indicates that the check engine warning light is lighted up when a malfunction is detected. "N.A." indicates that the item is not included in malfunction diagnosis.

*2: " f " in the memory column indicates that a diagnostic trouble code is recorded in the ECU memory when a malfunction occurs.

Accordingly, output of diagnostic results in normal or test mode is done with the IG switch ON.

CONTINUED

DTC No. (See Page)	Detection Item	Trouble Area	*1 Check Engine Warning Light Normal Mode/ Test Node	*2 Memory
22 (DI-55)	Water Temp. Sensor Circuit Malfunction	S Open or short in water temp. sensor circuit S Water temp. sensor S Engine ECU	ON/ON	f
24 (DI-60)	Intake Air Temp. Sensor Circuit Malfunction	S Open or short in intake air temp. sensor circuit S Intake air temp. sensor S Engine ECU	OFF/ON	f
32 (DI-66)	Injection Pump System Malfunction	S Injection pump correction unit cuicuit S Injection pump correction unit S Engine ECU	OFF/N.A.	f
35 (DI-68)	Intake air Pressure Sensor Circuit Malfunction	S Open or short in turbo pressure sensor circuit S Intake air pressure sensor S Engine ECU	ON/ON	f
39 (DI-75)	Fuel Temp. Sensor Circuit Malfunction	S Open or short in fuel temp. sensor circuit S Fuel pressure sensor S Engine ECU	ON/ON	f
42 (DI-80)	Vehicle Speed Sensor Signal Circuit Malfunction	S Open or short in fuel temp. sensor circuit S Vehicle speed sensor S Combination meter S Engine ECU	ON/ON	f

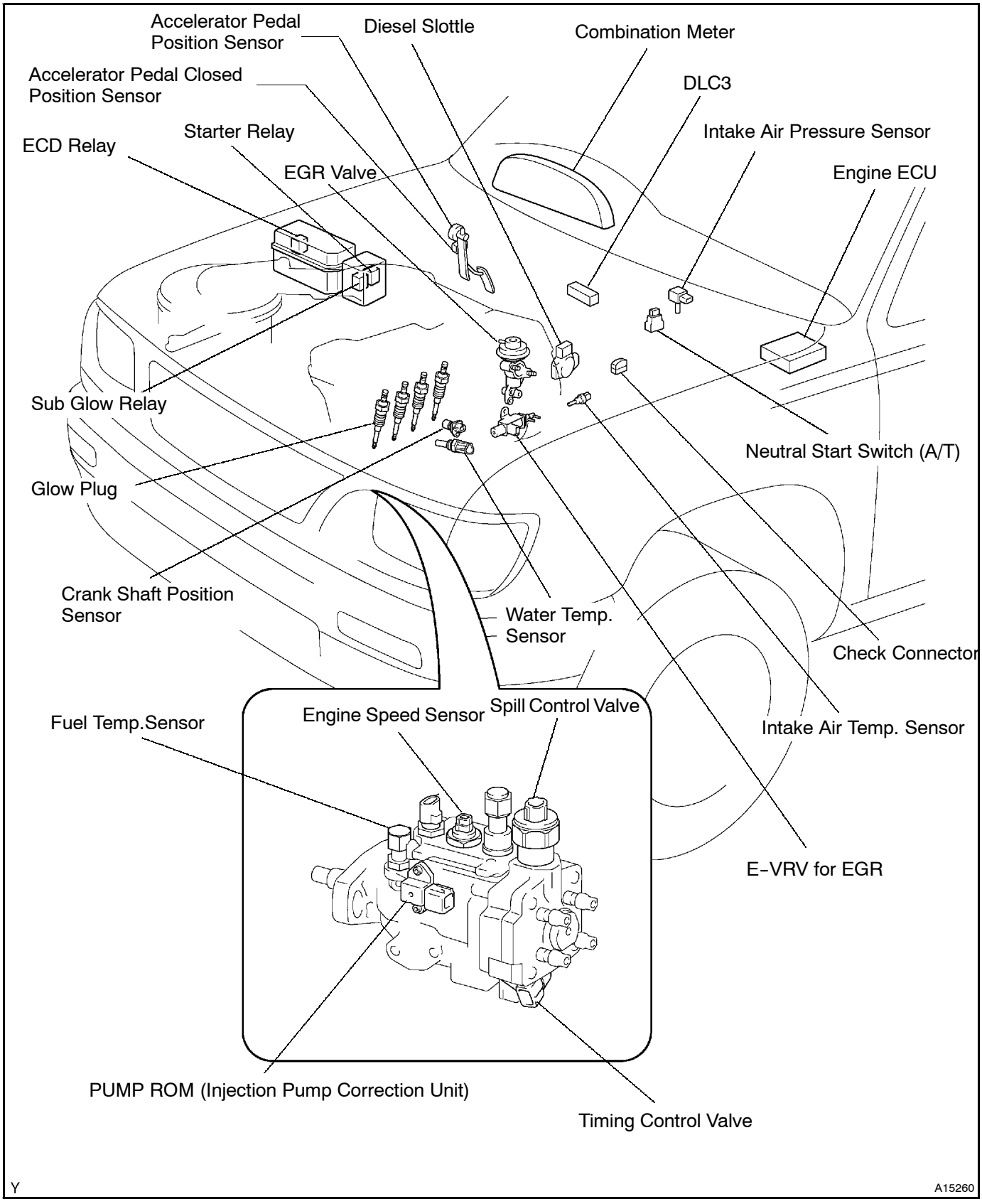
*1: "ON" displayed in the diagnosis mode column indicates that the check engine warning light is lighted up when a malfunction is detected. "OFF" indicates that the "CHECK ENGINE" does not light up during malfunction diagnosis, even if a malfunction is detected. "N.A." indicates that the item is not included in malfunction diagnosis.

*2: " f " in the memory column indicates that a diagnostic trouble code is recorded in the ECU memory when a malfunction occurs.

Accordingly, output of diagnostic results in normal or test mode is done with the IG switch ON.

DI062-16

PARTS LOCATION

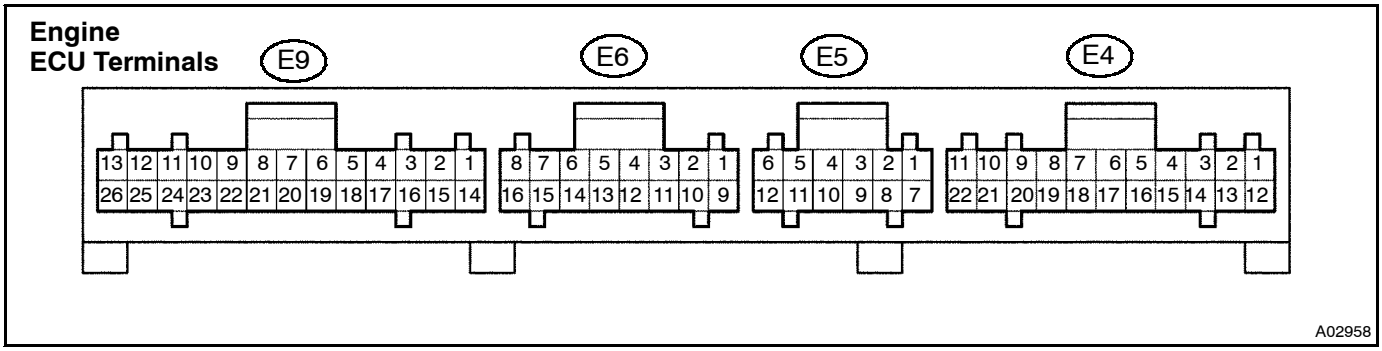


TERMINALS OF ECU:

DI8NN-01

TERMINALS OF ECU

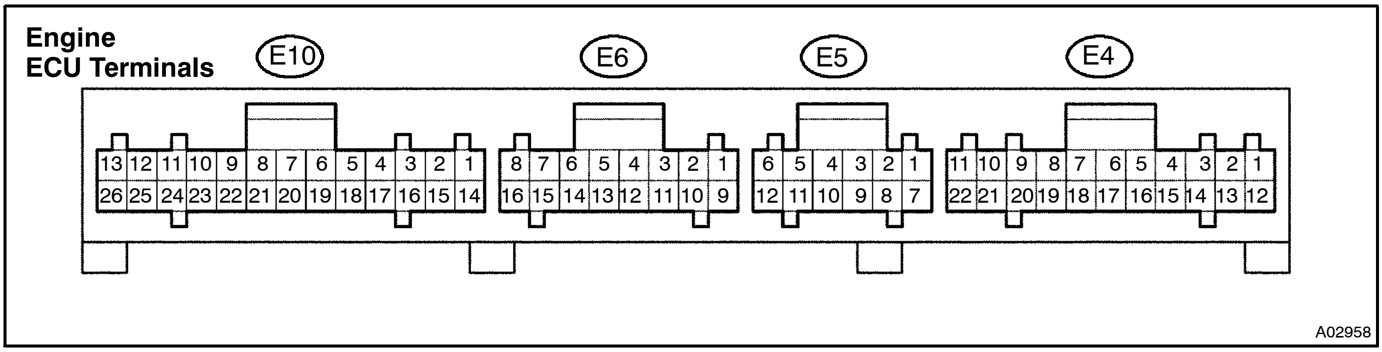
Australia (Except Thailand Made)



Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
BATT (E6-1) - E1 (E4-14)	R-B - BR	Always	9 - 14
+B (E6-12) - E1 (E4-14)	R-L - BR	IG switch ON	9 - 14
VC (E5-1) - E2 (E5-9)	B - G-R	IG switch ON	4.5 - 5.5
VCC (E9-6) - E2C (E9-4)	V - LG	IG switch ON	4.5 - 5.5
VA (E9-5) - E2C (E9-4)	B-L - LG	Accelerator pedal fully closed	0.3 - 0.8
		Accelerator pedal fully opened	2.9 - 4.9
VAS (E9-12) - E2C (E9-4)	R - LG	Accelerator pedal fully closed	0.3 - 0.8
		Acceleratot pedal fully opened	2.9 - 4.9
IDL (E9-9) - E2C (E9-4)	B-R - LG	Accelerator pedal fully closed	9 - 14
		Acceleratot pedal fully opened	0 - 3
PIM (E5-2) - E2 (E5-9)	B-Y - G-R	Apply vacuum 40 kPa (300 mmHg, 11.8 in.Hg)	0.2 - 0.8
		Apply vacuum 69 kPa (518 mmHg, 20.4 in.Hg)	3.2 - 3.8
THA (E5-3) - E2 (E5-9)	P-L - G-R	Idling, air intake temp. 0°C (32°F) to 80°C (176°F)	0.5 - 3.4
THW(E5-4) - E2 (E5-9)	P - G-R	Idling, engine coolant temp. 60°C (140°F) to 120°C (248°F)	0.2 - 1.0
THF (E5-5)- E2 (E5-9)	LG-B - G-R	IG switch ON (at engine cold)	0.5 - 3.4
DATA (E5-6) - E1 (E4-14)	V - BR	For 0.5 sec. after IG switch ON	Pulse generation
CLK (E5-14) - E2 (E5-9)	P - G-R	For 0.5 sec. after IG switch ON	Pulse generation
STA (E6-11) - E1 (E4-14)	P - BR	Cranking	6.0 or more
TDC+ (E4-17) - TDC- (E4-16)	R - G	Idling	Pulse generation (See page DI-27)
NE+ (E4-19) - NE- (E4-18)	W - B	Idling	Pulse generation (See page DI-27)
SP1(E6-9) - E1(E4-14)	G-O - BR	IG switch ON Rotate driving wheel slowly	Pulse generation
TCV (E4-11) - E01 (E4-13)	G-B - W-B	IG switch ON	9 - 14
		Idling	Pulse generation (See page DI-30)
SPV+ (E4-12) - E1 (E4-14)	GR - BR	IG switch ON	9 - 14
		Idling	Pulse generation
SPV- (E4-25) - E1 (E4-14)	R-B - BR	Idling	Pulse generation (See page DI-37)
LU+A (E4-10) - E01 (E4-13)	R - W-B	Racing (engine warmed up)	Pulse generation
LU- A(E4-9) - E01 (E4-13)	Y - W-B	Racing (engine warmed up)	Pulse generation
LU+ B(E4-8) - E01 (E4-13)	P - W-B	Racing (engine warmed up)	Pulse generation

LU- B(E4-7) - E01 (E4-13)	LG - W-B	Racing (engine warmed up)	Pulse generation
MREL (E6-3) - E1 (E4-14)	L-O - BR	IG switch ON	9 - 14
		IG switch OFF (after IG switch OFF for 2 sec.)	0 - 1.5
SREL (E6-2) - E01 (E4-13)	B-R - W-B	Cranking	9 - 14
		Idling (engine start and after 600 sec.)	0 - 1.5
IGSW (E6-14) - E1 (E4-14)	B-W - BR	IG switch ON	9 - 14
AC1 (E9-2) - E1 (E4-14)	Y - BR	A/C switch ON (at magnet clutch ON)	0 - 1.5
		A/C switch OFF	7.5 - 14
ACT (E9-8) - E1 (E4-14)	LG-R - BR	IG switch ON	9 - 14
		at A/C cut controlled (Driving below 30km/h, accelerator pedal fully opened for 5 sec.)	0 – 3
PDL (E9-3) - E1 (E4-14)	L - BR	Accelerator pedal fully closed	9 - 14
		Accelerator pedal fully opened	0 – 3
TAC (E9-7) - E1 (E4-14)	R-W - BR	Idling	Pulse generation
TC (E6-4) - E1 (E4-14)	V - BR	IG switch ON	9 - 14
W (E6-5) - E1 (E4-14)	P - BR	Check engine warning light lights up	0 - 3
		except check engine warning light lights up	9 - 14
THOP (E5-15) - E1 (E4-14)	L-R - BR	Idling (engine warmed up)	9 - 14
		IG switch ON (onece within 5 sec.)	0 - 3
GIND (E9-1) - E1 (E4-14)	GR-L - BR	Glow indicator light lights up	0 - 3
		except glow indicator light lights up	9 - 14

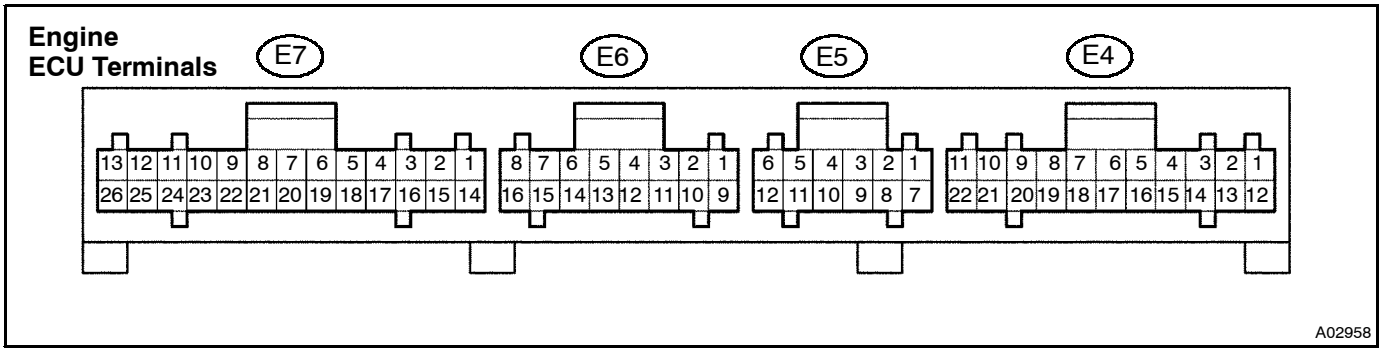
Australia (Thailand Made)



Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
BATT (E10-1) - E1 (E4-14)	R-B - BR	Always	9 - 14
+B (E10-12) - E1 (E4-14)	R-L - BR	IG switch ON	9 - 14
VC (E5-1) - E2 (E5-9)	B - G-R	IG switch ON	4.5 - 5.5
VCC (E6-6) - E2C (E6-4)	V - LG	IG switch ON	4.5 - 5.5
VA (E6-5) - E2C (E6-4)	B-L - LG	Accelerator pedal fully closed	0.3 - 0.8
		Accelerator pedal fully opened	2.9 - 4.9
VAS (E6-12) - E2C (E6-4)	R - LG	Accelerator pedal fully closed	0.3 - 0.8
		Acceleratot pedal fully opened	2.9 - 4.9
IDL (E6-9) - E2C (E6-4)	B-R - LG	Accelerator pedal fully closed	9 - 14
		Acceleratot pedal fully opened	0 - 3
PIM (E5-2) - E2 (E5-9)	B-Y - G-R	Apply vacuum 40 kPa (300 mmHg, 11.8 in.Hg)	0.2 - 0.8
		Apply vacuum 69 kPa (518 mmHg, 20.4 in.Hg)	3.2 - 3.8
THA (E5-3) - E2 (E5-9)	P-L - G-R	Idling, air intake temp. 0°C (32°F) to 80°C (176°F)	0.5 - 3.4
THW(E5-4) - E2 (E5-9)	P - G-R	Idling, engine coolant temp. 60°C (140°F) to 120°C (248°F)	0.2 - 1.0
THF (E5-5)- E2 (E5-9)	LG-B - G-R	IG switch ON (at engine cold)	0.5 - 3.4
DATA (E5-6) - E1 (E4-14)	V - BR	For 0.5 sec. after IG switch ON	Pulse generation
CLK (E5-14) - E2 (E5-9)	P - G-R	For 0.5 sec. after IG switch ON	Pulse generation
STA (E10-11) - E1 (E4-14)	P - BR	Cranking	6.0 or more
TDC+ (E4-17) - TDC- (E4-16)	R - G	Idling	Pulse generation (See page DI-27)
NE+ (E4-19) - NE- (E4-18)	W - B	Idling	Pulse generation (See page DI-27)
SP1(E10-9) - E1(E4-14)	G-O - BR	IG switch ON Rotate driving wheel slowly	Pulse generation
TCV (E4-11) - E01 (E4-13)	G-B - W-B	IG switch ON	9 - 14
		Idling	Pulse generation (See page DI-30)
SPV+ (E4-12) - E1 (E4-14)	GR - BR	IG switch ON	9 - 14
		Idling	Pulse generation
SPV- (E4-25) - E1 (E4-14)	R-B - BR	Idling	Pulse generation (See page DI-37)
LU+A (E4-10) - E01 (E4-13)	R - W-B	Racing (engine warmed up)	Pulse generation
LU- A(E4-9) - E01 (E4-13)	Y - W-B	Racing (engine warmed up)	Pulse generation
LU+ B(E4-8) - E01 (E4-13)	P - W-B	Racing (engine warmed up)	Pulse generation
LU- B(E4-7) - E01 (E4-13)	LG - W-B	Racing (engine warmed up)	Pulse generation

MREL (E10-3) - E1 (E4-14)	L-O - BR	IG switch ON	9 - 14
		IG switch OFF (after IG switch OFF for 2 sec.)	0 - 1.5
SREL (E10-2) - E01 (E4-13)	B-R - BR	Cranking	9 - 14
		Idling (engine start and after 600 sec.)	0 - 1.5
IGSW (E10-14) - E1 (E4-14)	B-W - BR	IG switch ON	9 - 14
PDL (E6-3) - E1 (E4-14)	L - BR	Accelerator pedal fully closed	9 - 14
		Accelerator pedal fully opened	0 – 3
TAC (E6-7) - E1 (E4-14)	R-W - BR	Idling	Pulse generation
TC (E10-4) - E1 (E4-14)	V - BR	IG switch ON	9 - 14
W (E10-5) - E1 (E4-14)	P - BR	Check engine warning light lights up	0 - 3
		except check engine warning light lights up	9 - 14
THOP (E5-15) - E1 (E4-14)	L-R - BR	Idling (engine warmed up)	9 - 14
		IG switch ON (onece within 5 sec.)	0 - 3
GIND (E6-1) - E1 (E4-14)	GR-L - BR	Glow indicator light lights up	0 - 3
		except glow indicator light lights up	9 - 14

Thailand



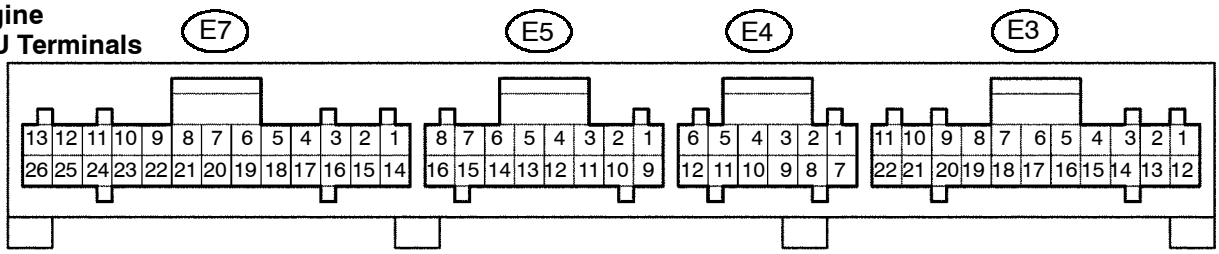
Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
BATT (E7-1) - E1 (E4-14)	Y - BR	Always	9 - 14
+B (E7-12) - E1 (E4-14)	R-L - BR	IG switch ON	9 - 14
VC (E5-1) - E2 (E5-9)	B - G-R	IG switch ON	4.5 - 5.5
VCC (E6-6) - E2C (E6-4)	V - LG	IG switch ON	4.5 - 5.5
VA (E6-5) - E2C (E6-4)	B-L - LG	Accelerator pedal fully closed	0.3 - 0.8
		Accelerator pedal fully opened	2.9 - 4.9
VAS (E6-12) - E2C (E6-4)	P - LG	Accelerator pedal fully closed	0.3 - 0.8
		Acceleratot pedal fully opened	2.9 - 4.9
IDL (E6-9) - E2C (E6-4)	B-R - LG	Accelerator pedal fully closed	9 - 14
		Acceleratot pedal fully opened	0 - 3
PIM (E5-2) - E2 (E5-9)	B-Y - G-R	Apply vacuum 40 kPa (300 mmHg, 11.8 in.Hg)	0.2 - 0.8
		Apply vacuum 69 kPa (518 mmHg, 20.4 in.Hg)	3.2 - 3.8
THA (E5-3) - E2 (E5-9)	P-L - G-R	Idling, air intake temp. 0°C (32°F) to 80°C (176°F)	0.5 - 3.4
THW(E5-4) - E2 (E5-9)	P - G-R	Idling, engine coolant temp. 60°C (140°F) to 120°C (248°F)	0.2 - 1.0
THF (E5-5)- E2 (E5-9)	LG-B - G-R	IG switch ON (at engine cold)	0.5 - 3.4
DATA (E5-6) - E1 (E4-14)	V - BR	For 0.5 sec. after IG switch ON	Pulse generation
CLK (E5-14) - E2 (E5-9)	P - G-R	For 0.5 sec. after IG switch ON	Pulse generation
STA (E7-11) - E1 (E4-14)	P-L - BR	Cranking	6.0 or more
TDC+ (E4-17) - TDC- (E4-16)	R - G	Idling	Pulse generation (See page DI-27)
NE+ (E4-19) - NE- (E4-18)	W - B	Idling	Pulse generation (See page DI-27)
SP1(E7-9) - E1(E4-14)	G-O - BR	IG switch ON Rotate driving wheel slowly	Pulse generation
TCV (E4-11) - E01 (E4-13)	G-B - W-B	IG switch ON	9 - 14
		Idling	Pulse generation (See page DI-30)
SPV+ (E4-12) - E1 (E4-14)	GR - BR	IG switch ON	9 - 14
		Idling	Pulse generation
SPV- (E4-25) - E1 (E4-14)	R-B - BR	Idling	Pulse generation (See page DI-37)
EGR (E4-24) - E01 (E4-13)	G-W - W-B	IG switch ON	9 - 14
		EGR ON (maintain engine speed at 1500 rpm)	Pulse generation
LU+A (E4-10) - E01 (E4-13)	R - W-B	Racing (engine warmed up)	Pulse generation
LU- A(E4-9) - E01 (E4-13)	Y - W-B	Racing (engine warmed up)	Pulse generation

CONTINUED

LU+ B(E4-8) - E01 (E4-13)	P - W-B	Racing (engine warmed up)	Pulse generation
LU- B(E4-7) - E01 (E4-13)	LG - W-B	Racing (engine warmed up)	Pulse generation
MREL (E7-3) - E1 (E4-14)	L-O - BR	IG switch ON	9 - 14
		IG switch OFF (after IG switch OFF for 2 sec.)	0 - 1.5
SREL (E7-2) - E01 (E4-13)	B-R - W-B	Cranking	9 - 14
		Idling (engine start and after 600 sec.)	0 - 1.5
IGSW (E7-14) - E1 (E4-14)	B-W - BR	IG switch ON	9 - 14
AC1 (E6-2) - E1 (E4-14)	Y - BR	A/C switch ON (at magnet clutch ON)	0 - 1.5
		A/C switch OFF	7.5 - 14
ACT (E6-8) - E1 (E4-14)	LG-B - BR	IG switch ON	9 - 14
		at A/C cut controlled (Driving below 30km/h, accelerator pedal fully opened for 5 sec.)	0 - 3
PDL (E6-3) - E1 (E4-14)	L - BR	Accelerator pedal fully closed	9 - 14
		Accelerator pedal fully opened	0 - 3
TAC (E6-7) - E1 (E4-14)	B - BR	Idling	Pulse generation
TC (E7-4) - E1 (E4-14)	V - BR	IG switch ON	9 - 14
W (E7-5) - E1 (E4-14)	P - BR	Check engine warning light lights up	0 - 3
		except check engine warning light lights up	9 - 14
NSW (E7-22) - E1 (E4-14)	P - BR	At shift position in P and N position	0 - 3
		At other shift position in P and N position	9 - 14
THOP (E5-15) - E1 (E4-14)	L-R - BR	Idling (engine warmed up)	9 - 14
		IG switch ON (onece within 5 sec.)	0 - 3
GIND (E6-1) - E1 (E4-14)	R-W - BR	Glow indicator light lights up	0 - 3
		except glow indicator light lights up	9 - 14

South Africa

Engine ECU Terminals



Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
BATT (E5-1) - E1 (E3-14)	Y - BR	Always	9 - 14
+B (E5-12) - E1 (E3-14)	R-L - BR	IG switch ON	9 - 14
VC (E4-1) - E2 (E4-9)	B - G-R	IG switch ON	4.5 - 5.5
VCC (E7-6) - E2C (E7-4)	V - LG	IG switch ON	4.5 - 5.5
VA (E7-5) - E2C (E7-4)	B-L - LG	Accelerator pedal fully closed	0.3 - 0.8
		Accelerator pedal fully opened	2.9 - 4.9
VAS (E7-12) - E2C (E7-4)	P - LG	Accelerator pedal fully closed	0.3 - 0.8
		Acceleratot pedal fully opened	2.9 - 4.9
IDL (E7-9) - E2C (E7-4)	B-R - LG	Accelerator pedal fully closed	9 - 14
		Acceleratot pedal fully opened	0 - 3
PIM (E4-2) - E2 (E4-9)	B-Y - G-R	Apply vacuum 40 kPa (300 mmHg, 11.8 in.Hg)	0.2 - 0.8
		Apply vacuum 69 kPa (518 mmHg, 20.4 in.Hg)	3.2 - 3.8
THA (E4-3) - E2 (E4-9)	P-L - G-R	Idling, air intake temp. 0°C (32°F) to 80°C (176°F)	0.5 - 3.4
THW(E4-4) - E2 (E4-9)	P - G-R	Idling, engine coolant temp. 60°C (140°F) to 120°C (248°F)	0.2 - 1.0
THF (E4-5)- E2 (E4-9)	LG-B - G-R	IG switch ON (at engine cold)	0.5 - 3.4
DATA (E4-6) - E1 (E3-14)	V - BR	For 0.5 sec. after IG switch ON	Pulse generation
CLK (E4-14) - E2 (E4-9)	P - G-R	For 0.5 sec. after IG switch ON	Pulse generation
STA (E5-11) - E1 (E3-14)	P - BR	Cranking	6.0 or more
TDC+ (E3-17) - TDC- (E3-16)	R - G	Idling	Pulse generation (See page DI-27)
NE+ (E3-19) - NE- (E3-18)	W - B	Idling	Pulse generation (See page DI-27)
TCV (E3-11) - E01 (E3-13)	G-B - W-B	IG switch ON	9 - 14
		Idling	Pulse generation (See page DI-30)
SPV+ (E3-12) - E1 (E3-14)	GR - BR	IG switch ON	9 - 14
		Idling	Pulse generation
SPV (E3-25) - E1 (E3-14)	R-B - BR	Idling	Pulse generation (See page DI-37)
LU+A (E3-10) - E01 (E3-13)	R - W-B	Racing (engine warmed up)	Pulse generation
LU- A(E3-9) - E01 (E3-13)	Y - W-B	Racing (engine warmed up)	Pulse generation
LU+ B(E3-8) - E01 (E3-13)	P - W-B	Racing (engine warmed up)	Pulse generation
LU- B(E3-7) - E01 (E3-13)	LG - W-B	Racing (engine warmed up)	Pulse generation
MREL (E5-3) - E1 (E3-14)	L-O - BR	IG switch ON	9 - 14
		IG switch OFF (after IG switch OFF for 2 sec.)	0 - 1.5

CONTINUED

SREL (E5-2) - E01 (E3-13)	B-R - W-B	Cranking	9 - 14
		Idling (engine start and after 600 sec.)	0 - 1.5
IGSW (E5-14) - E1 (E3-14)	B-W - BR	IG switch ON	9 - 14
AC1 (E7-2) - E1 (E3-14)	Y - BR	A/C switch ON (at magnet clutch ON)	0 - 1.5
		A/C switch OFF	7.5 - 14
ACT (E7-8) - E1 (E3-14)	LG-R - BR	IG switch ON	9 - 14
		at A/C cut controlled (Driving below 30km/h, accelerator pedal fully opened for 5 sec.)	0 - 3
PDL (E7-3) - E1 (E3-14)	L - BR	Accelerator pedal fully closed	9 - 14
		Accelerator pedal fully opened	0 - 3
TAC (E7-7) - E1 (E3-14)	B - BR	Idling	Pulse generation
TC (E5-4) - E1 (E3-14)	V - BR	IG switch ON	9 - 14
W (E5-5) - E1 (E3-14)	P - BR	Check engine warning light lights up	0 - 3
		except check engine warning light lights up	9 - 14
THOP (E4-15) - E1 (E3-14)	L-R - BR	Idling (engine warmed up)	9 - 14
		IG switch ON (onece within 5 sec.)	0 - 3
GIND (E7-1) - E1 (E3-14)	R-W - BR	Glow indicator light lights up	0 - 3
		except glow indicator light lights up	9 - 14
SPD (E5-9) - E1(E3-14)	G-O - BR	IG switch ON Rotate driving wheel slowly	Pulse generation

DI064-21

PROBLEM SYMPTOMS TABLE

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

Symptom	Suspect Area	See page
Does not crank (Difficult to start)	1. Starter and starter relay	*
No initial combustion (Difficult to start)	1. ECU power source circuit	DI-82
	2. Pre-heating system	DI-88
	3. Compression	*
	4. Engine ECU	ED-25
	5. Injection pump	FU-7
Cold engine (Difficult to start)	1. Pre-heating system	DI-88
	2. STA signal circuit	DI-101
	3. Water temperature sensor	ED-12
	4. Injection nozzle	*
	5. Fuel filter	*
	6. Diesel throttle body	*
	7. Engine ECU	ED-25
	8. Injection pump	FU-7
Hot engine (Difficult to start)	1. STA signal circuit	DI-101
	2. Injection nozzle	*
	3. Fuel filter	*
	4. Diesel throttle body	*
	5. Engine ECU	ED-25
	6. Injection pump	FU-7
Soon after starting (Engine stall)	1. Fuel filter	*
	2. Diesel throttle body	*
	3. Engine ECU	ED-25
	4. Injection pump	FU-7
Others (Engine stall)	1. ECU power source circuit	DI-82
	2. Diesel throttle body	*
	3. Engine ECU	ED-25
	4. Injection pump	FU-7
Incorrect first idle (Poor idling)	1. Water temperature sensor	ED-12
	2. Fuel filter	*
	3. Engine ECU	ED-25
	4. Injection pump	FU-7
High engine idle speed (Poor idling)	1. A/C signal circuit	DI-106
	2. Water temperature sensor	ED-12
	3. Engine ECU	ED-25
	4. Injection pump	FU-7
Lower engine idle speed (Poor idling)	1. A/C signal circuit	DI-106
	2. Injection nozzle	*
	3. EGR system	DI-96
	4. Water temperature sensor	ED-12
	5. Diesel throttle body	*
	6. Compression	*
	7. Valve clearance	*
	8. Fuel line (Air beed)	-
	9. Engine ECU	ED-25
	10. Injection pump	FU-7

L : See Pub. No. RM520E and RM582E

CONTINUED

Symptom	Suspect Area	See page
Rough idling (Poor idling)	1. Injection nozzle	*
	2. Fuel line (Air beed)	-
	3. Pre-heating system	DI-88
	4. EGR system	DI-96
	5. Diesel throttle body	ED-3
	6. Compression	*
	7. Valve clearance	*
	8. Engine ECU	ED-25
	9. Injection pump	FU-7
Hunting at hot engine (Poor idling)	1. Injection nozzle	*
	2. ECU power source circuit	DI-82
	3. Compression	*
	4. Fuel line (Air beed)	-
	5. Valve clearance	ED-25
	6. Engine ECU	ED-25
	7. Injection pump	FU-7
Hunting at cold engine (Poor idling)	1. Pre-heating system	DI-88
	2. Injection nozzle	*
	3. ECU power source circuit	DI-82
	4. Water temperature sensor	ED-12
	5. Compression	*
	6. Fuel line (Air beed)	-
	7. Valve clearance	ED-25
	8. Engine ECU	ED-25
	9. Injection pump	FU-7
Hesitation/ Poor acceleration (Poor driveability)	1. Injection nozzle	*
	2. Fuel filter	*
	3. EGR system	DI-96
	4. Compression	*
	5. Engine ECU	ED-25
	6. Injection pump	FU-7
Knocking (Poor driveability)	1. Injection nozzle	*
	2. EGR system	DI-96
	3. Water temperature sensor	ED-12
	4. Engine ECU	ED-25
Black smoke (Poor driveability)	1. Injection nozzle	*
	2. EGR system	DI-96
	3. Diesel throttle body	ED-3
	4. Intake air temperature sensor	ED-14
	5. Engine ECU	ED-25
	6. Injection pump	FU-7
White smoke (Poor driveability)	1. EGR system	DI-96
	2. Pre-heating system	DI-88
	3. Injection nozzle	*
	4. Fuel filter	*
	5. Diesel throttle body	ED-3
	6. Water temperature sensor	ED-12
	7. Intake air temperature sensor	ED-14
	8. Engine ECU	ED-25
	9. Injection pump	FU-7
Surging/ Hunting (Poor driveability)	1. Injection nozzle	*
	2. Engine ECU	ED-25
	3. Injection pump	FU-7

L : See Pub. No. RM520E and RM582E

CIRCUIT INSPECTION:

CONTINUED

CIRCUIT INSPECTION:

Page 2 of 4
DTC: 19(4) Accelerator Pedal Closed position Switch Circuit Malfunction (Open) DI-53
Circuit Description
Wiring Diagram
Inspection Procedure DI-54
DTC: 22 Water Temp. Sensor Circuit Malfunction DI-55
Circuit Description
Wiring Diagram DI-56
Inspection Procedure hand held DI-56/ No hand held DI-59
DTC: 24 Intake Air Temp. Sensor Circuit Malfunction DI-60
Circuit Description
Wiring Diagram DI-61
Inspection Procedure hand held DI-61/ No hand held DI-65
DTC: 32 Inspection Pump Correction System Malfunction DI-66
Circuit Inspection
Wiring Diagram
Inspection Procedure DI-66/67
DTC: 35 Intake Air Pressure Sensor Circuit Malfunction DI-68
Circuit description
Wiring Diagram DI-69
(Australia)
(Thailand)
South Africa DI-71
Inspection procedure hand held DI-71/ No hand held DI-74
DTC: 39 Fuel Temp. Sensor Circuit Malfunction
Circuit Description
Wiring Diagram DI-76
Inspection Procedure Hand held DI-76/ No hand held DI-79
DTC: 42 Vehicle Speed Sensor Signal Circuit Malfunction DI-80
Circuit Description DI-80
Wiring Diagram
Inspection Procedure DI-81

CONTINUED

CIRCUIT INSPECTION:

CONTINUED

CIRCUIT INSPECTION:

DI2ZO-02

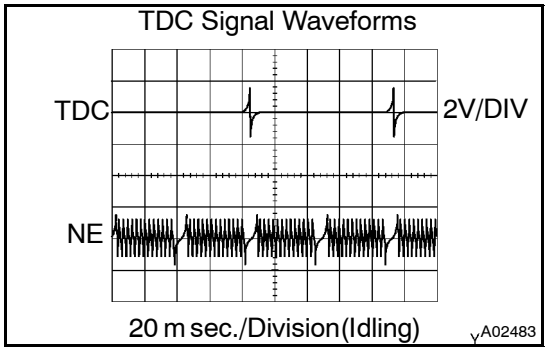
CIRCUIT INSPECTION

DTC	12	Crankshaft Position Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

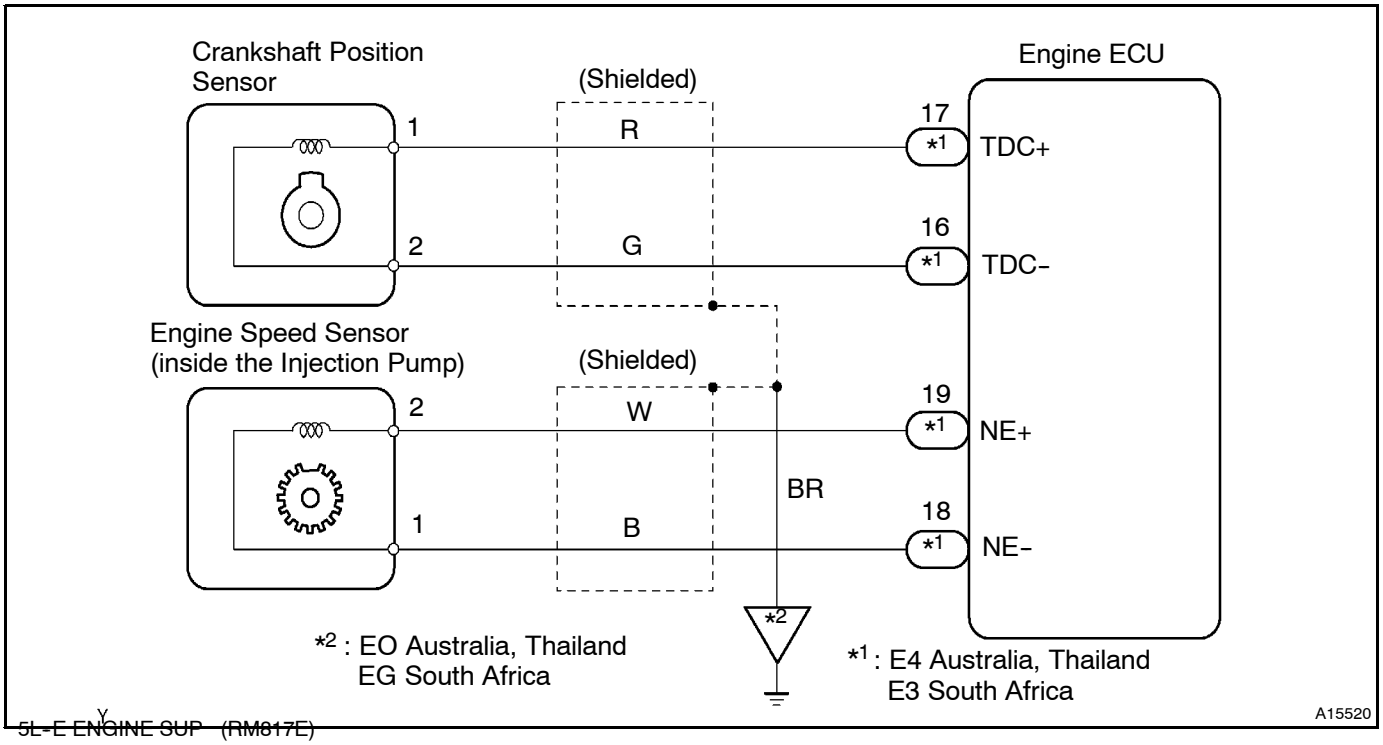
The crankshaft position sensor in the Engine Control System contains signal plate and a pickup coil for TDC signal. The TDC signal plate has 1 tooth on its outer circumference. The TDC signal sensor generates 1 signal for every engine revolution. The engine ECU detects the top dead center by the TDC 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 of engine 2 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. And NE signal is used for injection volume control, also.

DTC No.	DTC Detecting Condition	Trouble Area
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 engine ECU.
HINT:
The correct wavaforms are as shown.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	Check resistance of crankshaft position sensor (TDC) (See page ED-18).

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	Inspection sensor installation.

NG → Tighten sensor.

OK

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

CONTINUED

DTC	13	Engine Speed Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

Refer to DTC 12 (Crankshaft Position Sensor Circuit Malfunction) on page DI-27.

DTC No.	DTC Detecting Condition	Trouble Area
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	

WIRING DIAGRAM

Refer to DTC 12 (Crankshaft Position Sensor Circuit Malfunction) on page DI-27.

INSPECTION PROCEDURE

1	Check resistance of engine speed sensor (See page FU-7).

NG → Check and replace injection pump (See page FU-7).

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	Inspection sensor installation.

NG → Tighten sensor.

OK ↓

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

CONTINUED

DTC	14	Timing Control System Malfunction

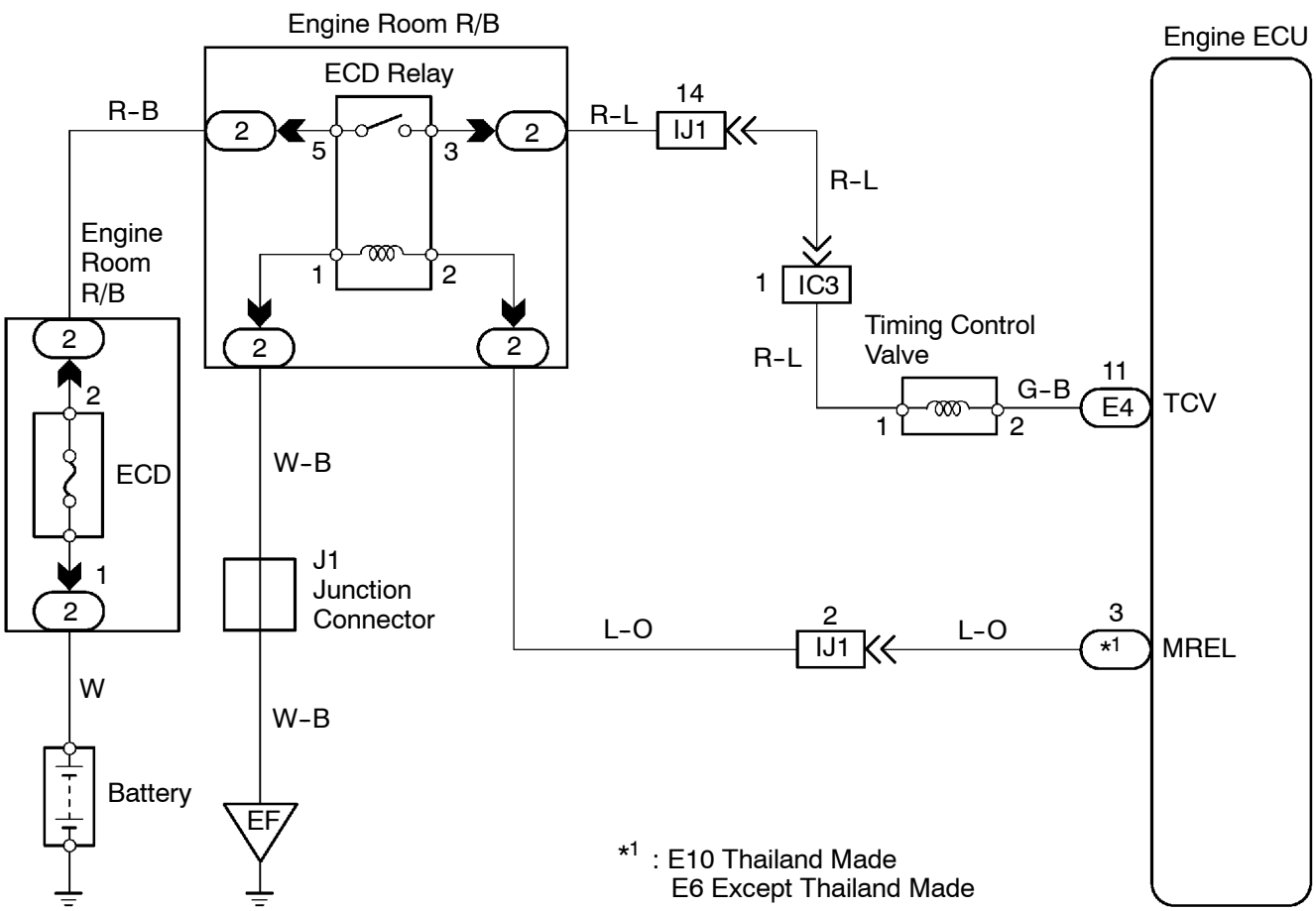
CIRCUIT DESCRIPTION

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

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

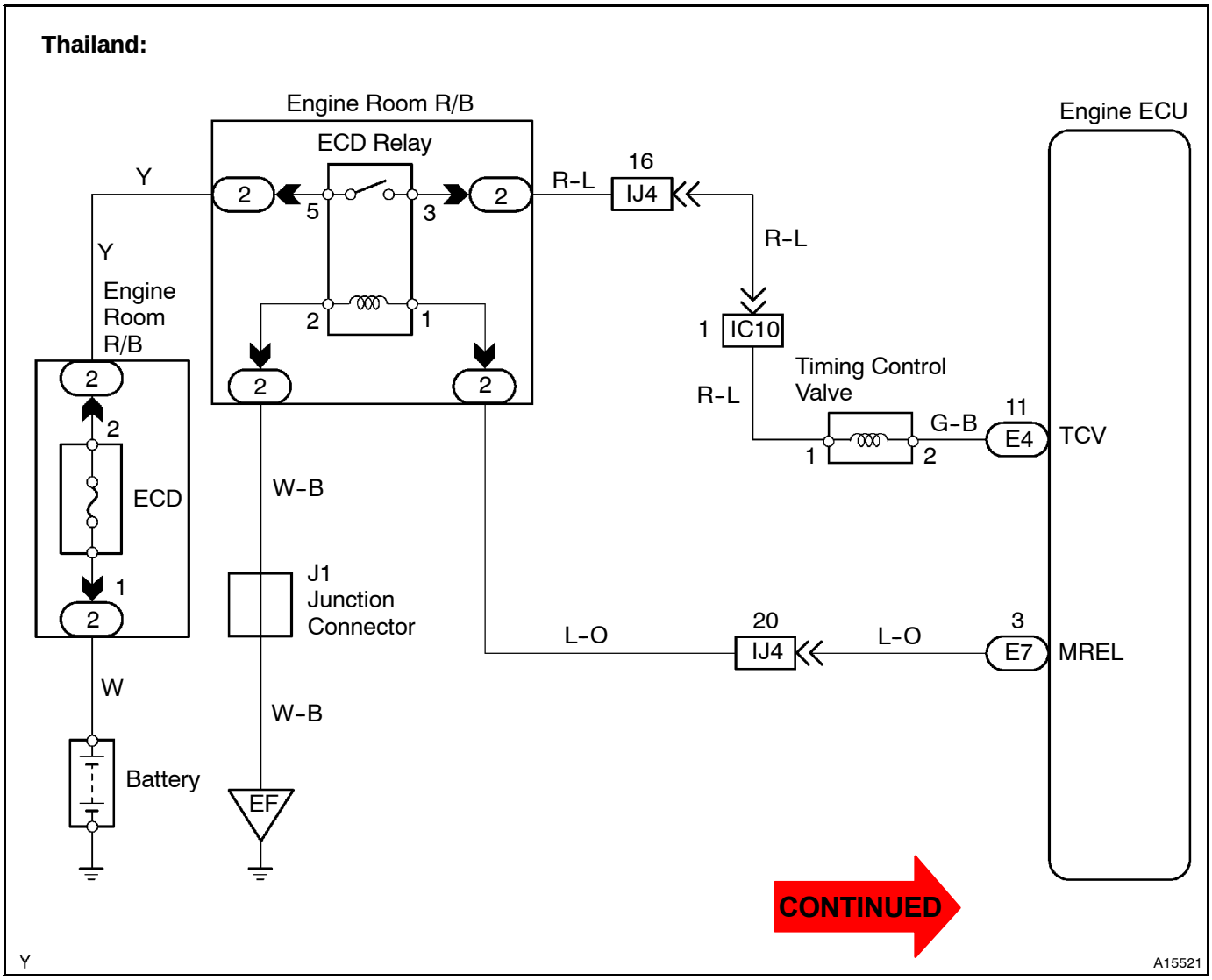
WIRING DIAGRAM

Australia:

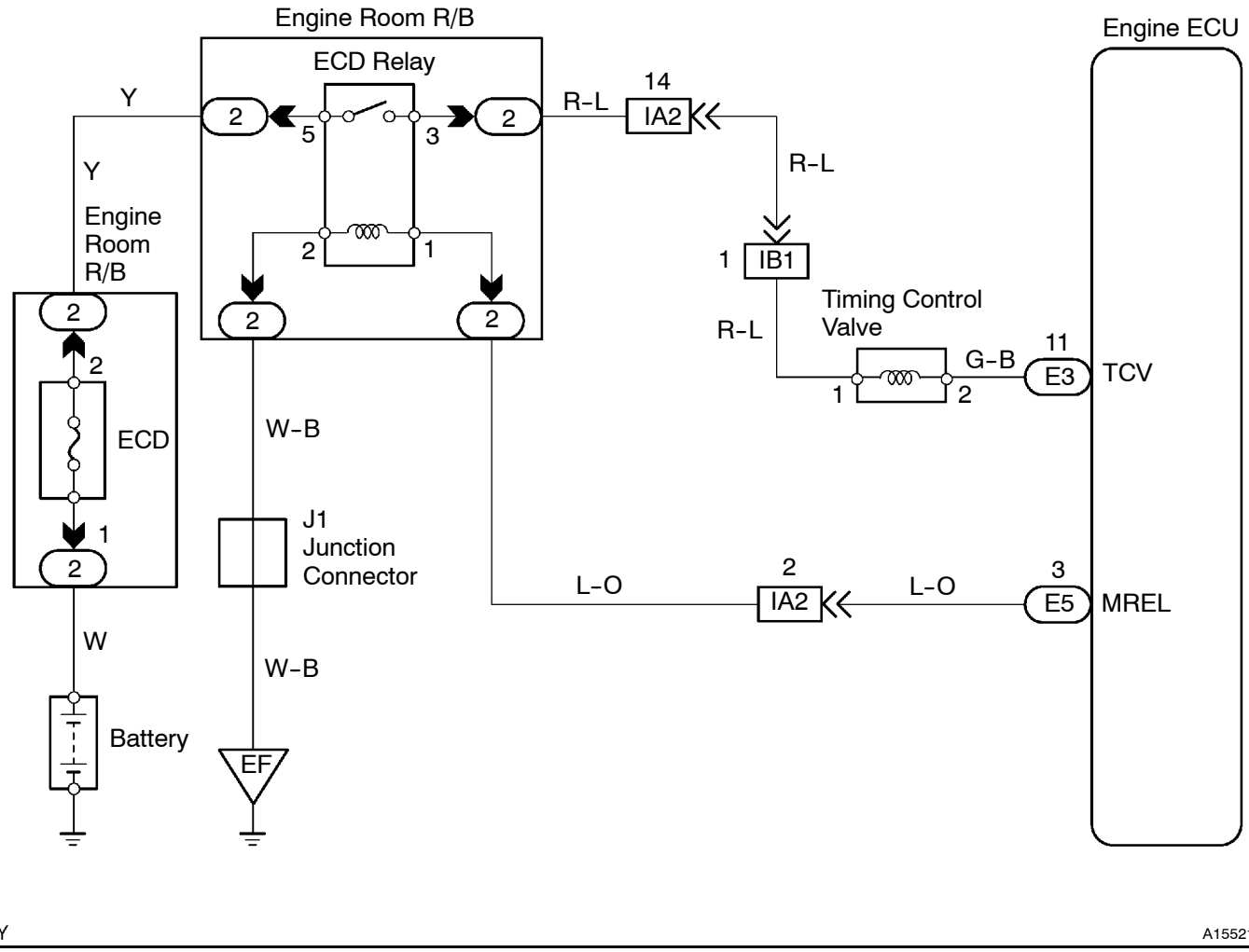


CONTINUED

Thailand:


Engine Room R/B
ECD Relay
Engine ECU
Y
2
5
3
2
R-L
16
IJ4
R-L
Y
Engine
Room
R/B
2
1
IC10
1
Timing Control
Valve
R-L
G-B
11
E4
TCV
1
2
2
2
2
2
2
ECD
W-B
J1
Junction
Connector
1
2
L-O
20
IJ4
L-O
3
E7
MREL
W
W-B
Battery
EF
CONTINUED
Y
A15521

South Africa:



INSPECTION PROCEDURE

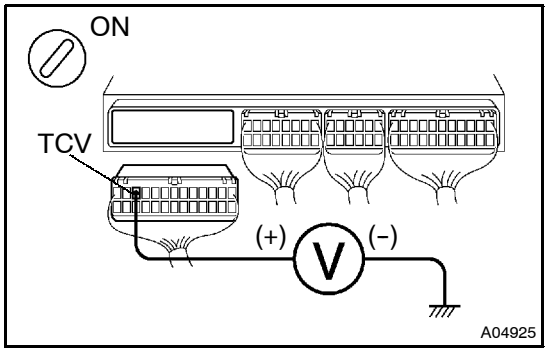
1	**Check timing control valve (See page FU-7).**

NG → **Check and replace injection pump (See page FU-7).**

OK →

CONTINUED

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



PREPARATION:

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

CHECK:

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

OK:

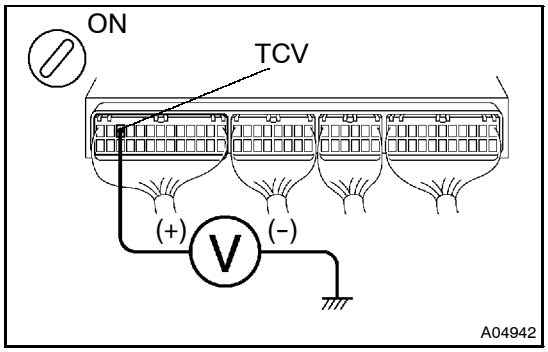
Voltage: 9 - 14 V

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 ECD relay (Marking: ECD) **(See page IN-19).**

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



PREPARATION:

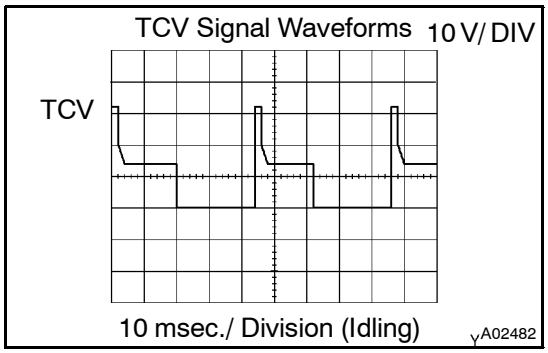
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.

CHECK:

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

OK:

Voltage: 9 - 14 V



Reference: INSPECTION USING OSCILLOSCOPE

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

HINT:

The correct waveform is as shown.

CONTINUED

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 page FU-7).

CONTINUED

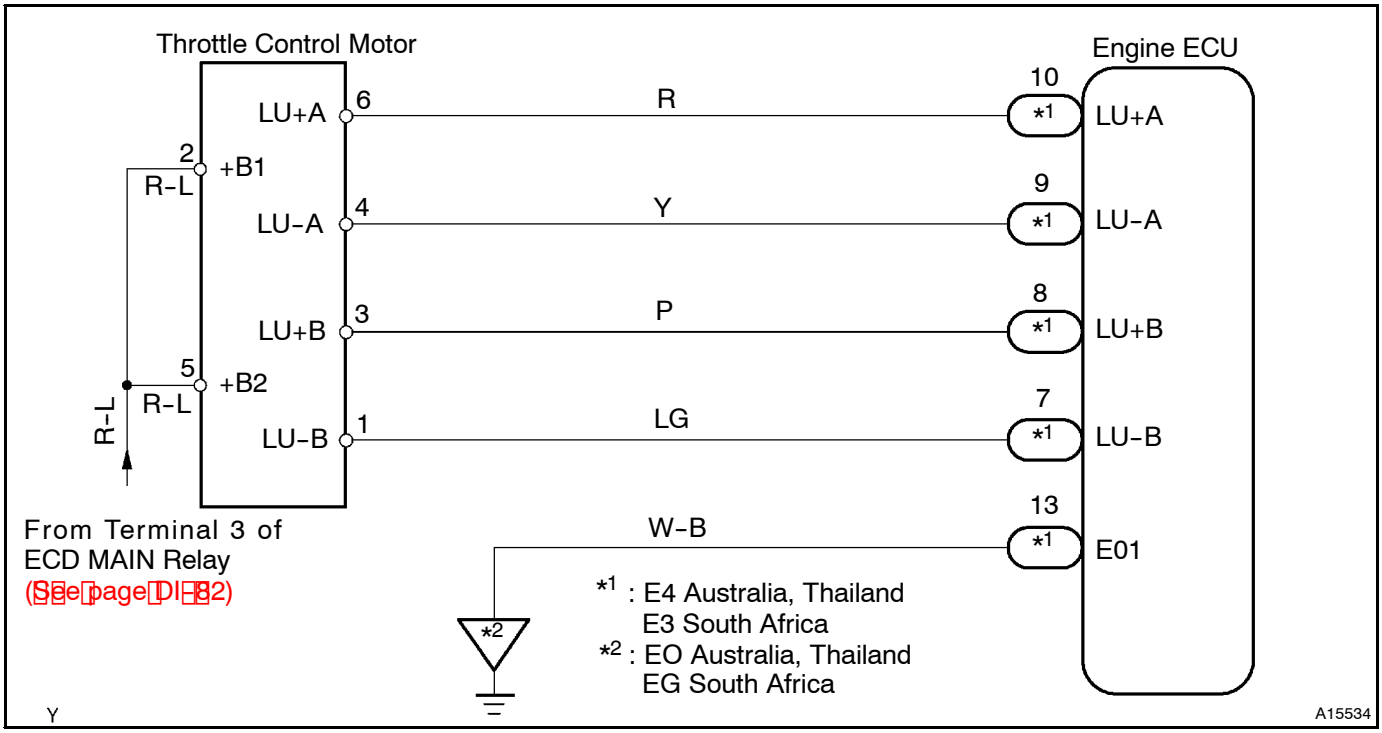
DTC	15	Throttle Control Motor Circuit Malfunction

CIRCUIT DESCRIPTION

Throttle control motor is operated by the engine ECU and it opens and closes the throttle valve.
The fully opening of the throttle valve is detected by the throttle fully open 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 Detecting Condition	Trouble Area
15	Open or short in throttle control motor circuit	S Open or short in throttle control motor circuit S Throttle control motor S Throttle valve S Engine ECU
	Open or short in throttle full switch circuit	

WIRING DIAGRAM

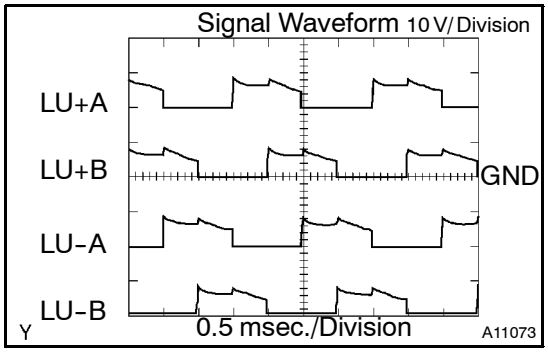


INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand-held tester. Because freeze frame records the engine conditions when the malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air-fuel ratio was lean or rich, etc. at the time of the malfunction.

CONTINUED

1	**Check throttle control motor circuit.**



PREPARATION:

(a) Connect the oscilloscope between terminals LU+A/LU-A/LU+B/LU-B and E01 of the engine ECU connector.

(b) Start the engine.

CHECK:

Check the waveform between terminals LU+A/LU-A/LU+B/LU-B and E01 of the engine ECU connector when the engine is racing and accele OFF.

OK:

The correct waveform is as shown.

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

NG

2	**Check throttle control motor (See page ED-3).**

NG → **Replace throttle body (See page ED-4).**

OK

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

NG → **Repair or replace.**

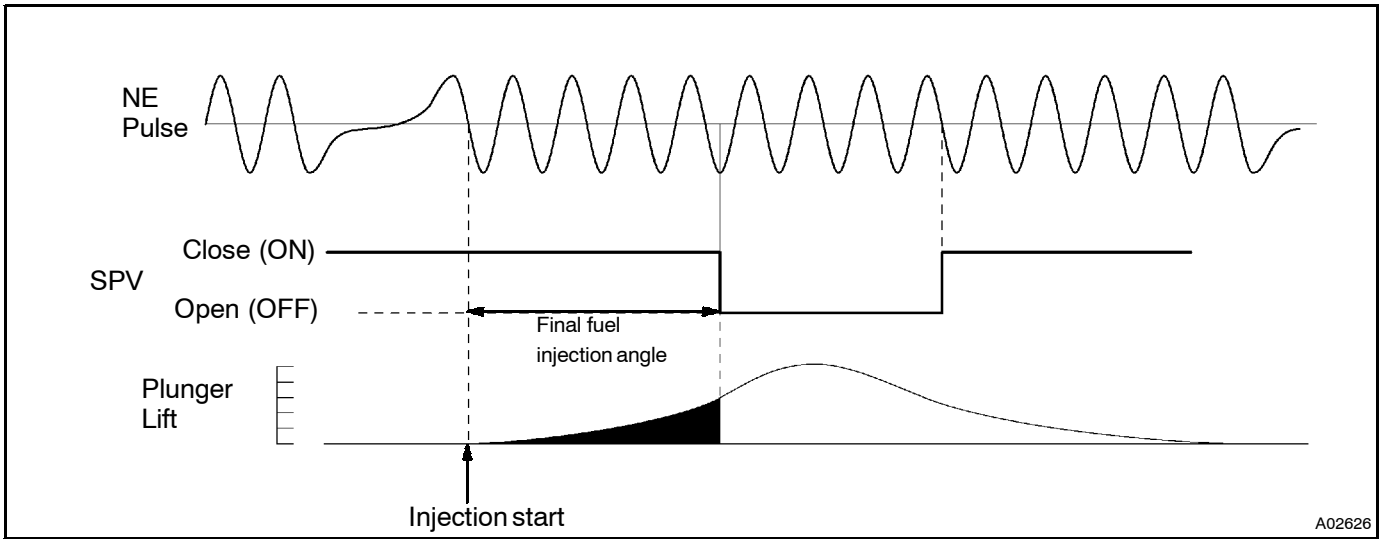
OK

Check and replace engine ECU (See page ED-23).

DTC	18	Spill Control Circuit Malfunction

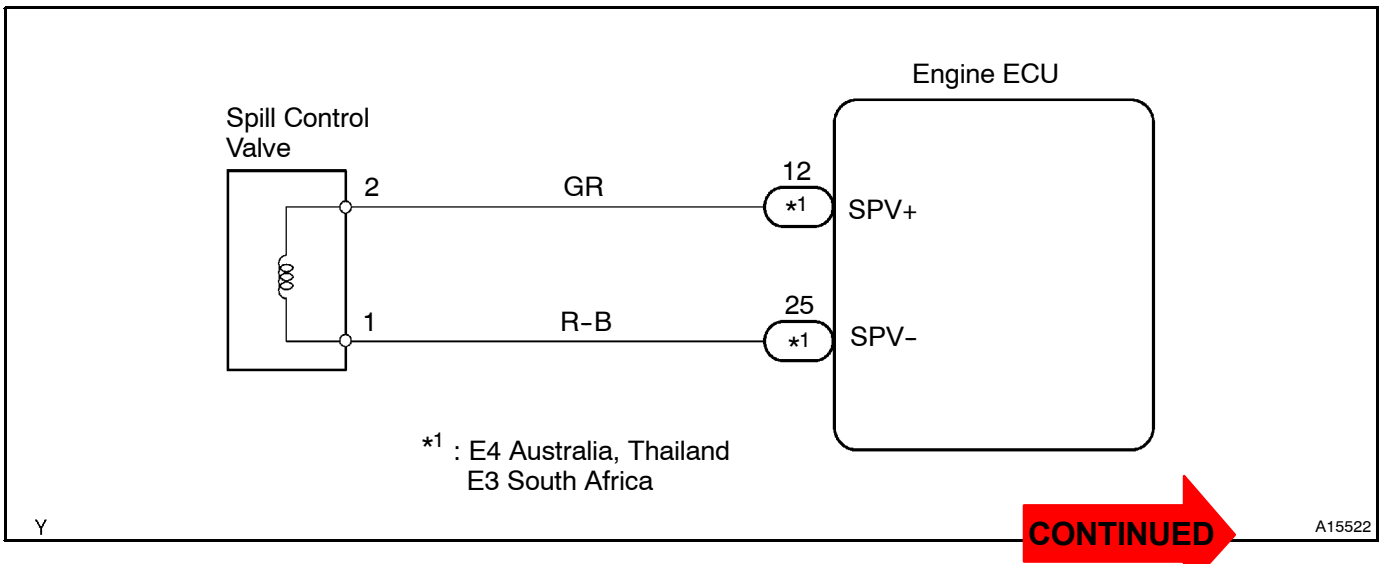
CIRCUIT DESCRIPTION

The engine ECU controls the fuel injection volume by operating the spill control valve. The spill control valve is mounted on the injection pump, and open or close the injection pressure releasing port by the solenoid valve in the spill control valve (During injection; valve is close (ON)), The engine ECU decides the basic fuel injection volume by the engine rpm and accelerator pedal opening angle, and calculates the final fuel injection angle to add the various corrections on the basic fuel injection volume. The engine ECU counts the NE pulse to detects the angle from injection starts and operates the spill control valve from ON to OFF (The injection pressure releasing port is open.) at the position which watches the final fuel injection angle.



DTC No.	DTC Detecting Condition	Trouble Area
18	Open or short in spill control valve at 500 rpm or more	S Open or short in spill control valve circuit S Spill control valve S Engine ECU

WIRING DIAGRAM



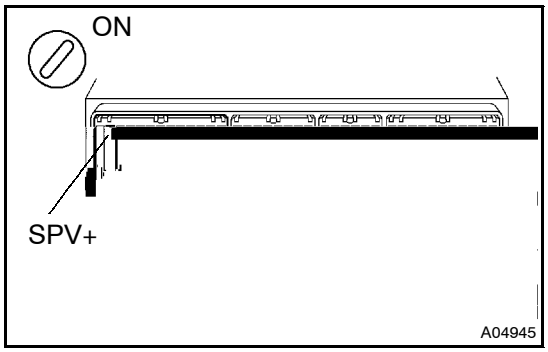
INSPECTION PROCEDURE

1	Check spill control valve (See page FU-14).

NG → Replace injection pump.

OK

2	Check voltage between terminal SPV+ of engine ECU connector and body ground.



PREPARATION:

(a) Remove the glove compartment door (See page ED-24).

(b) Turn the ignition switch ON.

CHECK:

Measure voltage between terminal SPV+ of engine ECU connector and body ground.

OK:

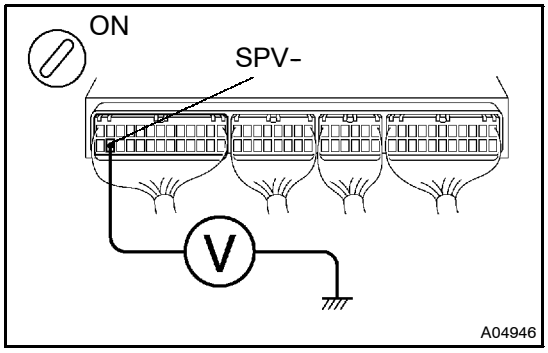
Voltage: 9 - 14 V

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

OK

CONTINUED

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



PREPARATION:

(a) Remove the glove compartment door (See page ED-24).

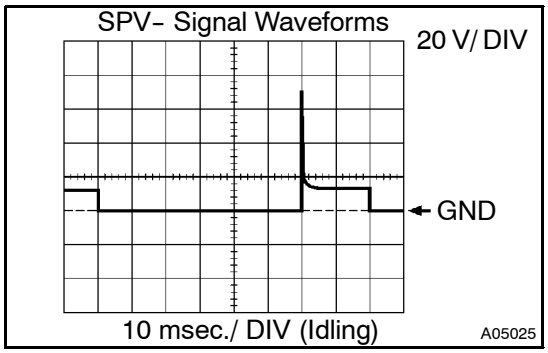
(b) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals SPV- of engine ECU and body ground.

OK:

Voltage: 9 - 14 V



Reference: INSPECTION USING OSCILLOSCOPE

During idling, check waveform between terminals SPV- and E1 of engine ECU.

HINT:

The correct waveform is as shown.

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

OK

Check for open or short in harness and connector between spill control valve and engine ECU (See page IN-19).

DI8NQ-01

DTC	19 (1)	Accelerator Pedal Position Sensor circuit Malfunction (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 accelerator pedal is fully closed.
This system has 2 way accelerator pedal position sensor and accelerator pedal closed position switch for fail safe.

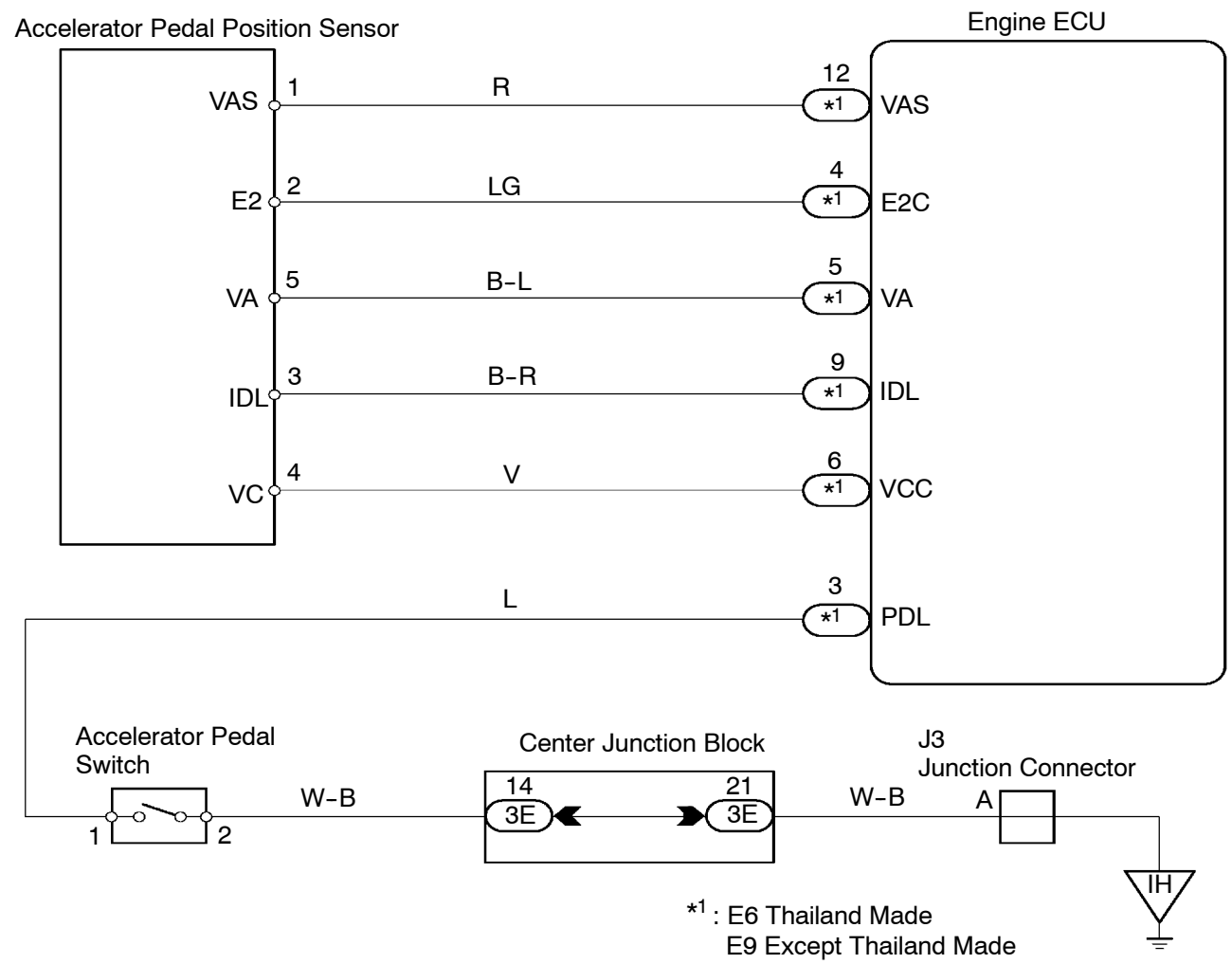
DTC No.	DTC Detecting Condition	Trouble Area
19 (1)	Open or short in accelerator pedal position sensor circuit for 0.05 sec. or more	S Open or short in accelerator pedal position sensor circuit S Accelerator pedal position sensor S Engine ECU

HINT:
After confirming DTC 19 (1) use the hand-held tester 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

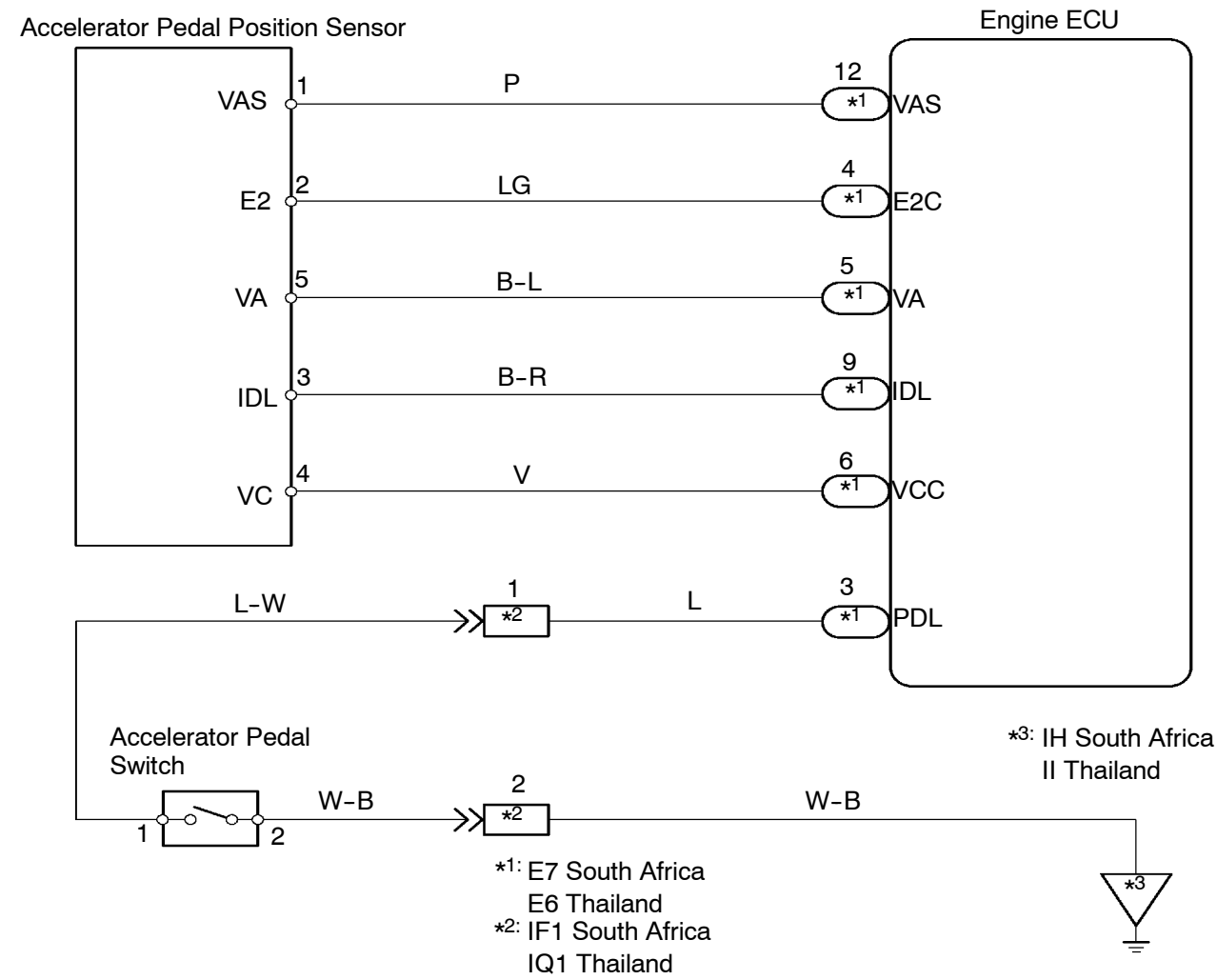
WIRING DIAGRAM

Australia:



CONTINUED

Thailand, South Africa:



INSPECTION PROCEDURE

When using hand-held tester

1	**Connect the hand-held tester, read the accelerator pedal opening percentage.**

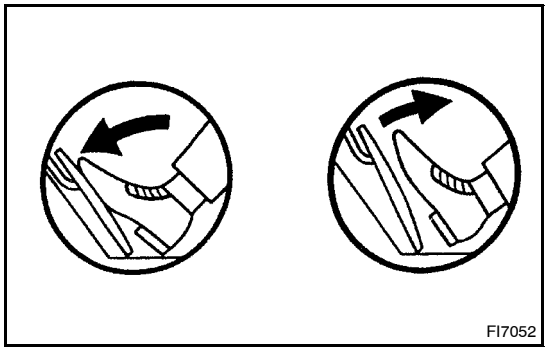
PREPARATION:

(a) Connect the hand-held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand-held tester main switch ON.

CHECK:

Read the accelerator pedal opening percentage.



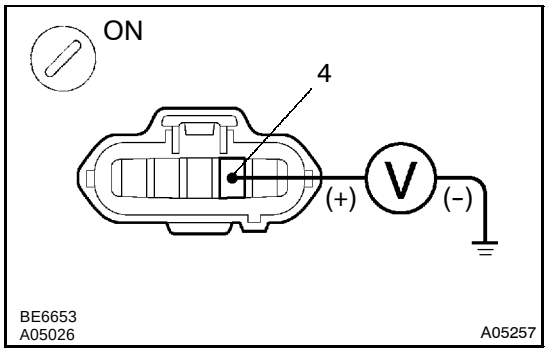
OK:

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

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

OK:

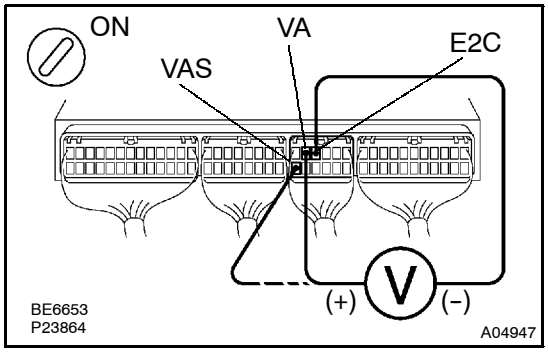
Voltage: 4.5 - 5.5 V

NG → **Go to step 5.**

OK

CONTINUED

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

OK:

Accelerator pedal	Voltage
Fully closed	0.7 - 1.1 V
Fully open	2.9 - 4.9 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 accelerator pedal position sensor (VA, VAS line) (See page IN-19).

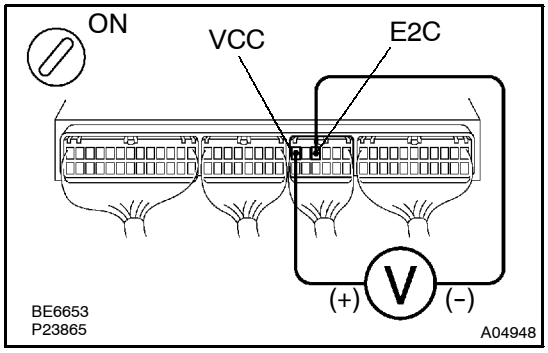
NG → **Repair harness or connector.**

OK

Replace accelerator pedal position sensor.

CONTINUED

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 voltage between terminals VCC and E2C of engine ECU connector.

OK:

Voltage: 4.5 - 5.5 V

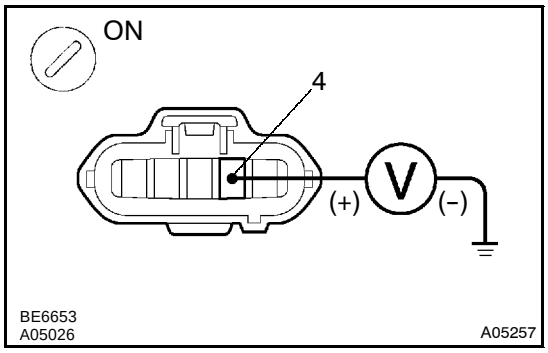
NG → **Check and replace engine ECU (See page IN-19).**

OK

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

When not using hand-held tester

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

OK:

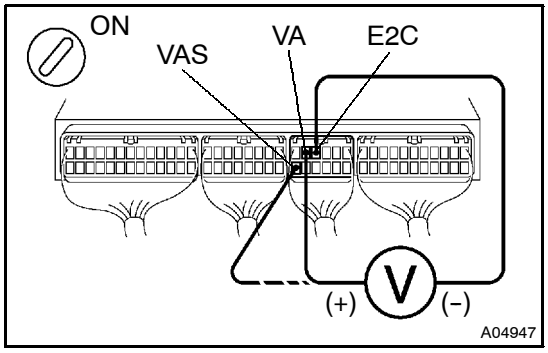
Voltage: 4.5 - 5.5 V

NG → **Go to step 4.**

OK

CONTINUED

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

OK:

Accelerator pedal	Voltage
Fully closed	0.7 - 1.1 V
Fully open	2.9 - 4.9 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).

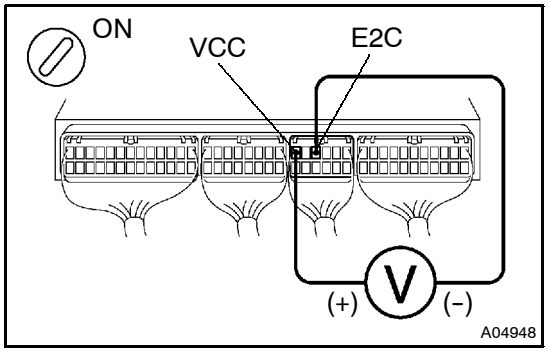
NG → **Repair harness or connector.**

OK

CONTINUED

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 ignition switch ON.

CHECK:

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

OK:

Voltage: 4.5 - 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).

DTC	19 (2)	Accelerator Pedal Position Sensor Circuit Malfunction (IDL Switch/Range Malfunction)

CIRCUIT DESCRIPTION

Refer to DTC 19 (1) (Accelerator Pedal Position Sensor Circuit Malfunction (Open/Short)) on page DI-40.

DTC No.	DTC Detecting Condition	Trouble Area
19(2)	Condition (a) or (b) continue 0.5 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) continue 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 19 (1) (Accelerator Pedal Position Sensor Circuit Malfunction (Open/Short)) on page DI-40.

INSPECTION PROCEDURE

When using hand-held tester

1	Connect the hand-held tester, read the IDL signal.

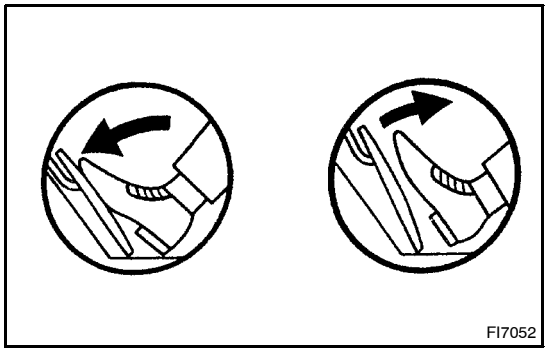
PREPARATION:

(a) Connect the hand-held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand-held tester main switch ON.

CHECK:

Read the IDL signal.



OK:

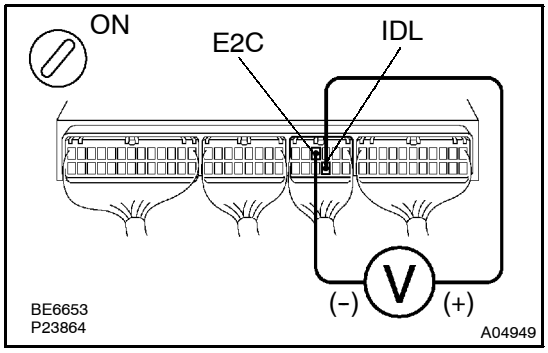
Accelerator pedal	IDL signal
Fully open	OFF
Fully closed	ON

OK → Go to step 4.

NG

CONTINUED

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 voltage between terminals IDL and E2C of engine ECU.

OK:

Accelerator pedal	Voltage
Fully closed	9 - 14 V
Fully open	0 - 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 harness or connector.

OK

Replace accelerator pedal position sensor.

4	Connect the hand-held tester, read the accelerator pedal operating percentage (See page DI-43, Step 1).

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

OK

CONTINUED

5	Check voltage between terminal VCC of wire harness side connector and body ground (See page DI-43, Step 2).

NG → Go to step 8.

OK

6	Check voltage between terminals VA, VAS and E2C of engine ECU (See page DI-44, 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 harness or connector.

OK

Replace accelerator pedal position sensor.

8	Check voltage between terminals VCC and E2C of engine ECU (See page DI-45, Step 5).

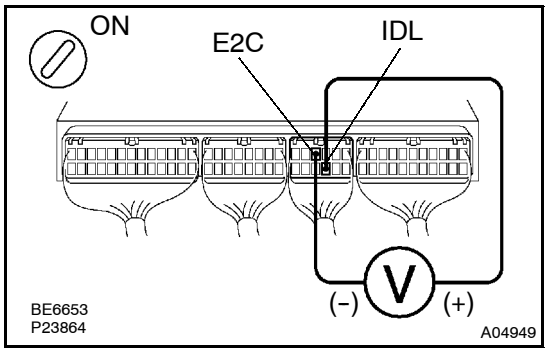
NG → Check and replace engine ECU (See page IN-19).

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 hand-held tester

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 voltage between terminals IDL and E2C of engine ECU.

OK:

Accelerator pedal	Voltage
Fully closed	9 - 14 V
Fully open	0 - 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 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-45, Step 2).**

NG → **Go to step 6.**

OK

CONTINUED

4	Check voltage between terminals VA, VAS and E2C of engine ECU (See page DI-44, 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 harness or connector.

OK

Replace accelerator pedal position sensor.

6	Check voltage between terminals VCC and E2C of engine ECU (See page DI-45, Step 5).

NG → Check and replace engine ECU).

OK

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

DTC	19 (3)	Accelerator Pedal Closed Position Switch Circuit Malfunction (Short)

BACK TO CHAPTER INDEX

DTC	19 (4)	Accelerator Pedal Closed Position Switch Circuit Malfunction (Open)

CIRCUIT DESCRIPTION

Refer to DTC 19 (1) (Accelerator Pedal Position Sensor Circuit Malfunction (Open/Short)) on page DI-40.

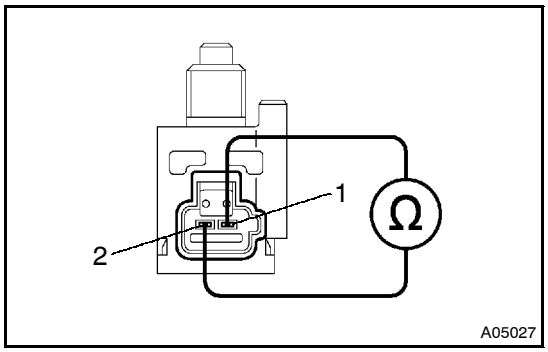
DTC No.	DTC Detecting Condition	Trouble Area
19(3)	Conditions (a), (b) and (c) continue 0.5 sec. or more: (a) PDL ON (b) VA > Fully closed study voltage +0.41 V (c) VAS > Fully closed study voltage +0.41 V	S Short in accelerator pedal closed position switch circuit S Accelerator pedal closed position switch S Engine ECU
19(4)	PDL does not turn ON even once while driving vehicle (2 trip detection logic)	S Open in accelerator pedal closed position switch circuit S Accelerator pedal closed position switch S Engine ECU
	Conditions (a) and (b) continue 5 sec. or more: (a) PDL OFF (b) IDL ON	

WIRING DIAGRAM

Refer to DTC 19 (1) (Accelerator Pedal Position Sensor Circuit Malfunction (Open/Short)) on page DI-40.

INSPECTION PROCEDURE

1	Check accelerator pedal closed position switch.



PREPARATION:

Disconnect the accelerator pedal closed position switch connector.

CHECK:

Measure resistance between terminals of accelerator pedal closed position switch.

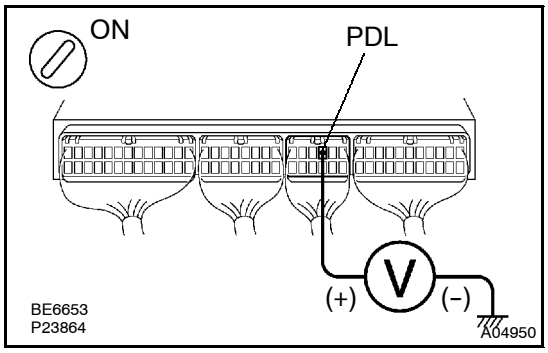
OK:

Terminals	Accelerator pedal	Resistance
1 - 2	Fully closed	∞
1 - 2	Fully open	0 - 20 Ω

NG → **Replace accelerator pedal closed position switch (See page ED-19).**

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 voltage between terminal PDL of engine ECU and body ground.

OK:

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

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

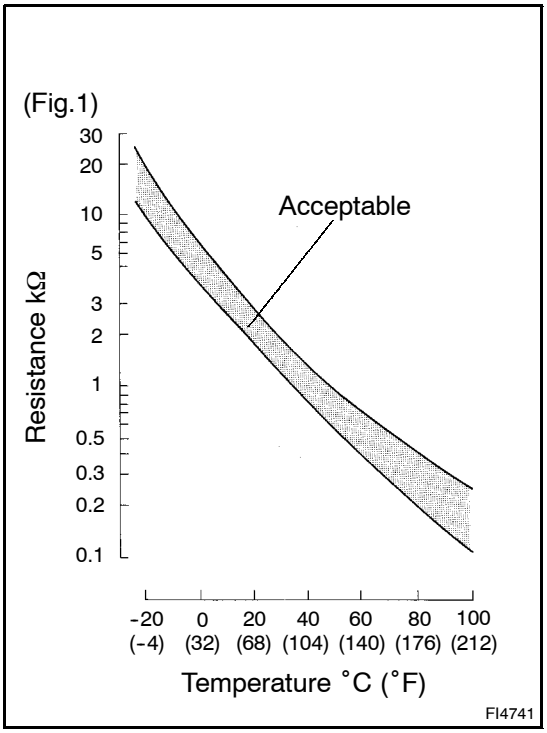
NG

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).

DI8NS-01

DTC	22	Water Temp. Sensor Circuit Malfunction

CIRCUIT DESCRIPTION



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 below). The 5 V power source voltage in the engine ECU is applied to the water temperature sensor from the terminal THW via a 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.

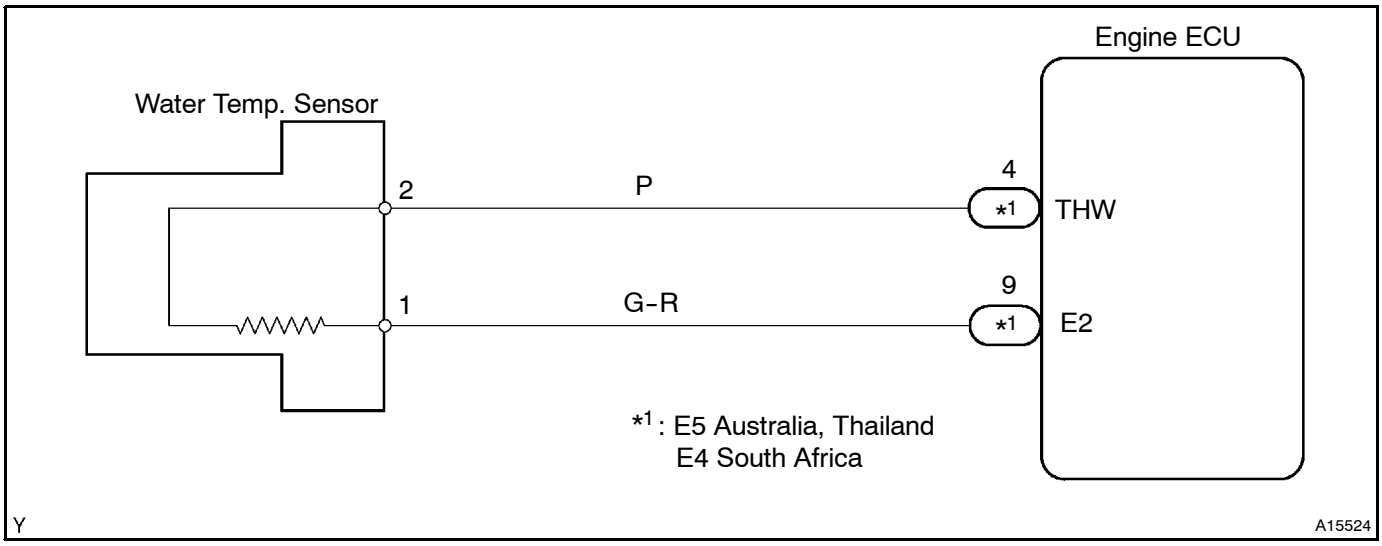
DTC No.	DTC Detecting Condition	Trouble Area
22	Open or short in water temp. sensor circuit for 0.5 sec. or more	• Open or short in water temp. sensor circuit • Water temp. sensor • Engine ECU

HINT:

After confirming DTC22 use the hand-held tester to confirm the water temperature from,"CURRENT DATA".

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

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

If DTC "22" (Water Temp. Sensor Circuit Malfunction), "24" (Intake Air Temp. Sensor Circuit Malfunction) and "39" (Fuel Temp. Sensor Circuit Malfunction) are output simultaneously, E2 (sensor ground) may be open.

When using hand-held tester

1	Connect the hand-held tester, and read value of water temperature.

PREPARATION:

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

(b) Turn the ignition switch ON and push the hand-held tester main switch ON.

CHECK:

Read temperature value on the hand-held tester.

OK:

Same as actual water temperature.

HINT:

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

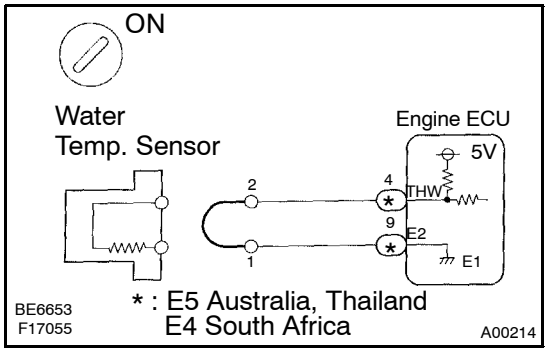
NG

-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-9).

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 temperature value on the hand-held tester.

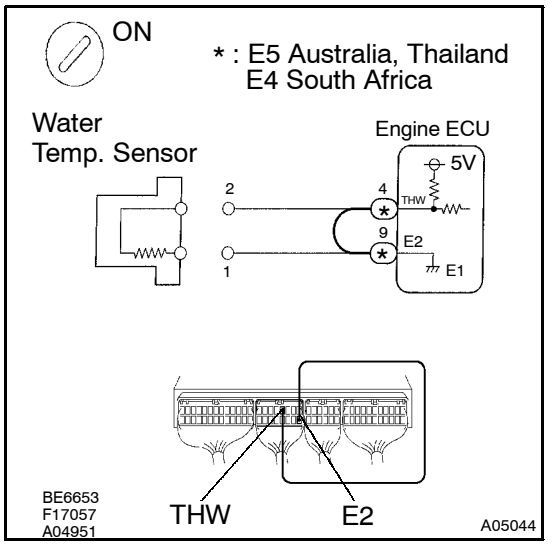
OK:

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 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 temperature value on the hand-held tester.

OK:

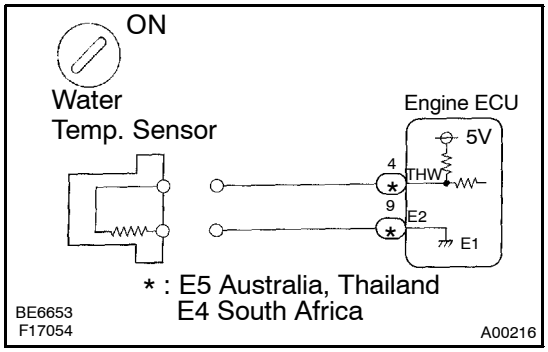
Temperature value: 140°C (284°F) or more

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 temperature value on the hand-held tester.

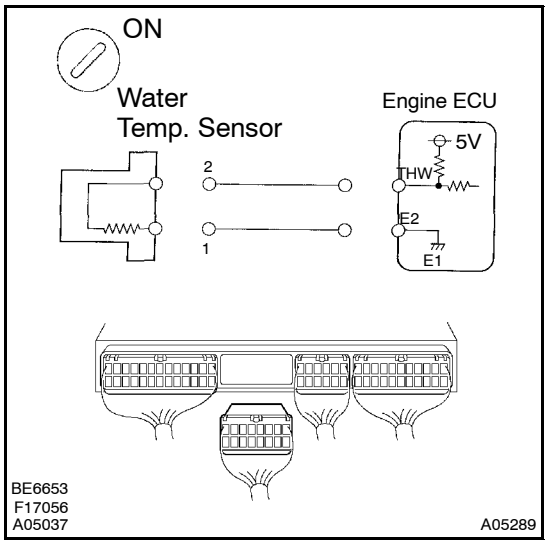
OK:

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 connector of engine ECU.

HINT:

Water temp. sensor connector is disconnected.

(c) Turn the ignition switch ON.

CHECK:

Read temperature value on the hand-held tester.

OK:

Temperature value: -40°C (-40°F)

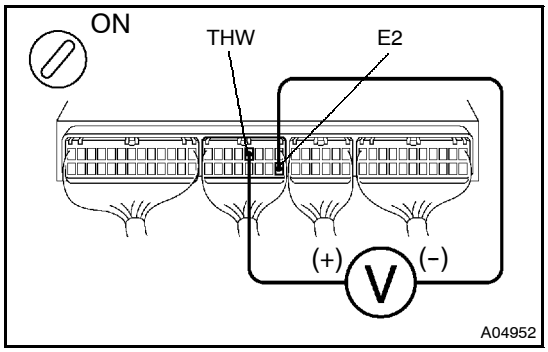
OK	Repair or replace harness or connector.

NG

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

When not using hand-held tester

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



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

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

OK:

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

OK → Check for intermittent problems (See page DI-9).

NG

2	Check water temp. sensor (See page ED-12).

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

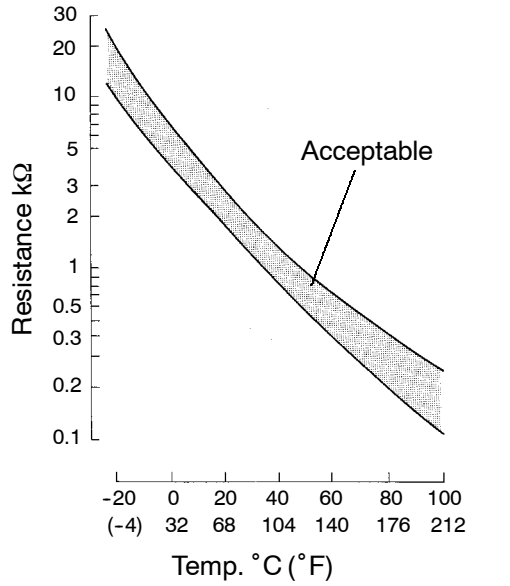
Check and replace engine ECU (See page IN-19).

DI8NT-01

DTC	24	Intake Air Temp. Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

(Fig.1)



The intake air temp. sensor is built into the intake manifold 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, 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 the terminal THA via a resistor R. That is the resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes. Based on this signal, the engine ECU increases the fuel injection volume to improve drivability during cold engine operation.

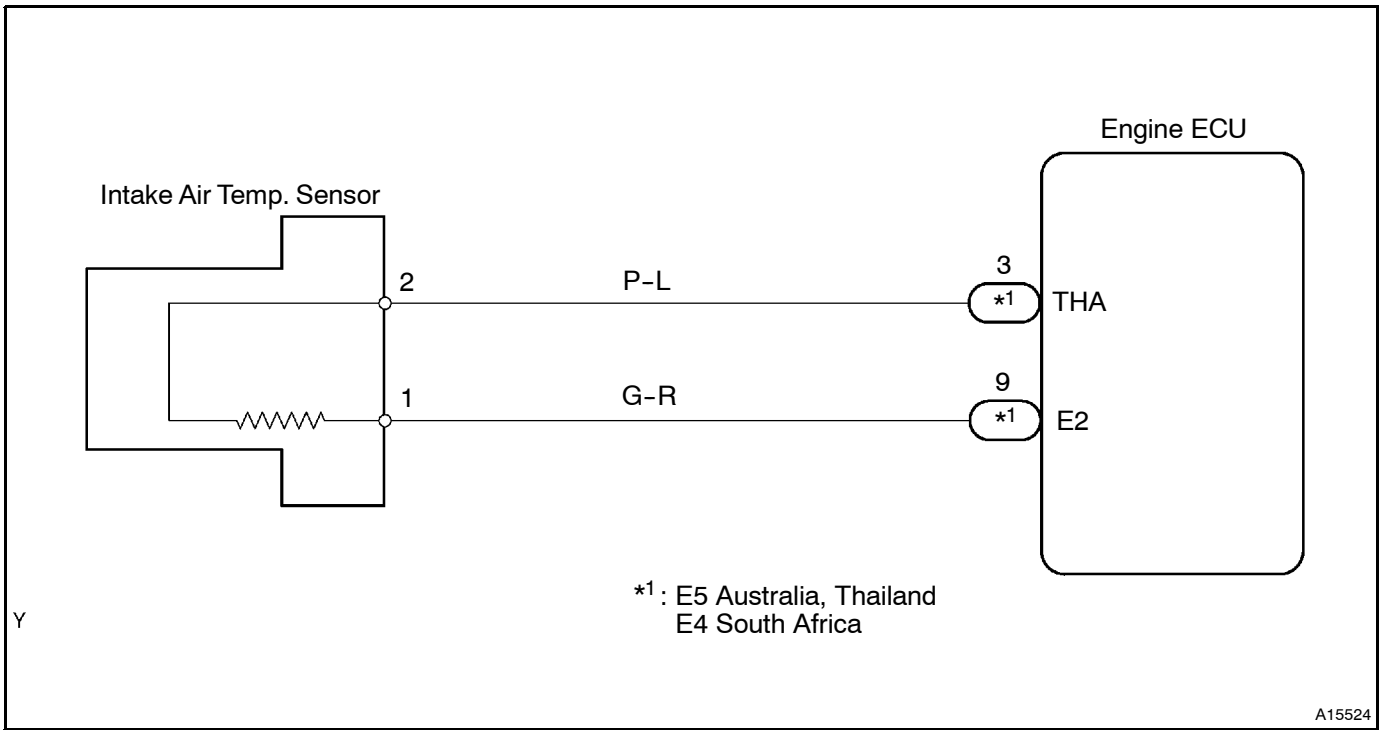
DTC No.	DTC Detecting Condition	Trouble Area
24	Open or short in intake air temp. sensor circuit for 0.5 sec. or more	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • Engine ECU

HINT:

After confirming DTC 24 use the hand-held tester to confirm the water temperature from "CURRENT DATA".

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

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

If DTC"22" (Water Temp. Sensor Circuit Malfunction), "24" (Intake Air Temp. Sensor Circuit Malfunction), "35" (Turbo Pressure Sensor Circuit Malfunction) and "39" (Fuel Temp. Sensor Circuit Malfunction) are output simultaneously, E2 (sensor ground) may be open.

When using hand-held tester

1	Connect the hand-held tester, and read value of water temperature.

PREPARATION:

(a) Connect the hand-held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand-held tester main switch ON.

CHECK:

Read temperature value on the hand-held tester.

OK:

Same as actual intake air temperature.

HINT:

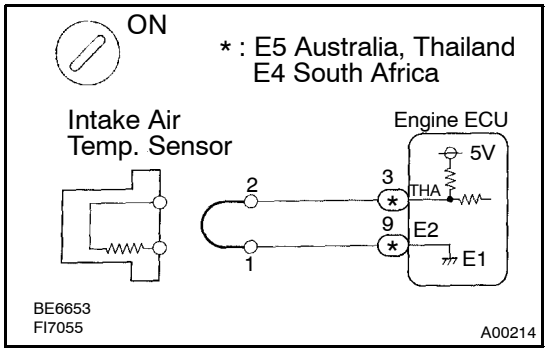
- If there is open circuit, hand-held tester indicates -40°C (-40°F).
- If there is short circuit, hand-held tester indicates 140°C (284°F) or more.

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-9).

2 Check for open in harness or engine ECU.



PREPARATION:

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

CHECK:

Read temperature value on the hand-held tester.

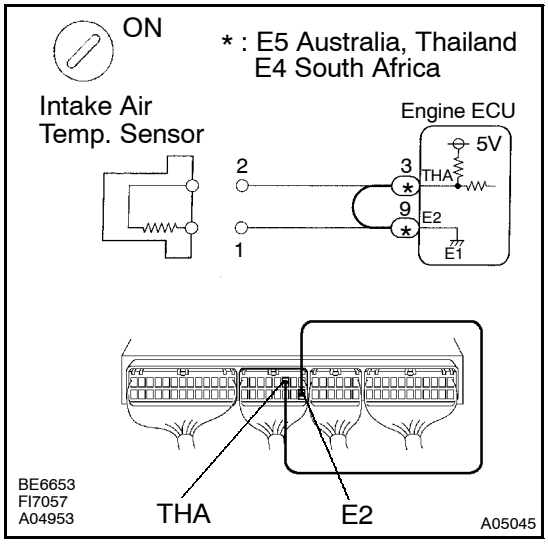
OK:

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

OK	Confirm good connection at sensor. If OK, replace intake air temp. sensor.

NG

3 Check for open in harness or engine ECU.



PREPARATION:

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

HINT:

Intake air 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.

CONTINUED

CHECK:

Read temperature value on the hand-held tester.

OK:

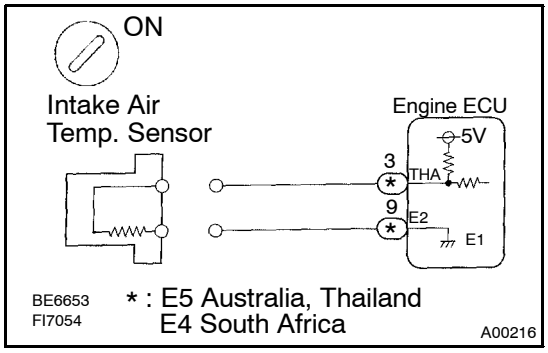
Temperature value: 140°C (284°F) or more

OK	Open in harness between terminal E2 or THA, 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 intake air temp. sensor connector.

(b) Turn the ignition switch ON.

CHECK:

Read temperature value on the hand-held tester.

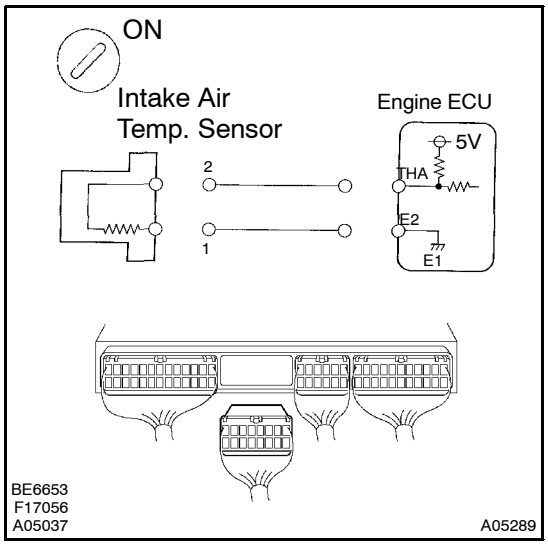
OK:

Temperature value: -40°C (-40°F)

OK	Replace intake air temp. sensor.

NG

5	Check for short in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.

(b) Disconnect the connector of engine ECU.

HINT:

Intake air temp. sensor connector is disconnected.

(c) Turn the ignition switch ON.

CHECK:

Read temperature value on the hand-held tester.

OK:

Temperature value: -40°C (-40°F)

OK	Repair or replace harness or connector.

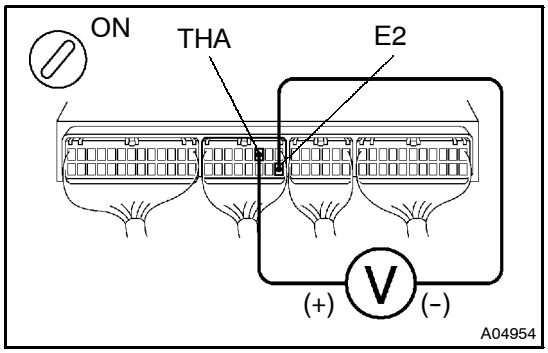
CONTINUED

NG

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

When not using hand-held tester

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



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

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

OK:

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

OK → Check for intermittent problems (See page DI-9).

NG

2	Check intake air temp. sensor (See page ED-14).

NG → Replace intake air temp. sensor.

OK

3	Check for open and short in harness and connector between engine ECU and intake air temp. sensor (See page IN-19).

NG → Repair or replace harness or connector.

OK ↓

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

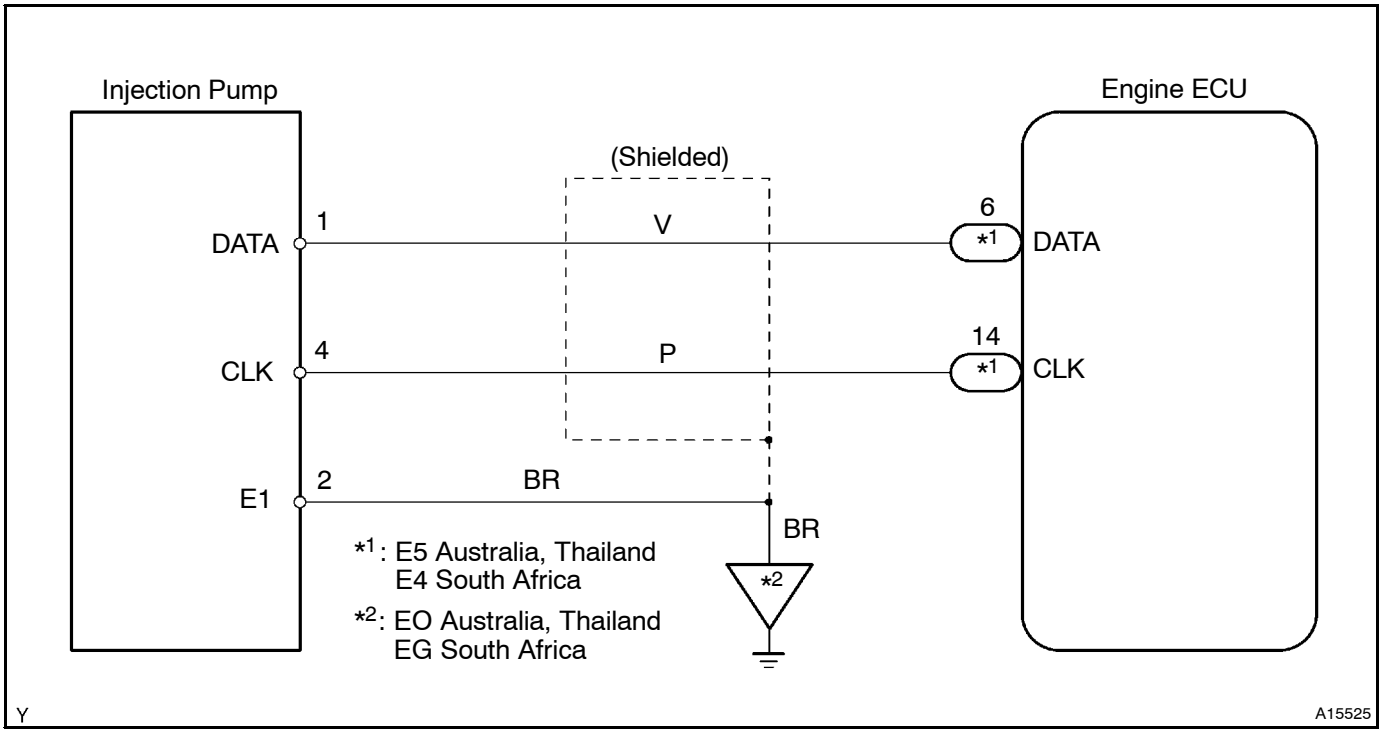
DTC	32	Injection Pump Correction System Malfunction

CIRCUIT DESCRIPTION

The correction system is correcting a few vary between each injection pumps.

DTC No.	DTC Detecting Condition	Trouble Area
32	Open or short in injection pump correction unit circuit	S Injection pump correction unit circuit S Injection pump correction unit S Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

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

NG → Repair harness or connector.

OK

CONTINUED

2	**Try to change the injection pump correction unit to another one.**

PREPARATION:

(a) Remove the injection pump correction unit from injection pump.
(b) Install the another injection pump correction unit.
(c) Clear DTC.
(d) Turn the ignition switch ON.

CHECK:

Read DTC again.

OK:

Does not output DTC "32" (Injection Pump Correction System Malfunction).

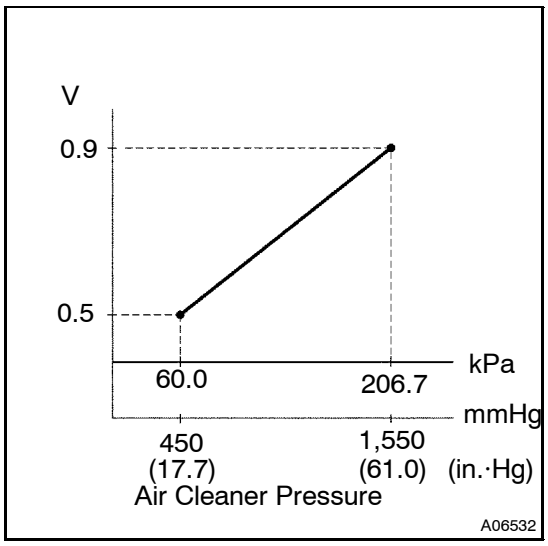
OK → **Check and replace injection pump (See page FU-7).**

NG

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

DTC	35	Intake Air Pressure Sensor Circuit Malfunction

CIRCUIT DESCRIPTION



The intake air pressure sensor is connected to the air cleaner. The engine ECU detects the air cleaner pressure as a voltage by the sensor. The engine ECU calculates the atmospheric intake air pressure by using the output voltage and uses this atomospheric value for correcting the injection volume and injection timing control.

DTC No.	DTC Detecting Condition	Trouble Area
35	Open or short in intake air pressure sensor circuit for 2 sec. or more	S Open or short in intake air pressure sensor circuit S Intake air pressure sensor S Engine ECU

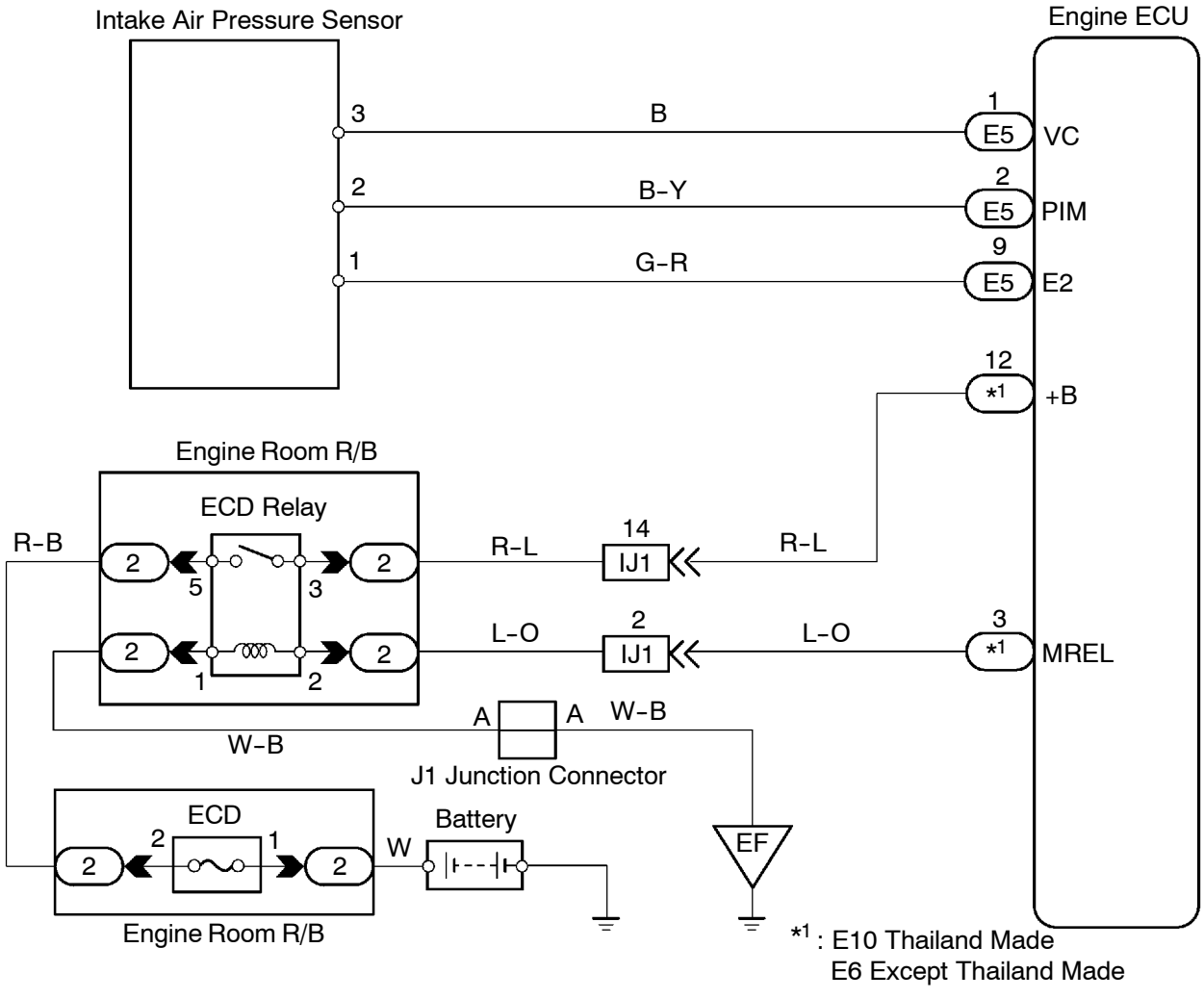
HINT:
After confirming DTC 35, use the hand-held tester to confirm the air cleaner pressure from "CURRENT DATA".

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

CONTINUED

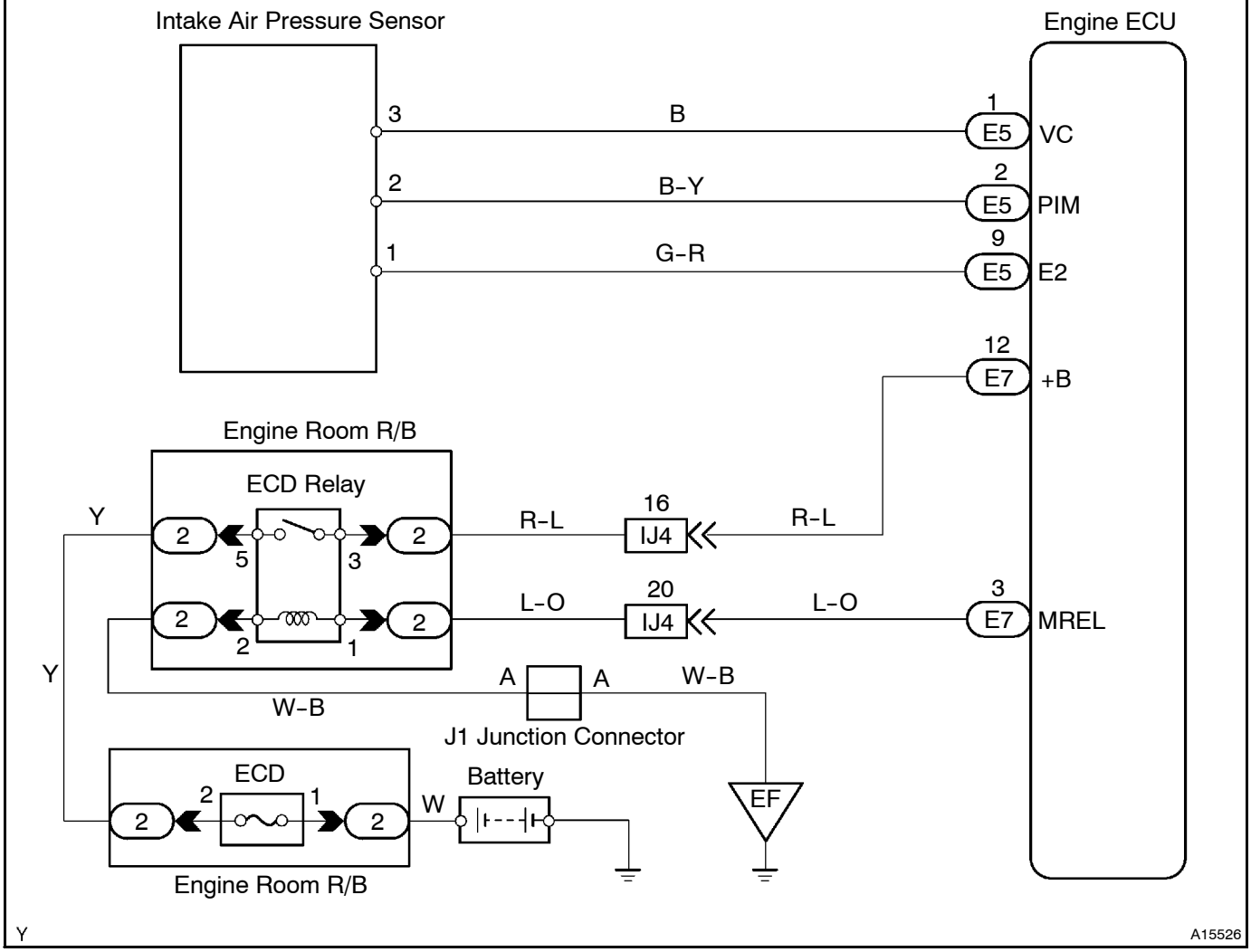
WIRING DIAGRAM

Australia:

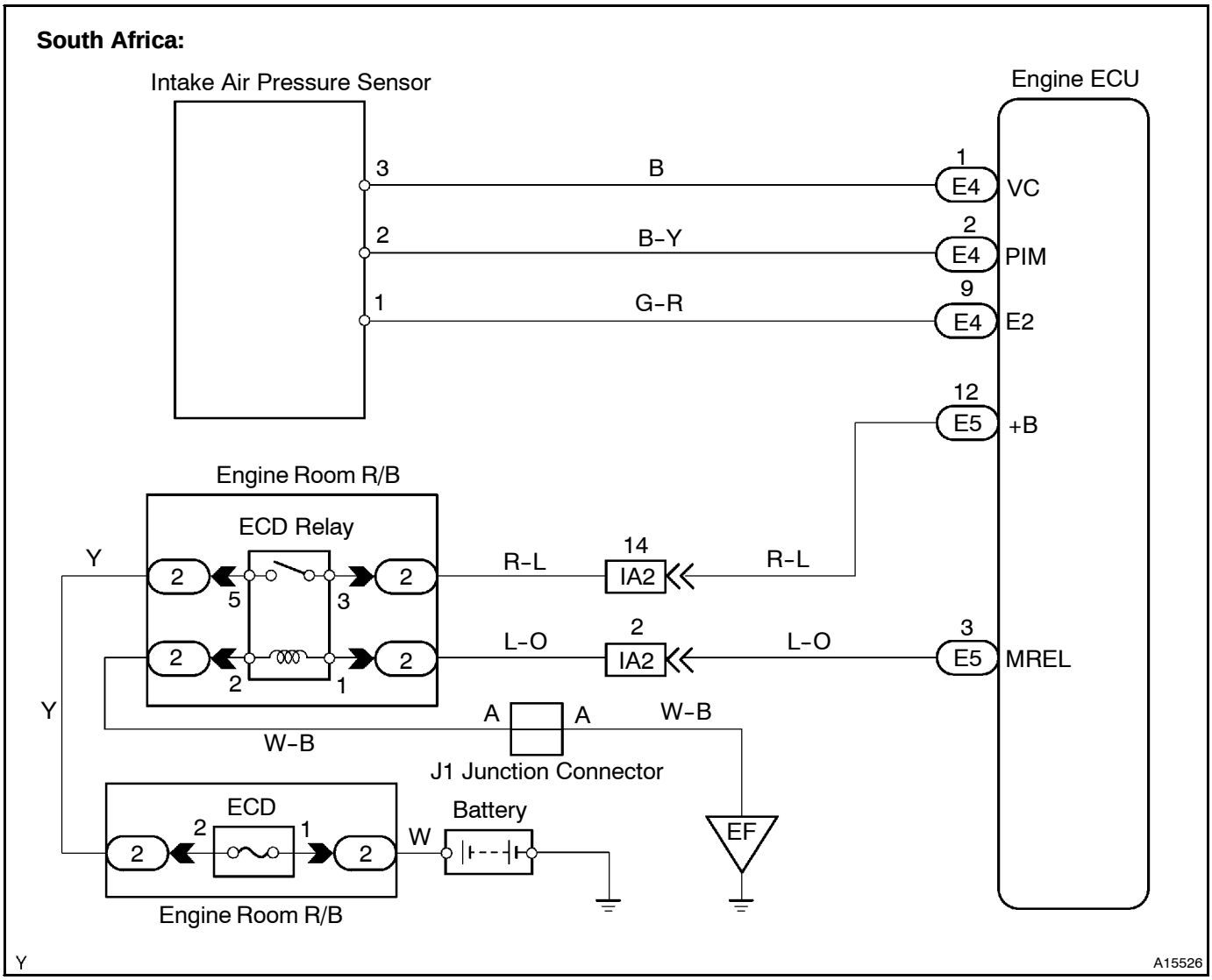


CONTINUED

Thailand:



CONTINUED



INSPECTION PROCEDURE

HINT:

If DTC ”22” (Water Temp. Sensor Circuit Malfunction), ”24” (Intake Air Temp, Sensor Circuit Malfunction), ”35” (Intake air Pressure Sensor Circuit Malfunction) and ”39” (Fuel Temp. Sensor Circuit Malfunction) are output simultaneously, E2 (sensor ground) may be open.

When using hand-held tester

1	**Connect the hand-held tester, and read value of air cleaner pressure.**

PREPARATION:

(a) Connect the hand-held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand-held tester main switch ON.

CHECK:

Read value of air cleaner pressure on the hand-held tester.

OK:

Same as atmospheric pressure.

CONTINUED

OK	**Repair or replace connection the vacuum hose.**

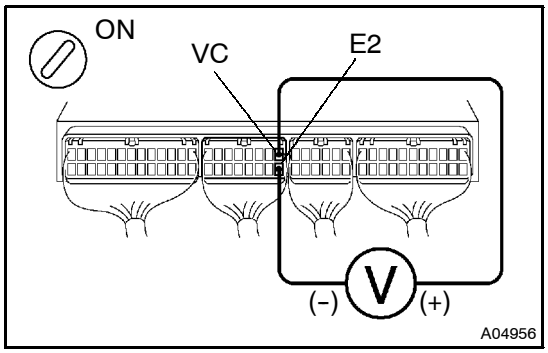
NG

2	Check intake air pressure sensor (See page ED-15).

NG → Replace inatake air 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 voltage between terminals VC and E2 of engine ECU.

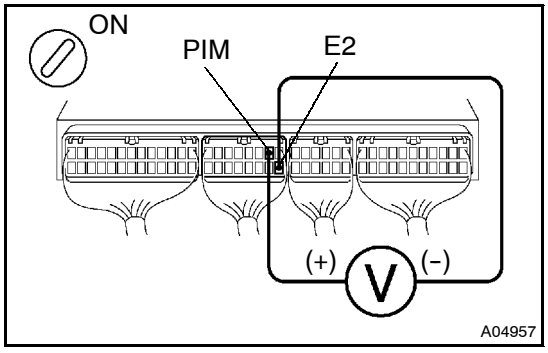
OK:

Voltage: 4.5 - 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 voltage between terminals PIM and E2 of engine ECU.

OK:

Voltage: 1.0 - 2.2 V

CONTINUED

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

NG

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

OK

Replace intake air pressure sensor.

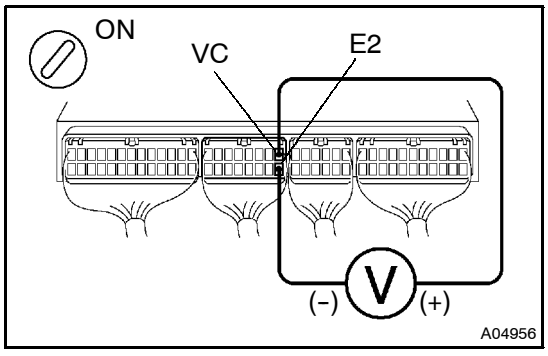
When not using hand-held tester

1	**Check intake air pressure sensor (See page ED-15).**

NG → **Replace intake air 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 voltage between terminals VC and E2 of engine ECU.

OK:

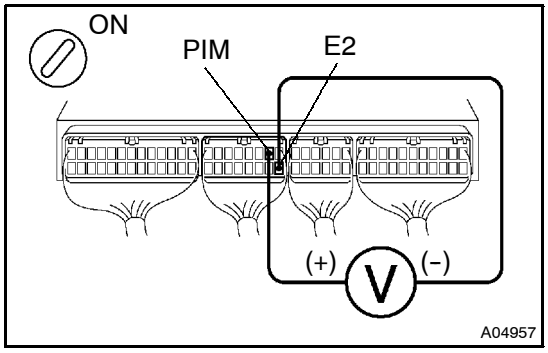
Voltage: 4.5 - 5.5 V

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

OK

CONTINUED

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 voltage between terminals PIM and E2 of engine ECU.

OK:

Voltage: 1.0 - 2.2 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 intake air pressure sensor (See page IN-19).

NG	Repair or replace harness or connector.

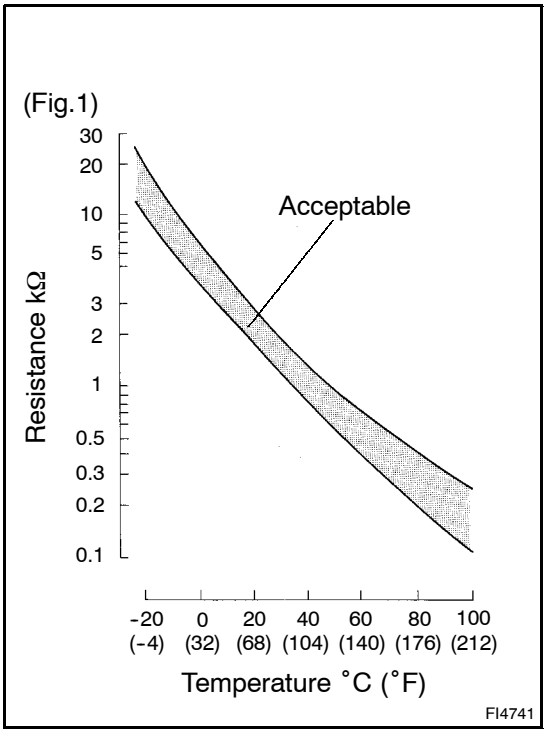
OK

Replace for intake air pressure sensor.

DI8NU-01

DTC	39	Fuel Temp. Sensor Circuit Malfunction

CIRCUIT DESCRIPTION



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 below). The 5 V power source voltage in the engine ECU is applied to the fuel temperature sensor from the terminal THF via a 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.

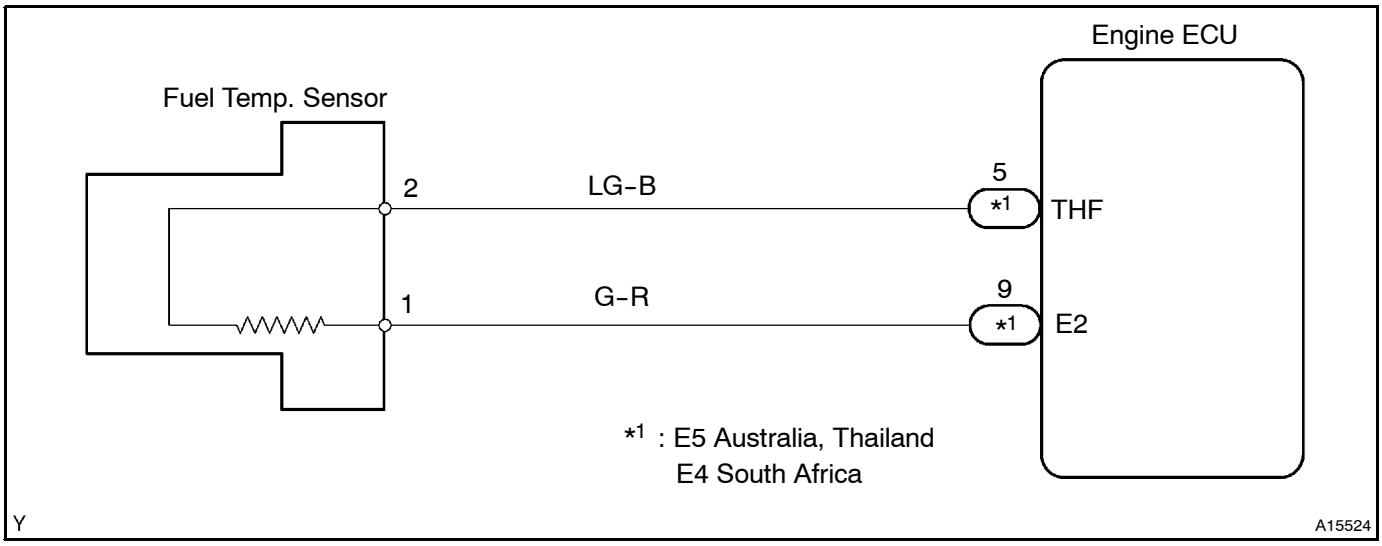
DTC No.	DTC Detecting Condition	Trouble Area
39	Open or short in fuel temp. sensor circuit for 0.5 sec. or more	• Open or short in fuel temp. sensor circuit • Fuel temp. sensor • Engine ECU

HINT:

After confirming DTC 39, use the hand-held tester to confirm the water temperature from "CURRENT DATA".

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

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

If DTC "22" (Water Temp. Sensor Circuit Malfunction), "24" (Intake Air Temp. Sensor Circuit Malfunction), "35" (Turbo Pressure Sensor Circuit Malfunction) and "39" (Fuel Temp. Sensor Malfunction) are output simultaneously, E2 (sensor ground) may be open.

When using hand-held tester

1	Connect the hand-held tester, and read value of fuel temperature.

PREPARATION:

(a) Connect the hand-held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand-held tester main switch ON.

CHECK:

Read temperature value on the hand-held tester.

OK:

Same as actual fuel temperature.

HINT:

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

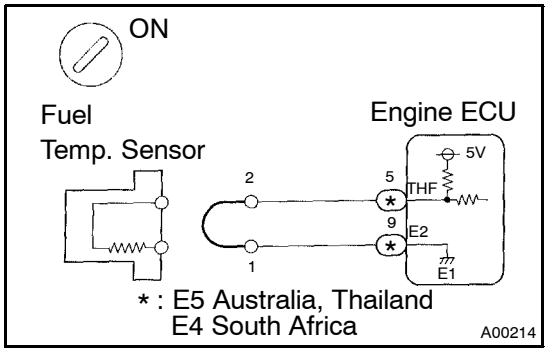
NG

-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-9).

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 temperature value on the hand-held tester.

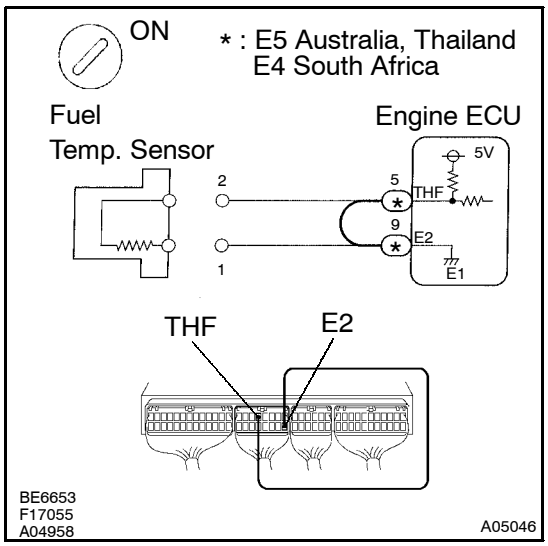
OK:

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 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 temperature value on the hand-held tester.

OK:

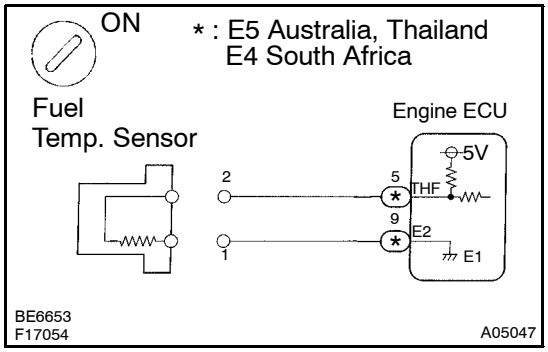
Temperature value: 140°C (284°F) or more

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 temperature value on the hand-held tester.

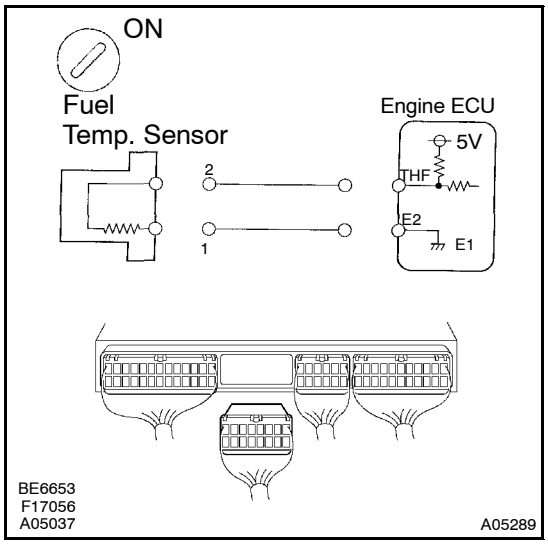
OK:

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 connector of engine ECU.

HINT:

Fuel temp. sensor connector is disconnected.

(c) Turn the ignition switch ON.

CHECK:

Read temperature value on the hand-held tester.

OK:

Temperature value: -40°C (-40°F)

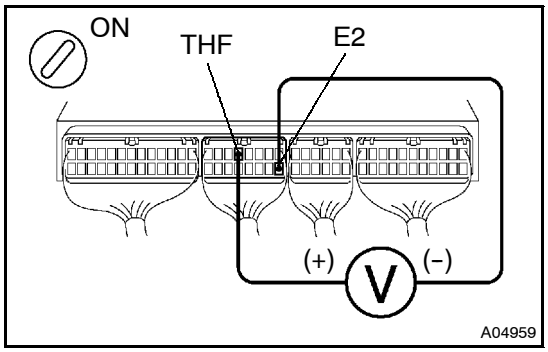
OK	Repair or replace harness or connector.

NG

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

When not using hand-held tester

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



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

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

OK:

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

OK	Check for intermittent problems (See page DI-9).

NG

2	Check fuel temp. sensor. (See page ED-13).

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.

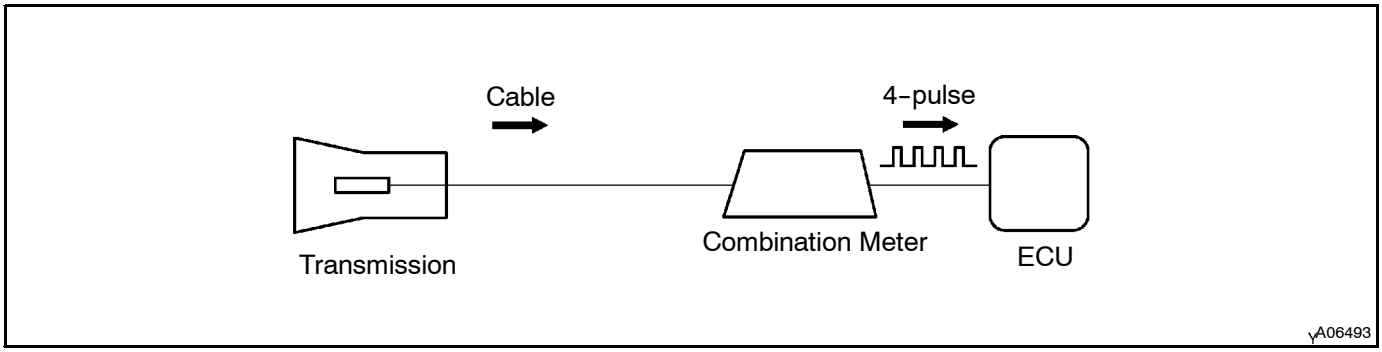
OK

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

DTC	42	Vehicle Speed Sensor Signal Circuit Malfunction

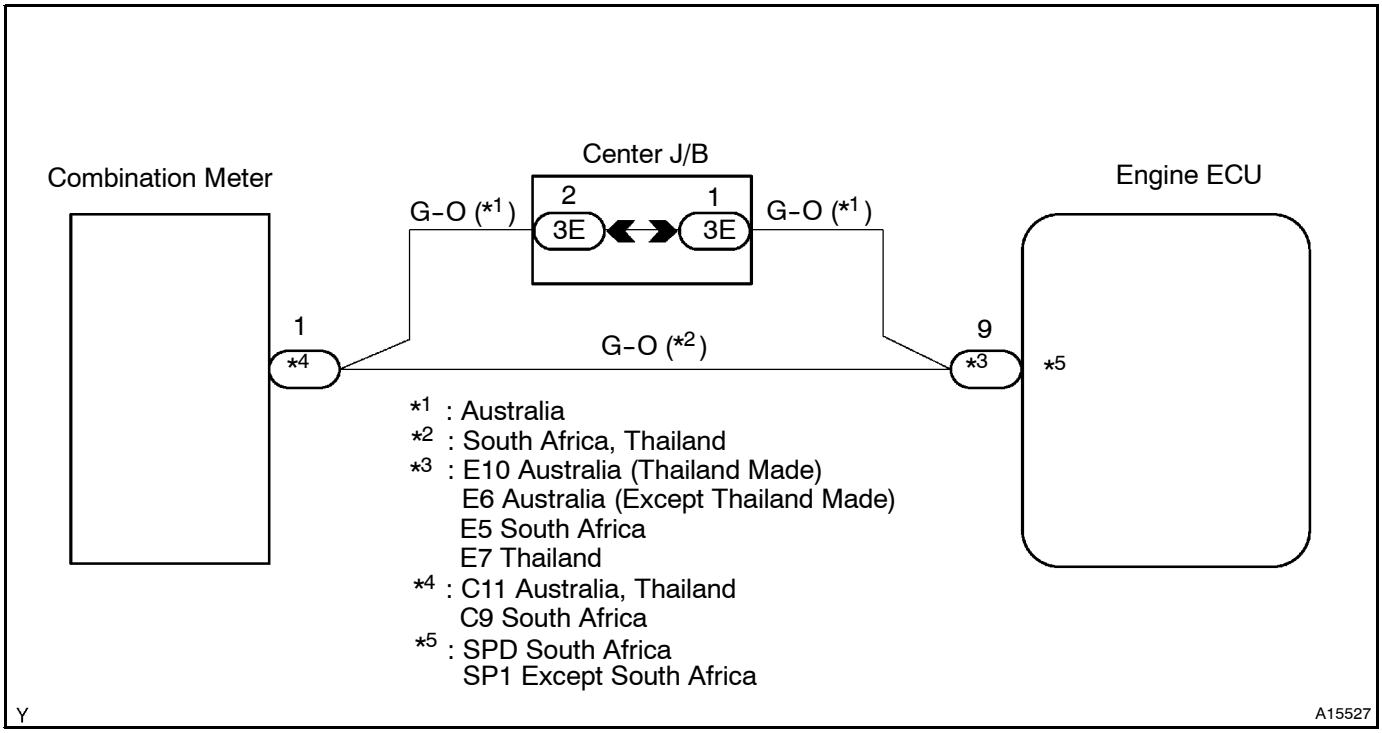
CIRCUIT DESCRIPTION

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 Detecting Condition	Trouble Area
42	All conditions below are detected continuously for 8 sec. or more: (a) Vehicle speed signal: 0 km/h (0 mph) (b) Engine speed: 2,400 ~ 4,000 rpm (c) Engine coolant temp.: 60°C (176°F) or more (d) Accelerator pedal opening angle : 60 % 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.

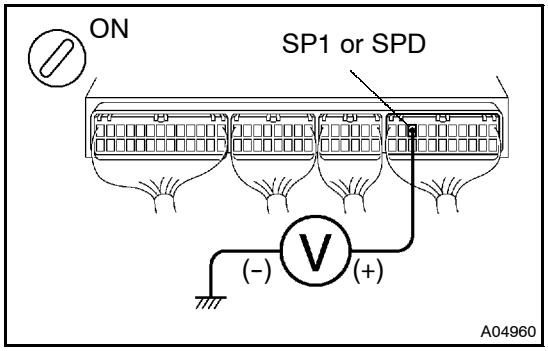
HINT:

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

NG → **Check speedometer.**

OK

2	**Check voltage between terminal SP1 of engine ECU and body ground.**



PREPARATION:

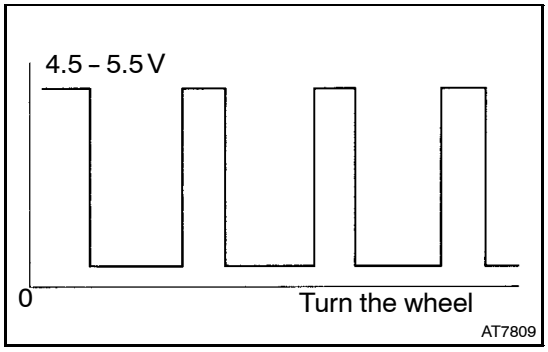
(a) Remove the glove compartment door.
(b) Shift the shift lever to neutral.
(c) Jack up one of the front wheels.
(d) Turn the ignition switch ON.

CHECK:

Measure voltage between terminal SP1 or SPD of engine ECU and
body ground when the wheel is turned slowly.

OK:

Voltage is generated intermittently.



NG → **Check and repair harness and connector between combination meter and engine ECU (See page IN-19).**

OK

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

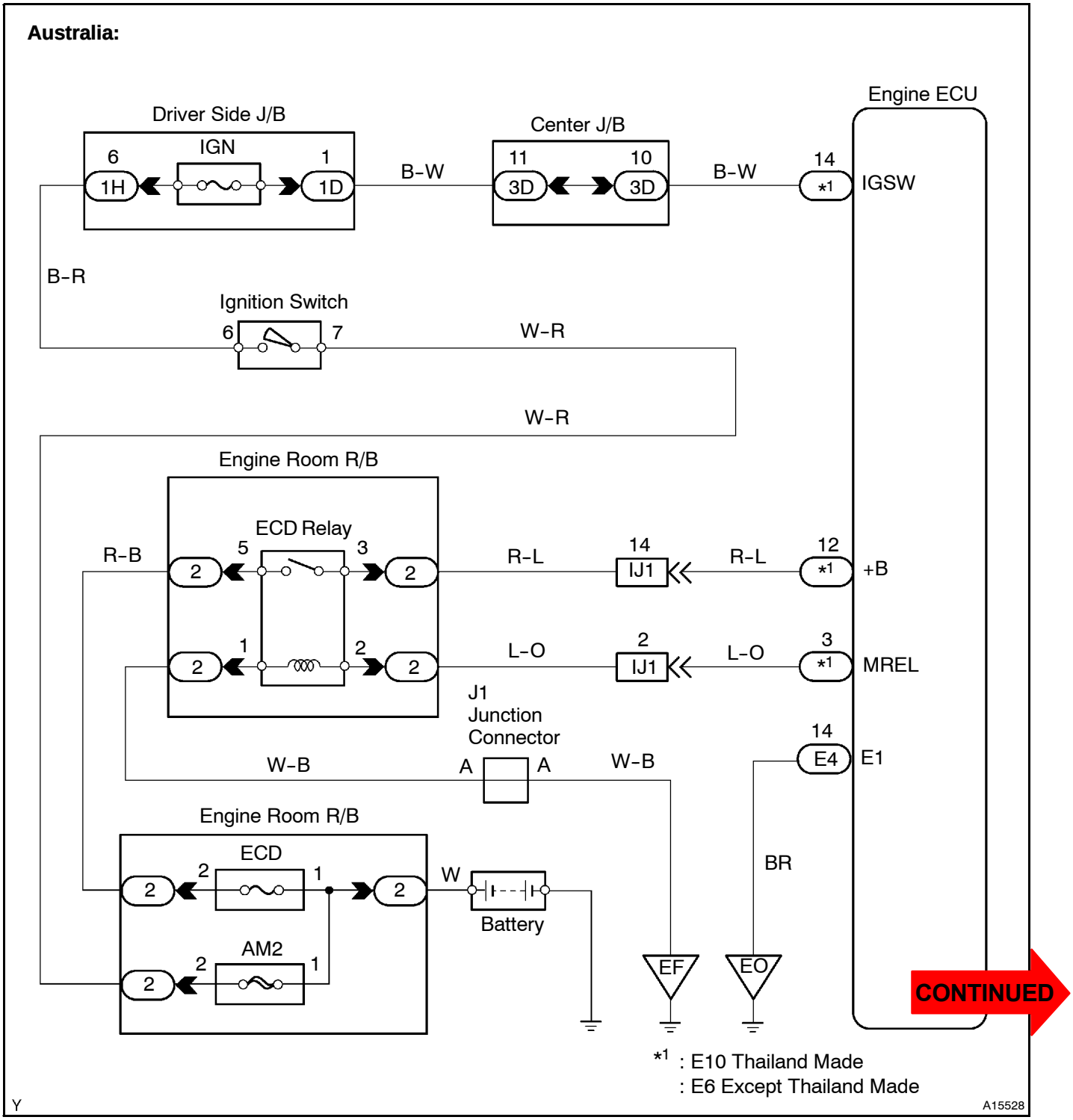
ECU Power Source Circuit

CIRCUIT DESCRIPTION

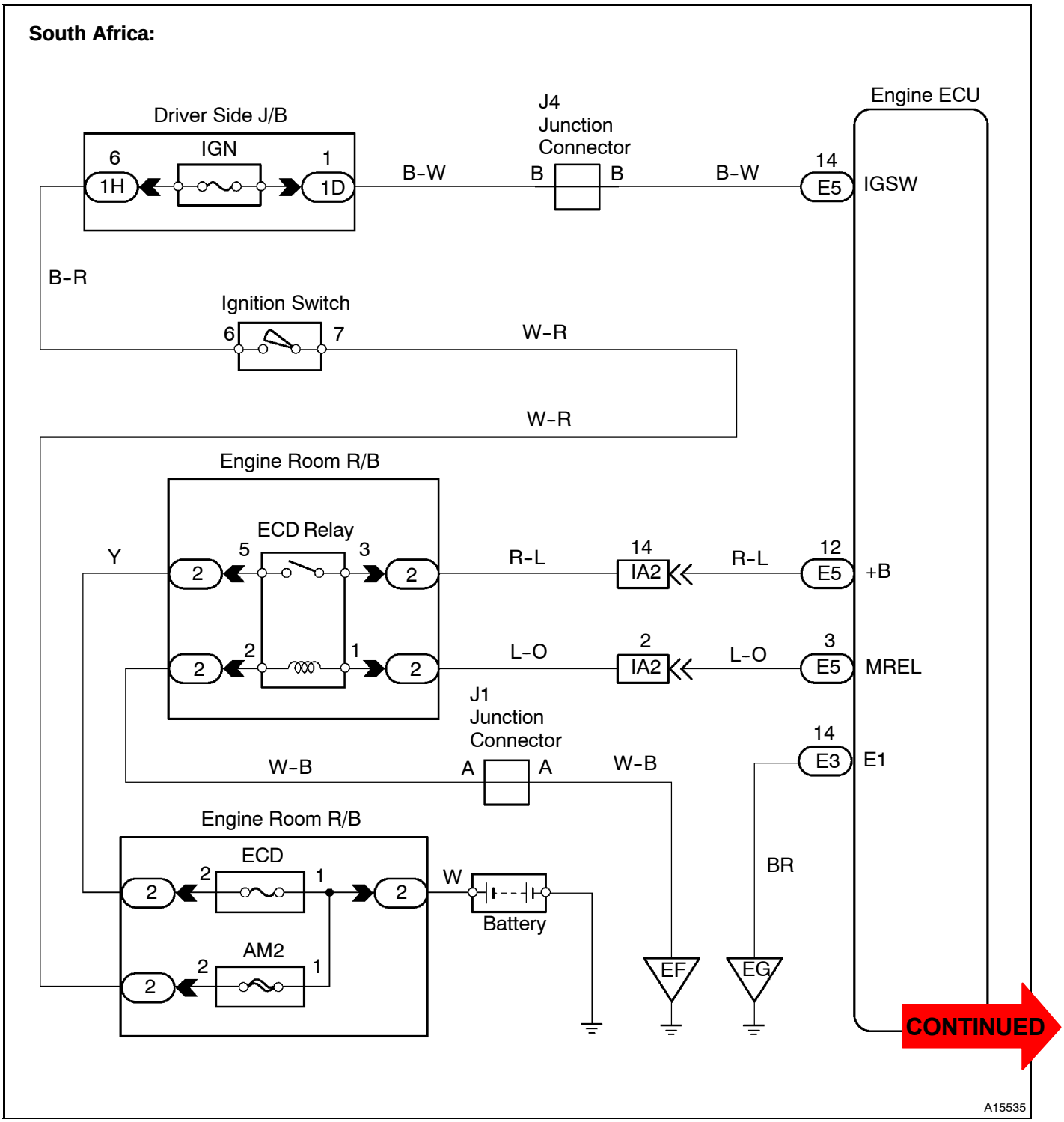
When the ignition switch is turned ON, battery positive voltage is applied to the coil, closing the contacts of the ECD main relay (Marking: ECD) and supplying power to the terminal +B of the engine ECU.

WIRING DIAGRAM

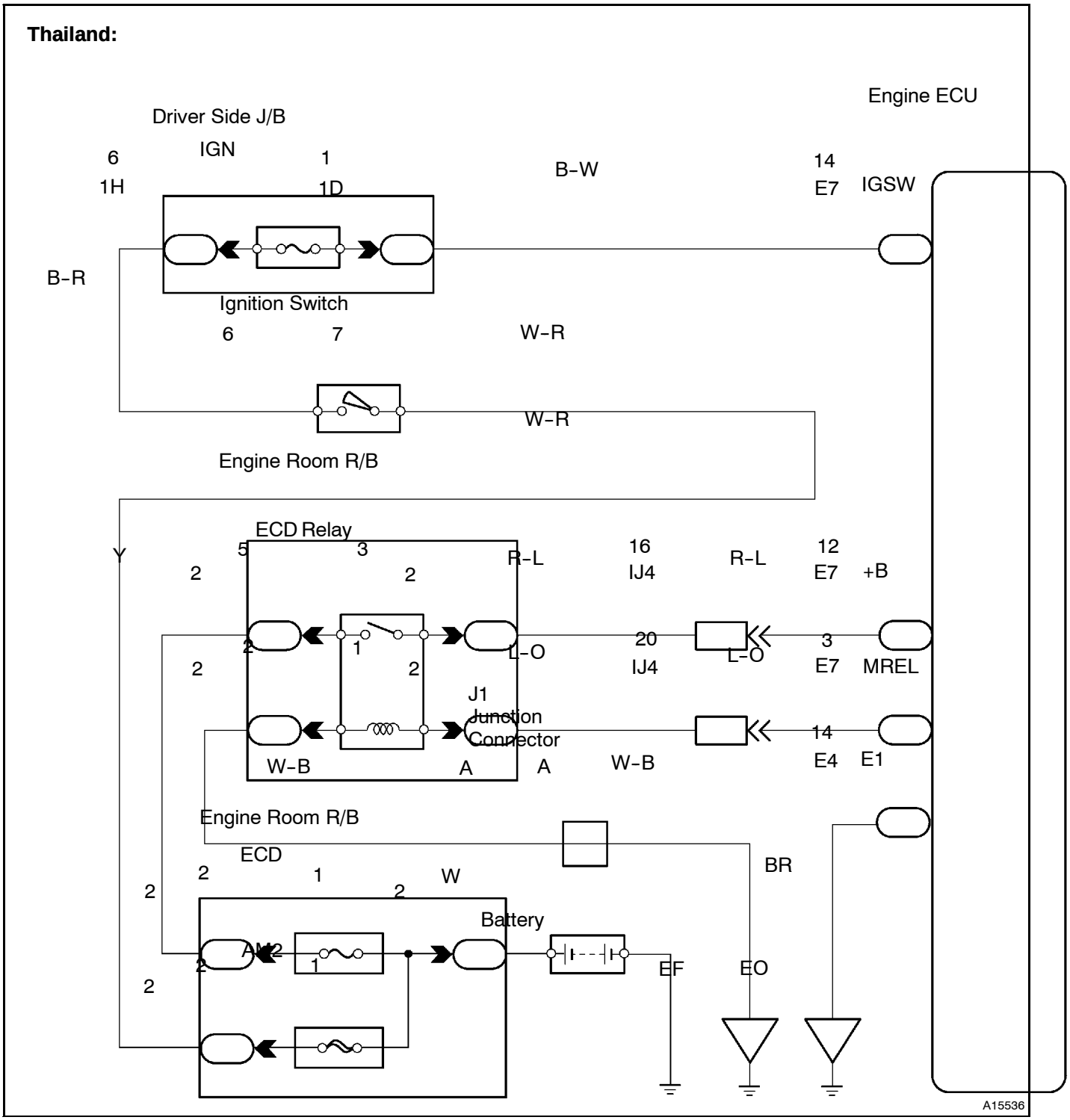
Australia:



South Africa:

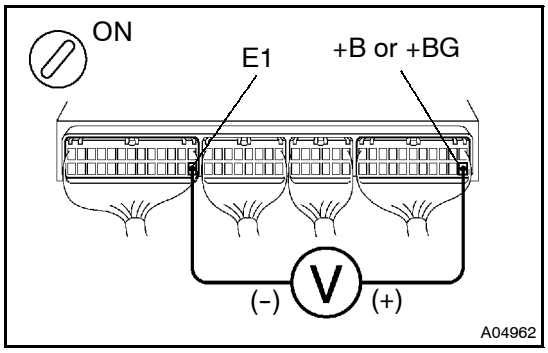


Thailand:


Engine ECU
Driver Side J/B
IGN
6
1H
1
1D
B-W
14
E7
IGSW
B-R
Ignition Switch
6
7
W-R
W-R
Engine Room R/B
ECD Relay
5
3
2
2
R-L
16
IJ4
R-L
12
E7
+B
Y
2
2
1
2
L-O
20
IJ4
L-O
3
E7
MREL
J1
Junction
Connector
W-B
A
A
W-B
14
E4
E1
Engine Room R/B
ECD
2
1
W
2
BR
2
Battery
AM2
2
1
2
EF
EO
A15536

INSPECTION PROCEDURE

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



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals +B or +BGand E1 of engine ECU.

OK:

Voltage: 9 - 14 V

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI-25).**

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 ECD relay (Marking: ECD) (See page ED-9).**

NG → **Replace ECD relay.**

CONTINUED

OK

4	**Check ECD fuse.**

PREPARATION:

Remove the ECD fuse from the engine room J/B.

CHECK:

Check continuity of ECD fuse.

OK:

Continuity

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

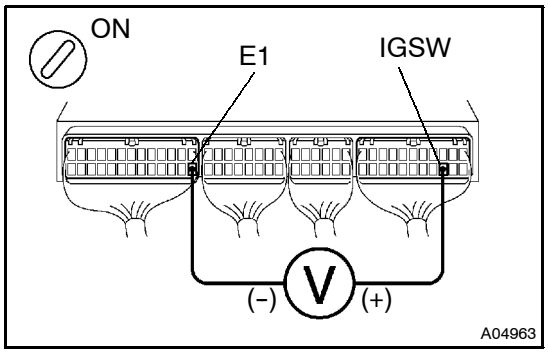
OK ↓

5	**Check for open in harness and connector between engine ECU and ECD main relay (Marking: ECD), ECD main relay and battery (See page IN-19).**

NG → **Repair 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 voltage between terminals IGSW and E1 of engine ECU.

OK:

Voltage : 9 - 14 V

OK → **Go to step 9.**

CONTINUED

NG ↓

7	Check ignition switch (See Pub. No. RM585E BE section).

NG → Replace ignition switch.

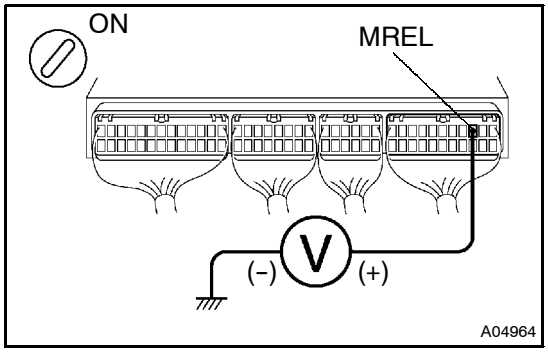
OK

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 voltage between terminal MREL of engine ECU and body ground.

OK:

Voltage: 9 - 14 V

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

NG

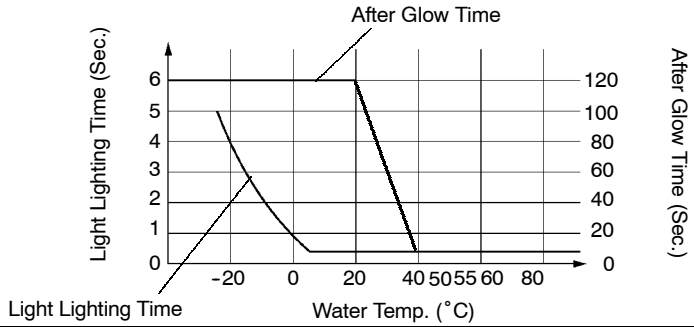
Check for open in harness and connector between engine ECU and ECD relay (Marking: ECD), ECD relay and body ground (See page IN-19).

DI8NW-01

Pre-Heating Control Circuit

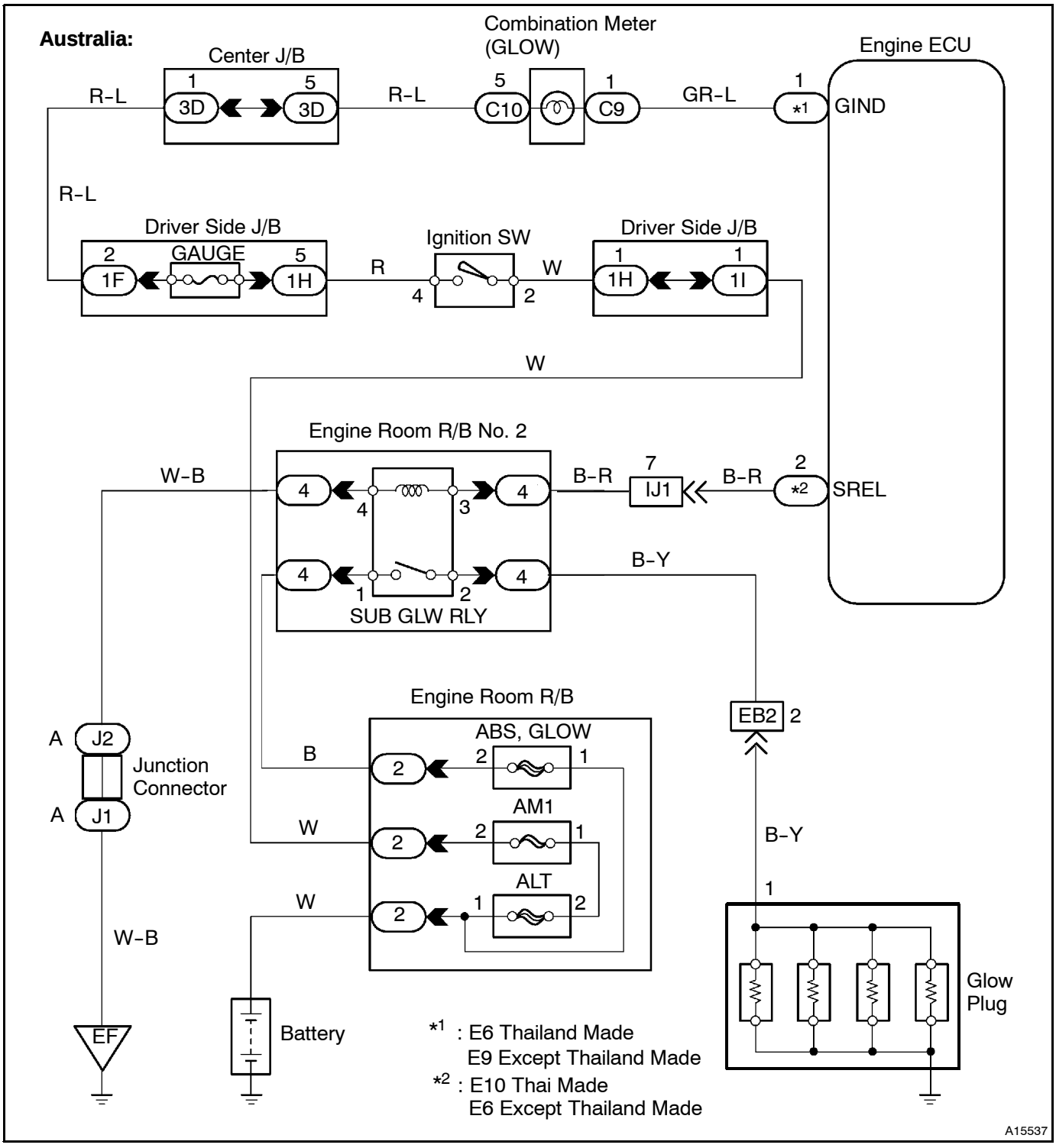
CIRCUIT DESCRIPTION

When the ignition switch turns ON, the engine ECU calculates the glow indicator lighting time/heating corresponding to the coolant temperature at that time and turns ON the glow indicator light/glow plug relay.
As the ceramics is used for a flow plug material, the current control is not performed.

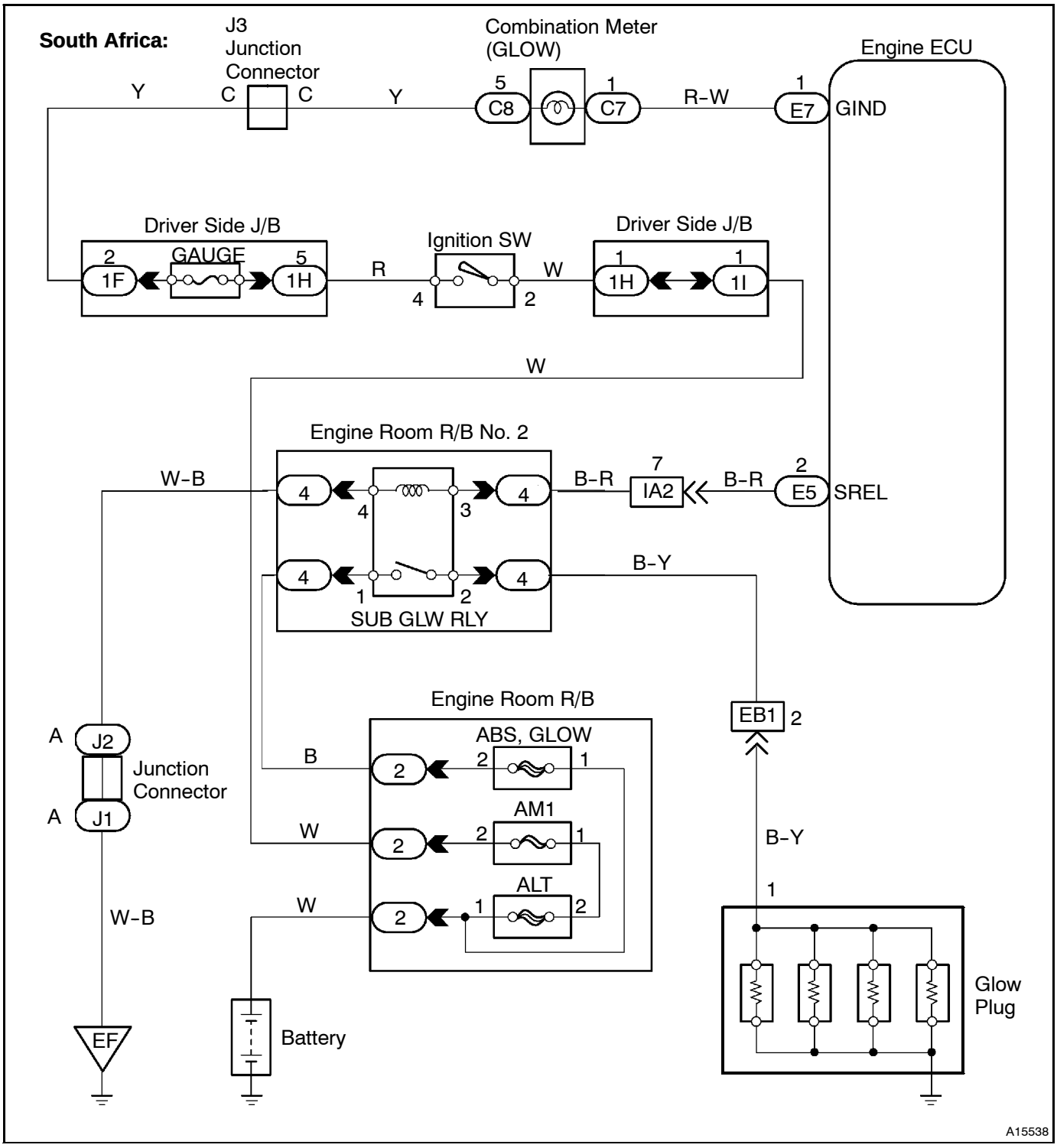


A15544

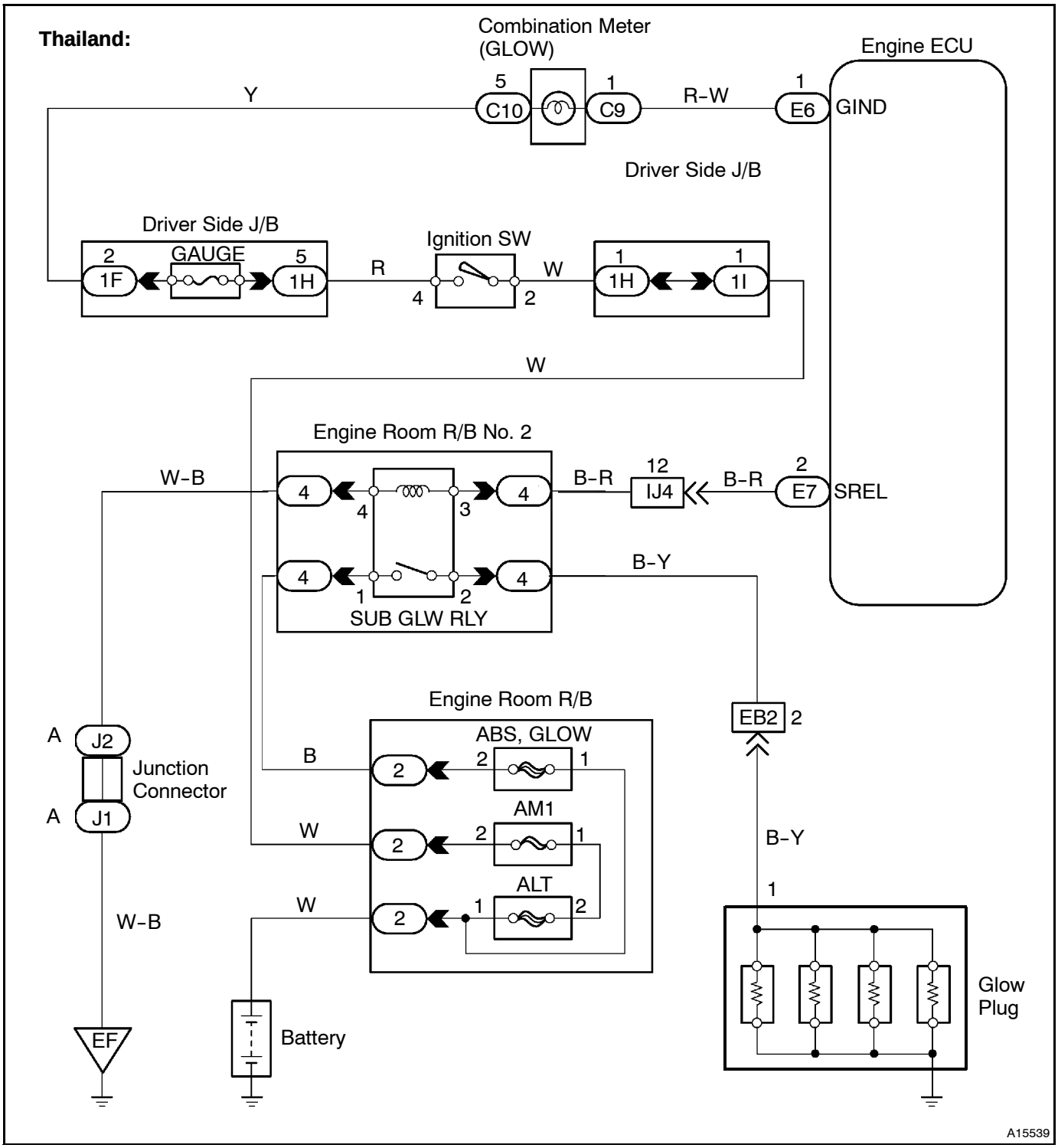
WIRING DIAGRAM



CONTINUED


South Africa:
J3
Junction
Connector
Combination Meter
(GLOW)
Engine ECU
Y
C
C
Y
5
C8
1
C7
R-W
1
E7
GIND
Driver Side J/B
2
1F
GAUGE
5
1H
R
Ignition SW
4
2
W
Driver Side J/B
1
1H
1
1I
W
Engine Room R/B No. 2
W-B
4
4
4
3
B-R
7
IA2
B-R
2
E5
SREL
4
4
1
2
4
SUB GLW RLY
B-Y
Engine Room R/B
EB1
2
ABS, GLOW
B
2
2
1
AM1
W
2
2
1
ALT
W
2
1
2
A
J2
Junction
Connector
A
J1
W-B
B-Y
1
Glow
Plug
EF
Battery
A15538

CONTINUED


Thailand:
Combination Meter
(GLOW)
Engine ECU
5
C10
1
C9
Y
R-W
1
E6
GIND
Driver Side J/B
Driver Side J/B
2
1F
GAUGE
5
1H
R
Ignition SW
4
2
W
1
1H
1
1I
W
Engine Room R/B No. 2
W-B
4
4
4
3
B-R
12
IJ4
B-R
2
E7
SREL
4
4
1
2
4
SUB GLW RLY
B-Y
Engine Room R/B
EB2
2
A
J2
Junction
Connector
A
J1
ABS, GLOW
B
2
2
1
AM1
W
2
2
1
ALT
W
2
1
2
B-Y
1
W-B
EF
Battery
Glow
Plug
A15539

INSPECTION PROCEDURE

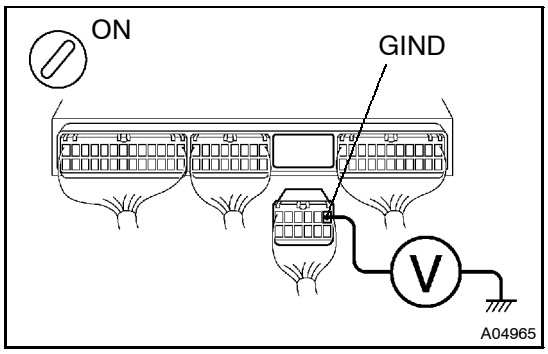
1	**Does glow indicator light up?**

PREPARATION:
Turn ignition switch ON.
CHECK:
Does the glow indicator light up?
OK:
The glow indicator lights up for 0.5 sec. or more.

OK	**Go to step 5.**

NG

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



PREPARATION:
(a) Remove the glove compartment door (See page ED-24).
(b) Disconnect the connector of engine ECU.
(c) Turn ignition switch ON.
CHECK:
Measure voltage between terminal GIND of engine ECU connector and body ground.
OK:
Voltage: 9 - 14 V

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

NG

3	**Check GLOW fuse.**

PREPARATION:
Remove the GLOW fuse.
CHECK:
Measure continuity of GAUGE fuse.
OK:
Continuity

CONTINUED

NG	**Check for short in all the harness and components connected to GLOW fuse.**

OK

4	Check glow indicator light bulb.

NG → Replace bulb.

OK

Check for open in harness and connector between combination meter and engine ECU, combination meter and GLOW fuse (See page IN-19).

5	Check glow indicator lighting time and after glow time (Refer to Pub. No. RM582E on ST section).

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

OK

6	Are there any DTC being output?

YES → Go to relevant DTC chart.

NO

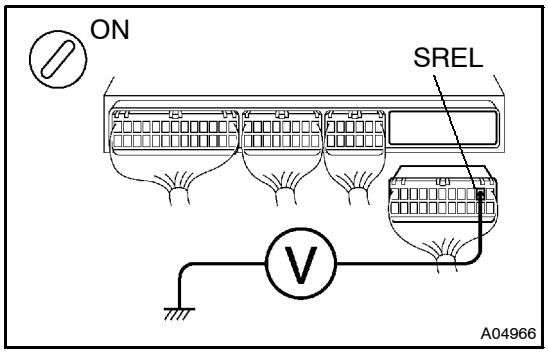
7	Check glow plug relay (Refer to Pub. No. RM582E on ST section).

NG → Replace glow plug relay.

CONTINUED

OK

8	Check voltage between terminal SREL of engine ECU and body ground at cranking.



PREPARATION:

(a) Remove the glove compartment door (See page ED-24).

(b) Disconnect the connector of engine ECU.

(c) Turn ignition switch STA.

CHECK:

Measure voltage between terminal SREL of engine ECU and body ground at cranking.

OK:

Voltage: 9 - 14 V

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

OK

9	Check for open and short in harness and connector between glow plug relay and engine ECU, glow plug relay and body ground (See page IN-19).

NG → **Repair harness or connector.**

OK

10	Check resistance of glow plug (Refer to Pub. No. RM582E on ST section).

NG → **Replace glow plug.**

OK

CONTINUED

11	Inspect glow plug installation.

NG → Tighten glow plug.

OK

12	Check for open in harness and connector between glow plug relay and glow plug (See page IN-19).

NG → Repair harness or connector.

OK

Proceed to next circuit inspection shown on problem symptoms table (See page DI-25).

EGR Control Circuit

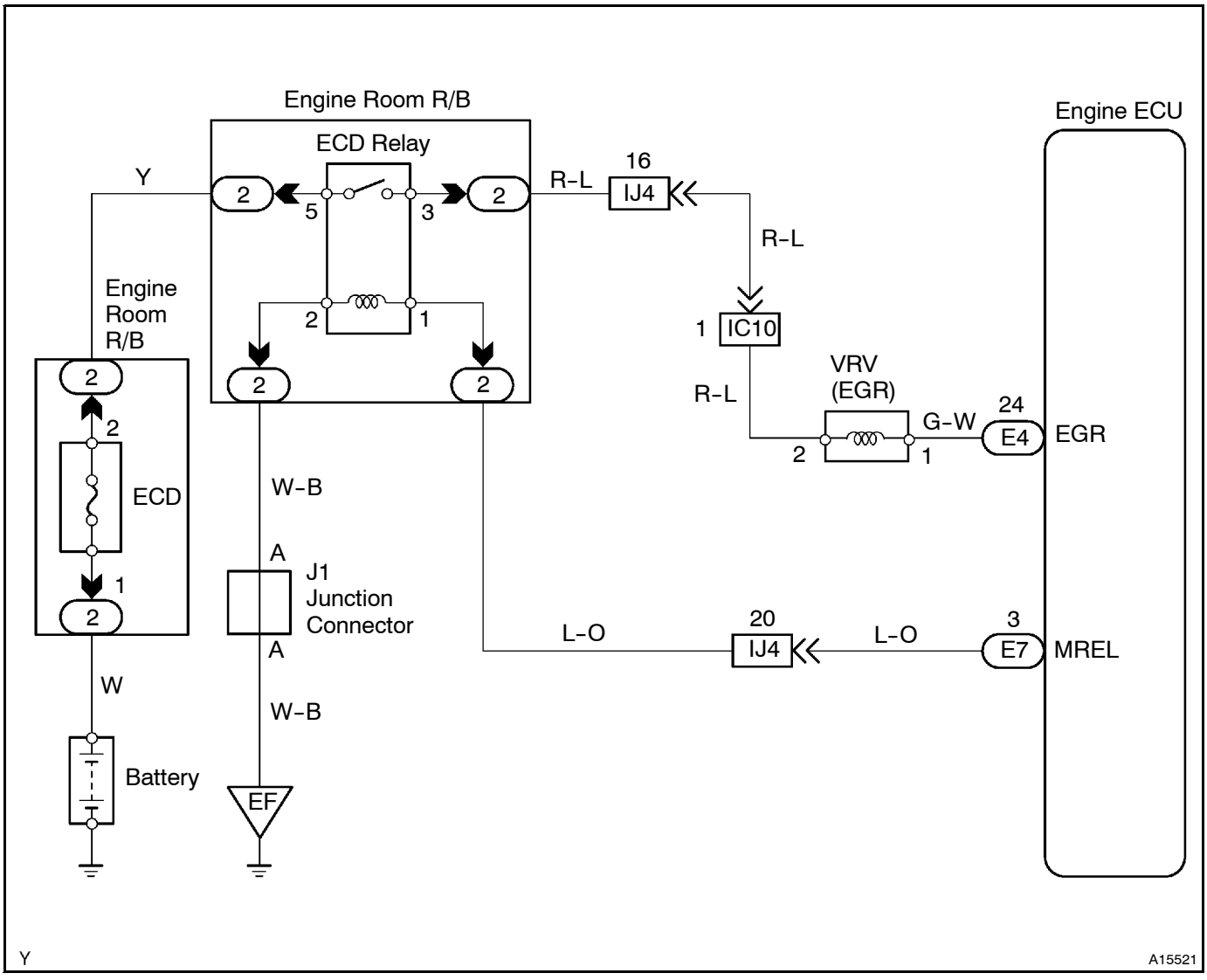
CIRCUIT DESCRIPTION

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 EGR valve is controlled by the vacuum which is regulated by the VRV operated by the engine ECU.
Under the following conditions, 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)
- Full speed over 3,200 rpm

WIRING DIAGRAM



INSPECTION PROCEDURE

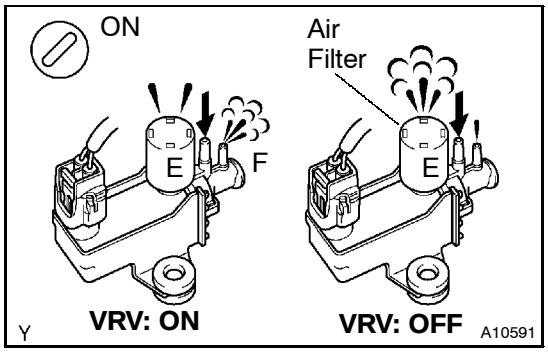
When using hand-held tester

1	Check the connection of vacuum hose between vacuum pump and VRV for EGR, VRV for EGR and EGR valve.

NG → Repair or replace.

OK ↓

2	Check operation of VRV for EGR.



PREPARATION:

(a) Disconnect the vacuum hoses from the VRV for EGR.
(b) Connect the hand-held tester to the DLC3.
(c) Turn ignition switch ON and push hand-held tester main switch ON.
(d) Select the active test mode on the hand-held tester.

CHECK:

Check operation of VRV for EGR, when it is operated by the hand-held tester.

OK:

(a) VRV ON:
Air from pipe E is flowing out through pipe F.
(b) VRV OFF:
Air from pipe E is flowing out through air filter.

OK → Go to step 5.

NG ↓

3	Check VRV for EGR (See page EC-7).

NG → Replace the VRV for EGR.

OK ↓

CONTINUED

4	Check for open and short in harness and connector between VRV for EGR and engine ECU, VRV for EGR and ECD relay (Marking : ECD) (See page IN-19).

NG → Repair or replace harness or connector.

OK

5	Check EGR valve (See page EC-4).

NG → Replace the EGR valve.

OK

6	Check EGR system (See page EC-4).

NG → Repair or replace.

OK

Proceed to next circuit inspection shown on problem symptoms table (See page DI-25).

When not using hand-held tester

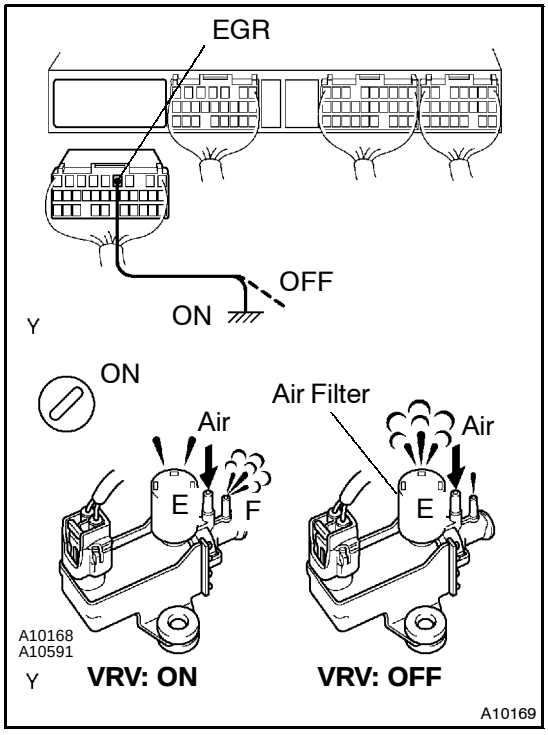
1	Check the connection of vacuum hose between vacuum pump and VRV for EGR, VRV for EGR and EGR valve.

NG → Repair or replace.

CONTINUED

OK

2	Check operation of VRV for EGR.



PREPARATION:

(a) Remove glove compartment door (See page ED-24).
(b) Disconnect the connector of engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Check E VRV operation.

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

OK:

(3) VRV ON :
Air from pipe E is flowing out through pipe F.
(4) VRV OFF :
Air from pipe E is flowing out through air filter.

OK	Go to step 5.

NG

3	Check VRV for EGR (See page EC-7).

NG	Replace the VRV for EGR.

OK

CONTINUED

4	Check for open and short in harness and connector between VRV for EGR and engine ECU, VRV for EGR and ECD relay (Marking : ECD) (See page IN-19).

NG → Repair or replace harness or connector.

OK

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

5	Check EGR valve (See page EC-4).

NG → Replace the EGR valve.

OK

6	Check EGR system (See page EC-4).

NG → Repair or replace.

OK

Proceed to next circuit inspection shown on problem symptoms table (See page DI-25).

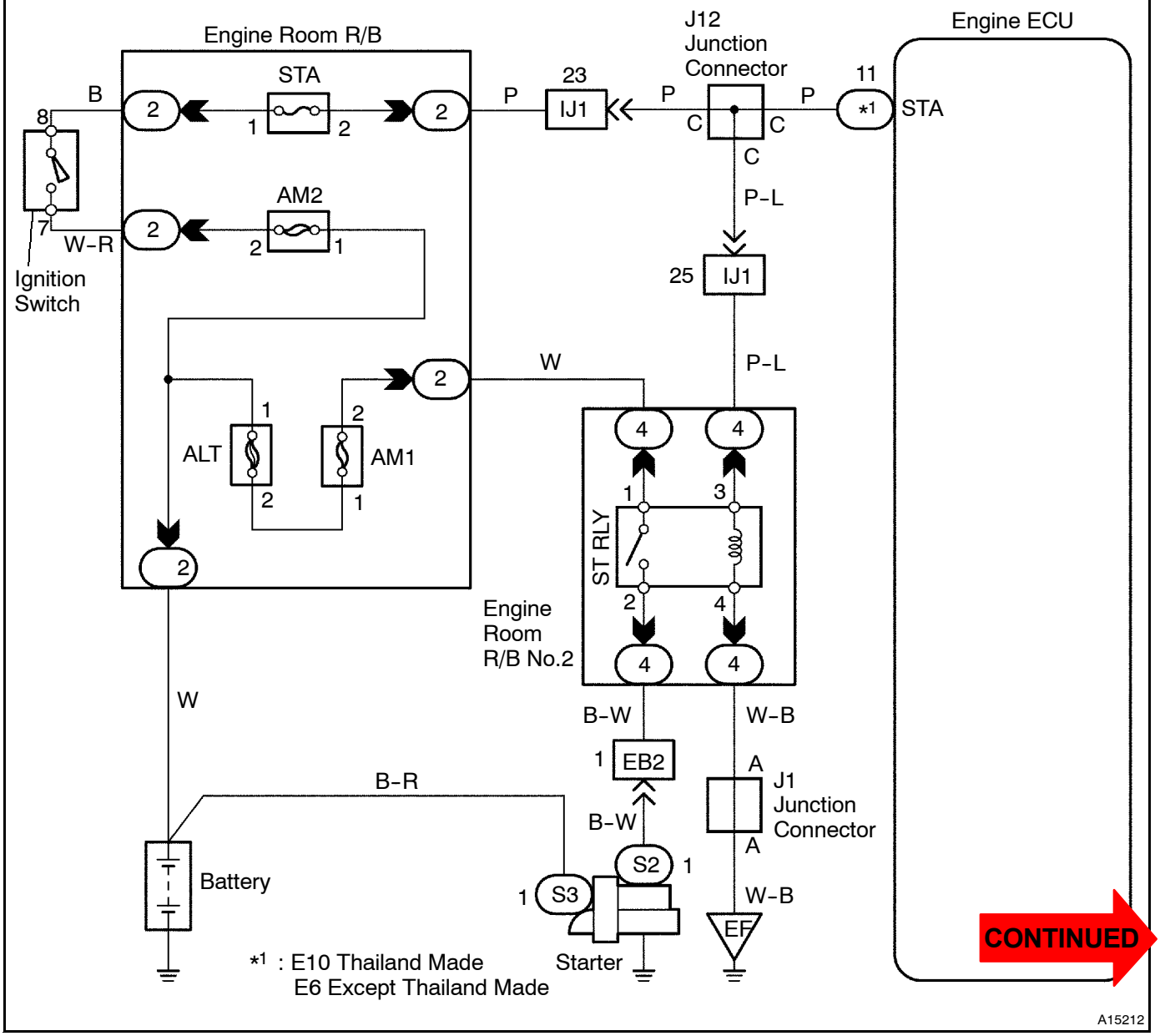
Starter Signal Circuit Malfunction

CIRCUIT DESCRIPTION

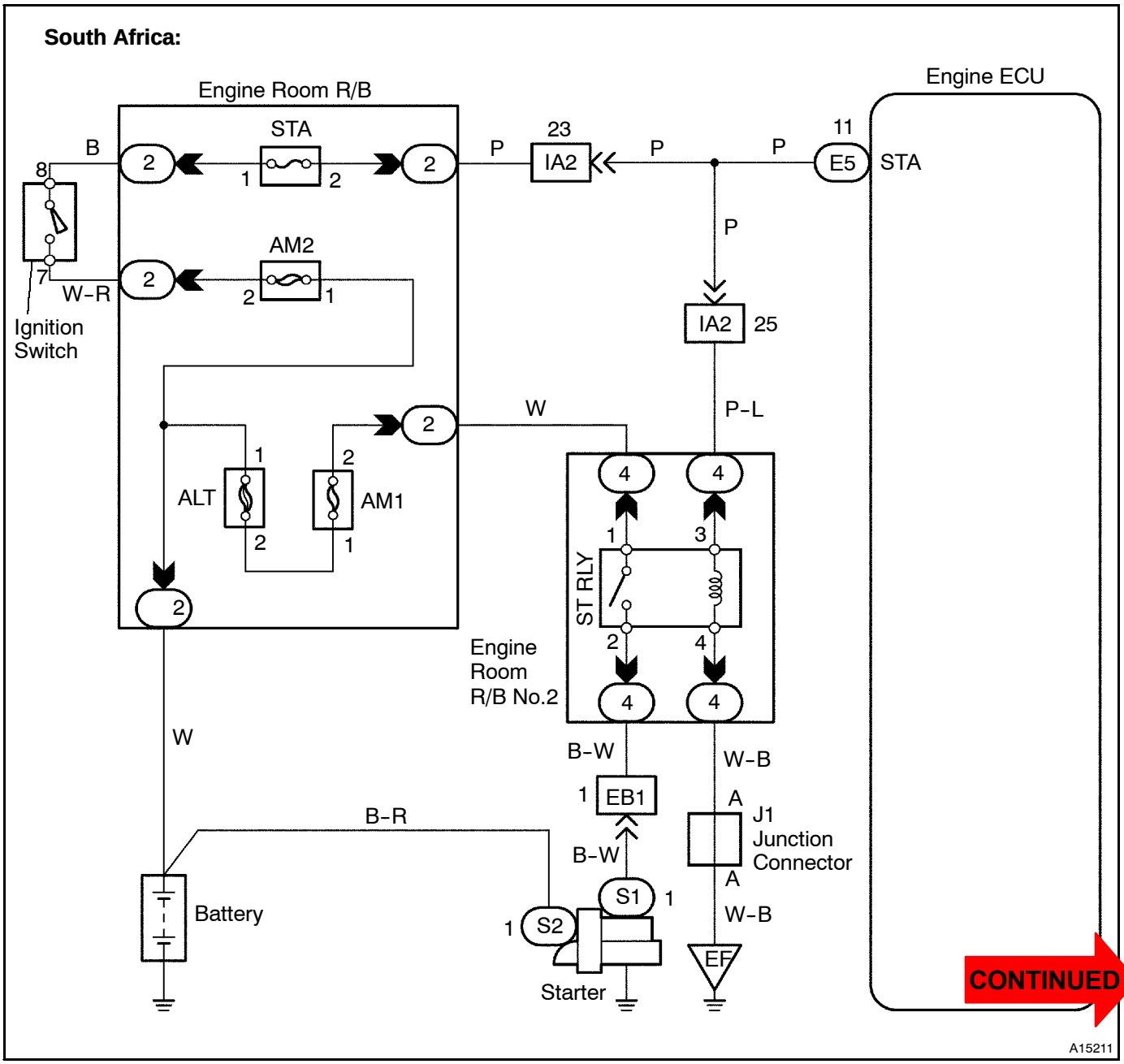
When the engine is being cranked, the intake air flow is slow, so fuel vaporization is poor. A rich mixture is therefore necessary in order to achieve good start ability. While the engine is being cranked, the battery positive voltage is applied to terminal STA of the engine ECU. The starter signal is mainly used to increase the fuel injection volume for the starting injection control and after-start injection control.

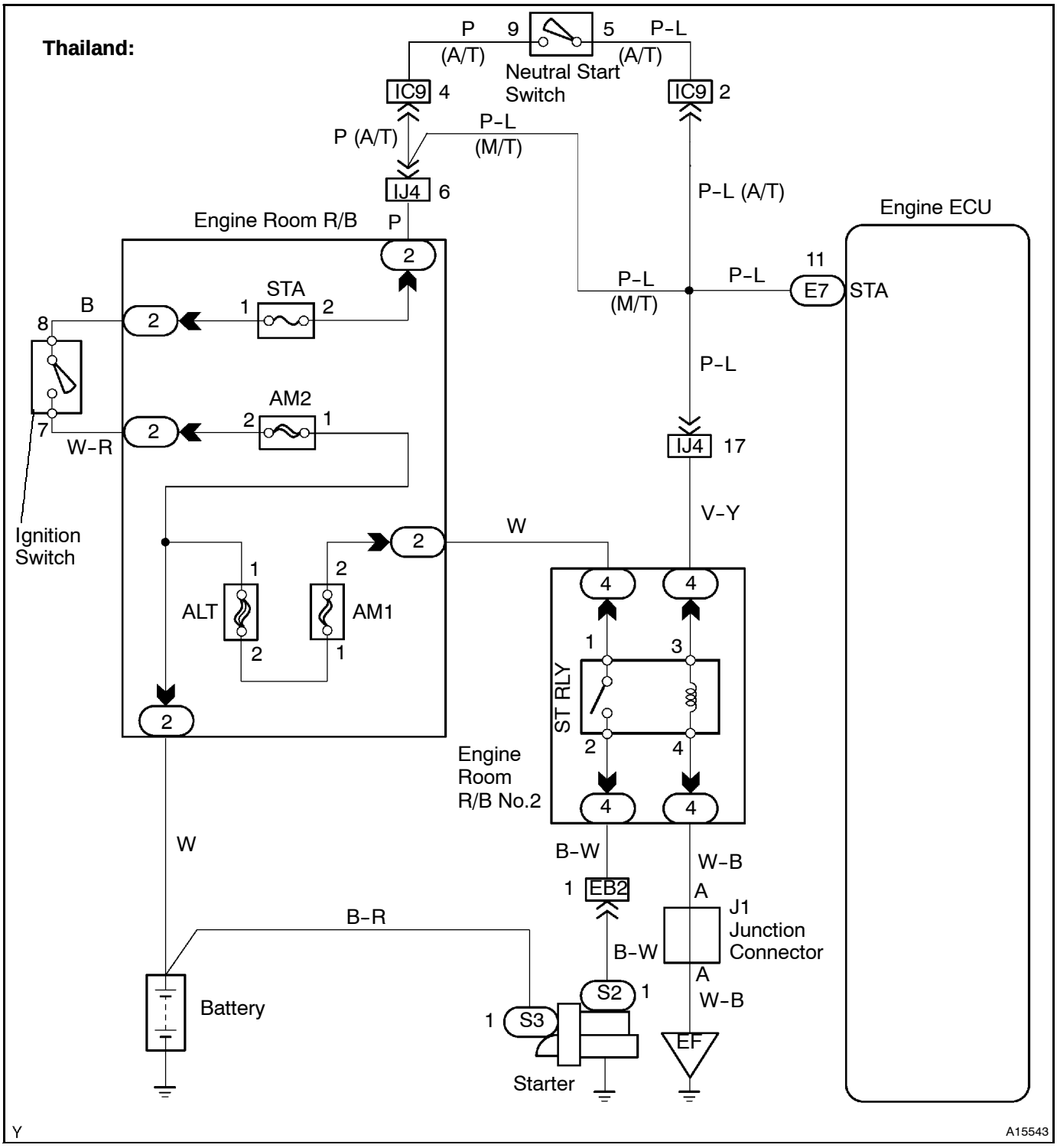
WIRING DIAGRAM

Australia:



South Africa:




Thailand:
P
9
5
P-L
(A/T)
(A/T)
Neutral Start
Switch
IC9
4
IC9
2
P (A/T)
P-L
(M/T)
IJ4
6
P-L (A/T)
Engine ECU
Engine Room R/B
P
2
11
P-L
P-L
E7
STA
B
STA
1
2
8
2
P-L
AM2
2
1
7
W-R
2
IJ4
17
V-Y
Ignition
Switch
W
2
1
2
ALT
AM1
2
1
4
4
1
3
ST RLY
2
4
2
Engine
Room
R/B No.2
4
4
W
B-W
W-B
1
EB2
A
J1
Junction
Connector
B-R
B-W
A
S2
1
W-B
Battery
1
S3
EF
Starter
Y
A15543

INSPECTION PROCEDURE

When using hand-held tester

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-25.

1	**Connect the hand-held tester and check STA signal.**

PREPARATION:

(a) Connect the hand-held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand-held tester main switch ON.

CHECK:

Read STA signal on the hand-held tester while starter operates.

OK:

Ignition switch position	ON	STA
STA signal	OFF	ON

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI-25).**

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

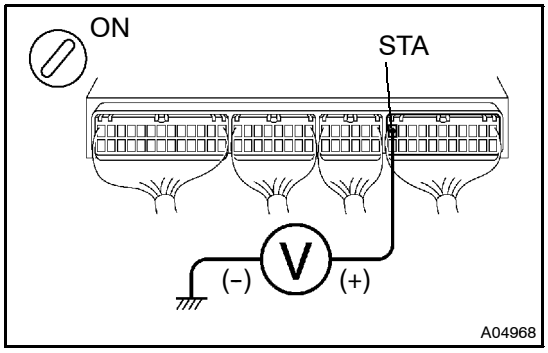
Check and replace engine ECU (See page IN-19).

When not using hand-held tester

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-25.

1	Check the starter signal.



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure voltage between terminal STA of 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-25).

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).

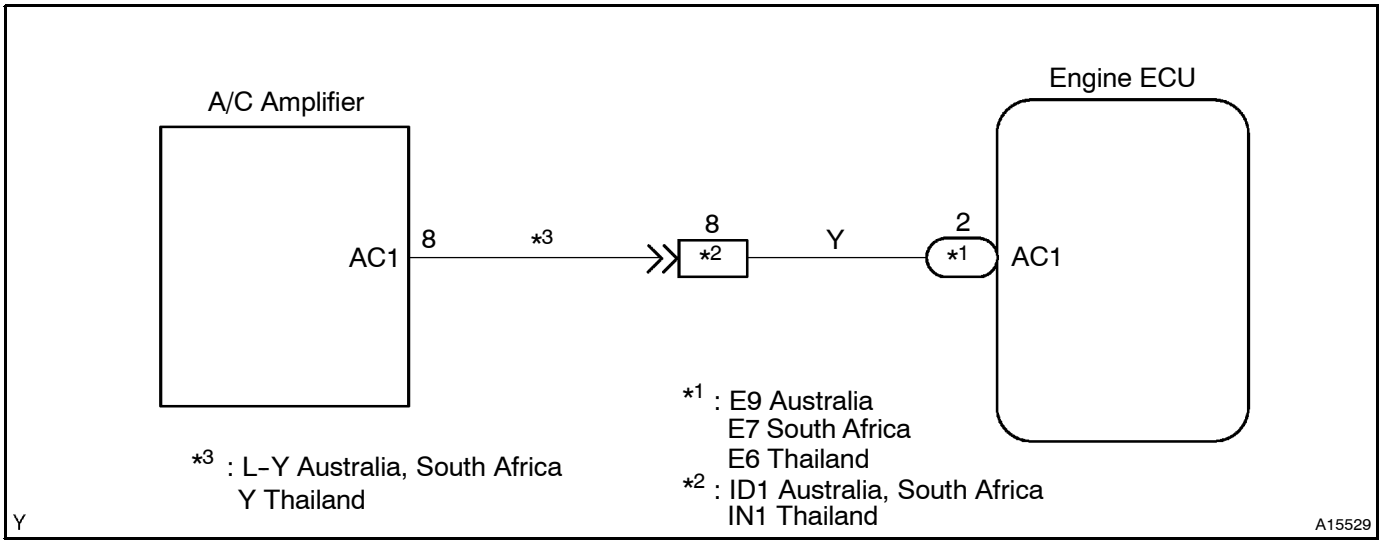
DI8NX-01

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 hand-held tester

1	**Connect the hand-held tester and check A/C signal.**

PREPARATION:

(a) Connect the hand-held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand-held tester main switch ON.

CHECK:

Read A/C signal on the hand-held tester while A/C compressor is ON.

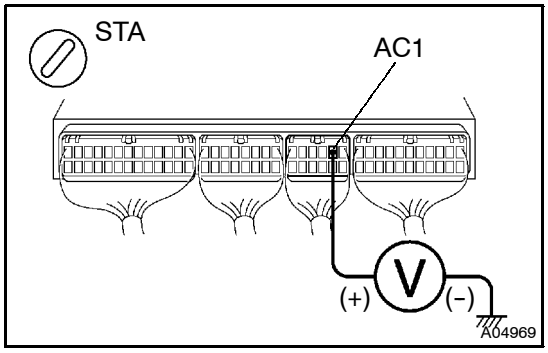
OK:

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-25).**

NG → CONTINUED

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

OK:

A/C switch condition	Voltage
ON	Below 1.5 V
OFF	7.5 - 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).

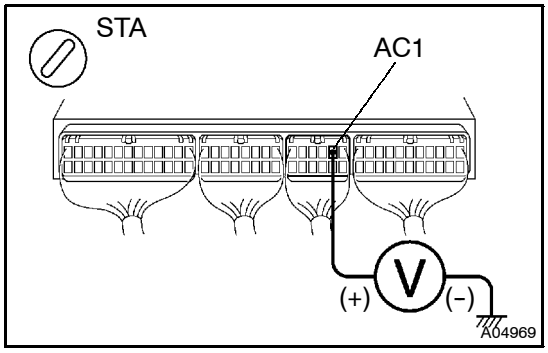
NG → **Repair or replace harness or connector.**

OK

Check and replace A/C amplifier.

When not using hand-held tester

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

OK:

A/C switch condition	Voltage
ON	Below 1.5 V
OFF	7.5 - 14 V

CONTINUED

OK → Proceed to next circuit inspection shown on problem symptoms table (See page DI-25).

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

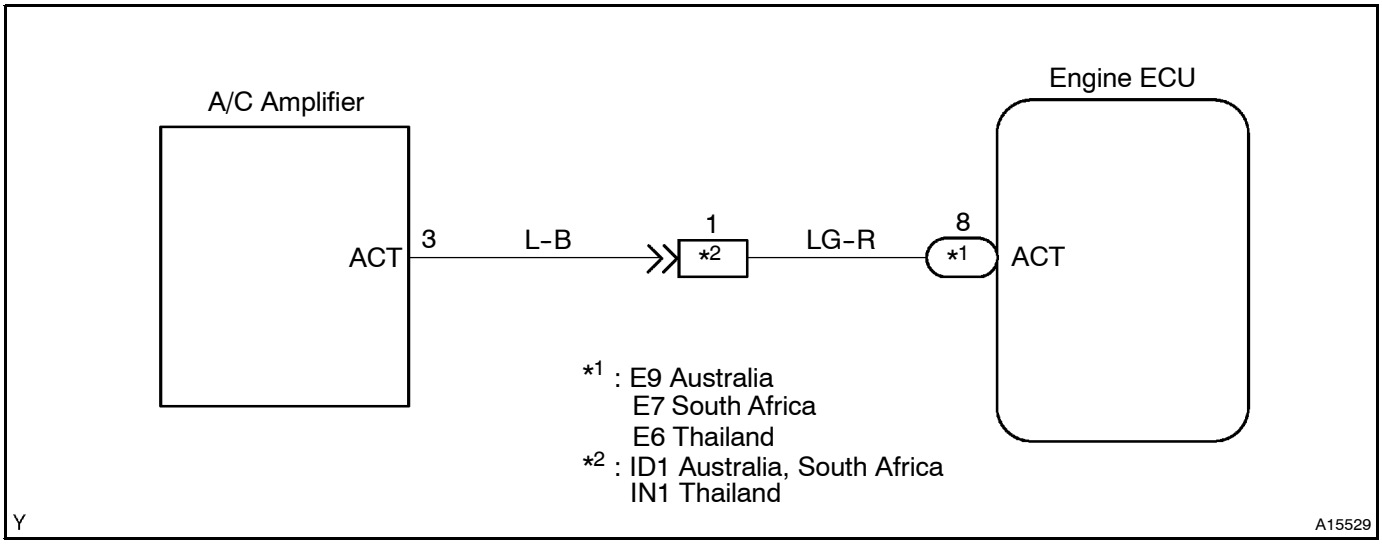
Check and replace A/C amplifier.

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 out putting the engine coolant temperature to A/C amplifier.

WIRING DIAGRAM



INSPECTION PROCEDURE
When using hand-held tester

1	**Connect the hand-held tester and check operation of air conditioning cut control.**

PREPARATION:

(a) Connect the hand held tester to the DLC3.
(b) Turn the ignition switch ON and push the hand-held tester main switch ON.
(c) Start the engine and air conditioning switch ON.

HINT:
A/C magnetic clutch is turned ON.

(d) Select the ACTIVE TEST mode on the hand-held tester.

CHECK:

Check operation of A/C magnetic clutch cut when air conditioning cut control is operated by the hand-held tester.

OK:

A/C magnet clutch is turned OFF.

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI-25).**

NG

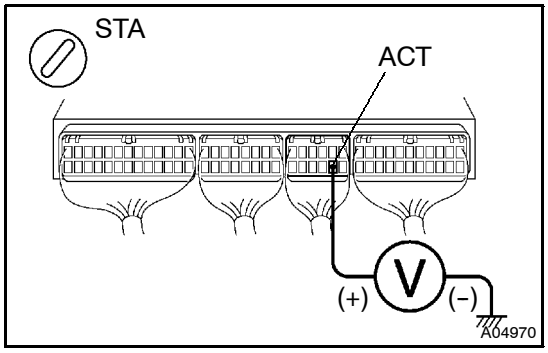
2	**Check for open and short in harness and connector between engine ECU and A/C amplifier (See page IN-19).**

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

OK

CONTINUED

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 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 - 14 V
OFF	0 - 3 V

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

OK →

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

When not using hand-held tester

1	**Check voltage between terminal ACT of engine ECU and body ground (See page DI-111, Step 3).**

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-109, Step 4).**

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

CONTINUED

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.

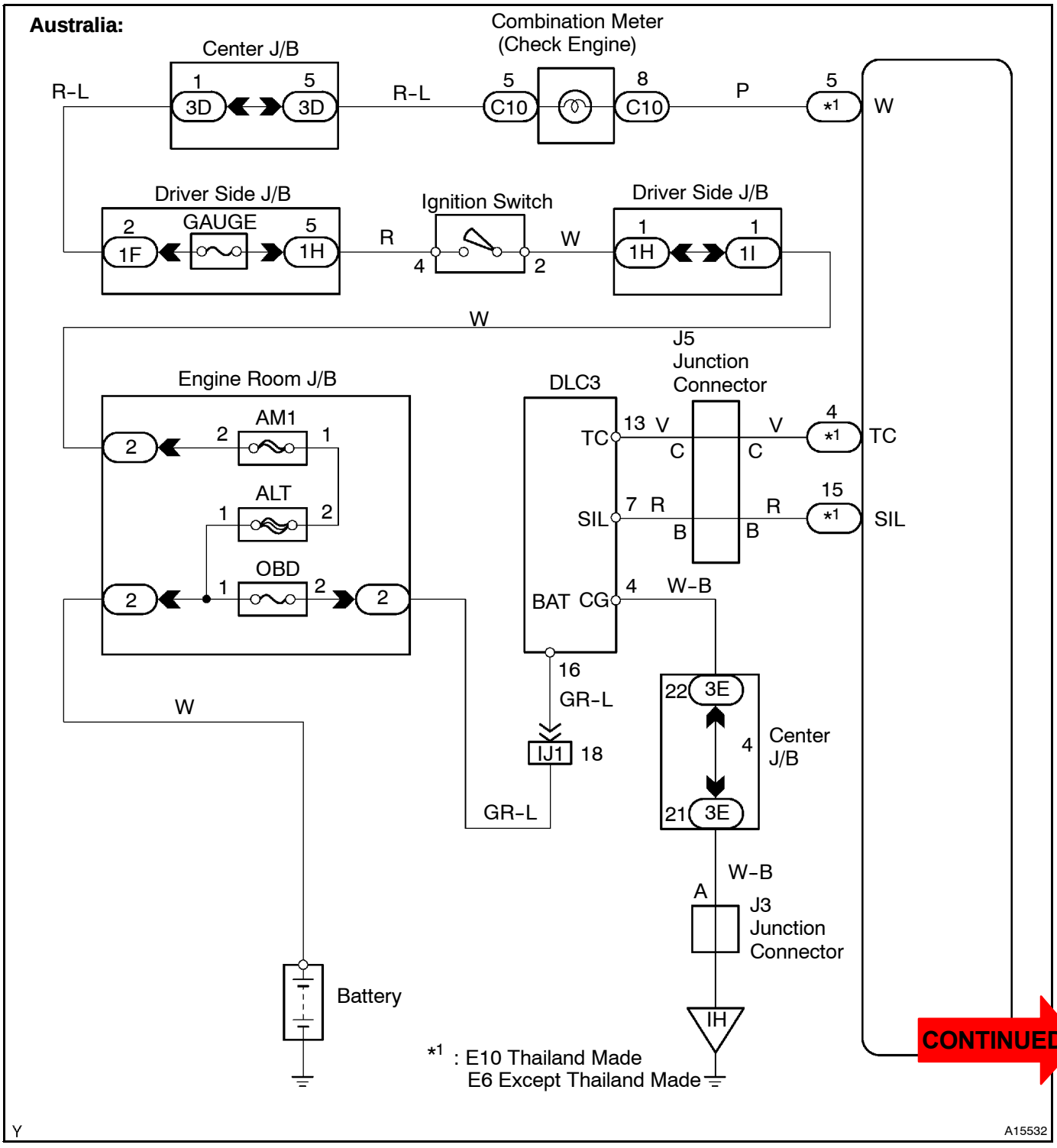
DI8NY-01

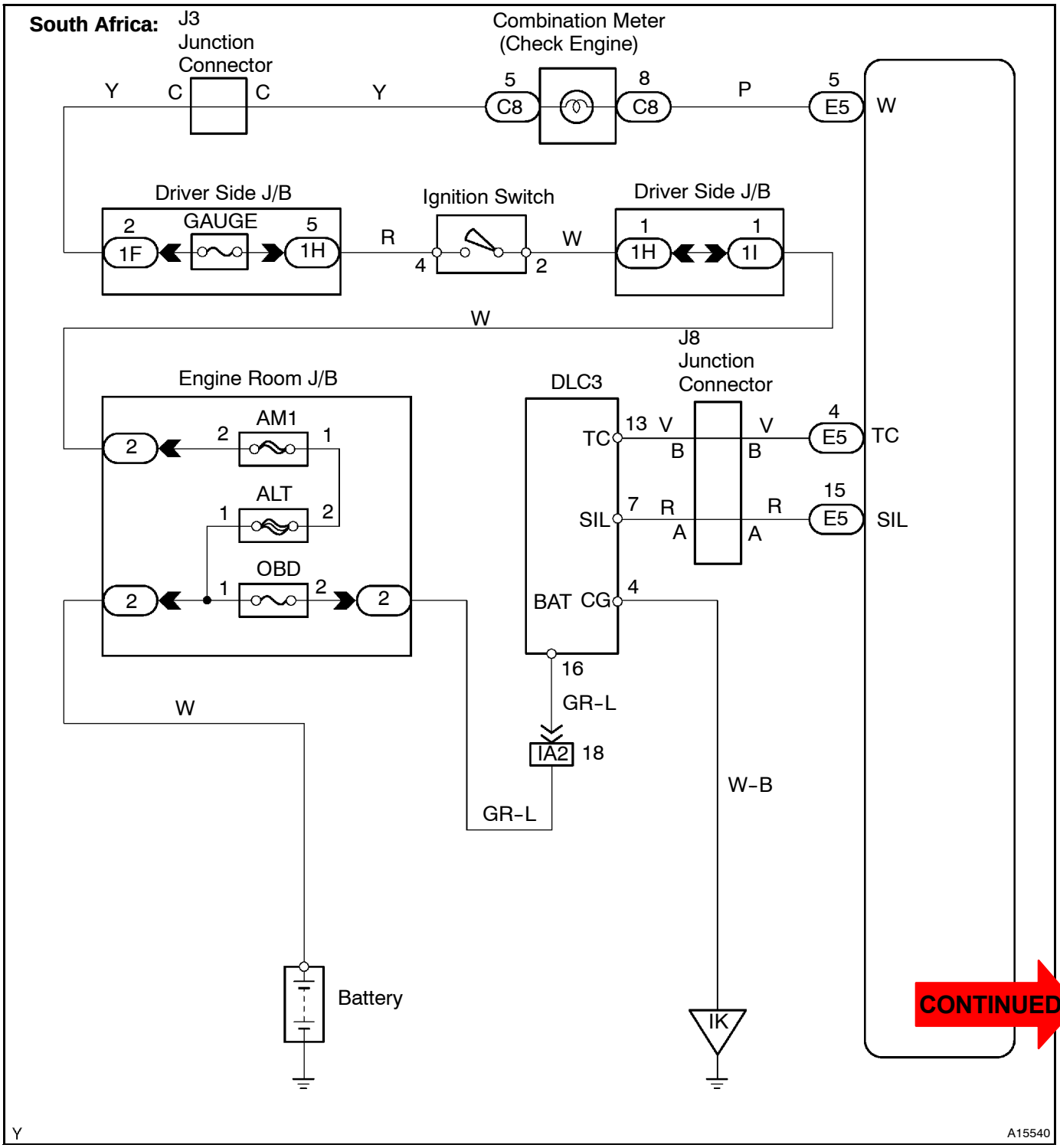
Diagnostic Connector (DLC3) Circuit

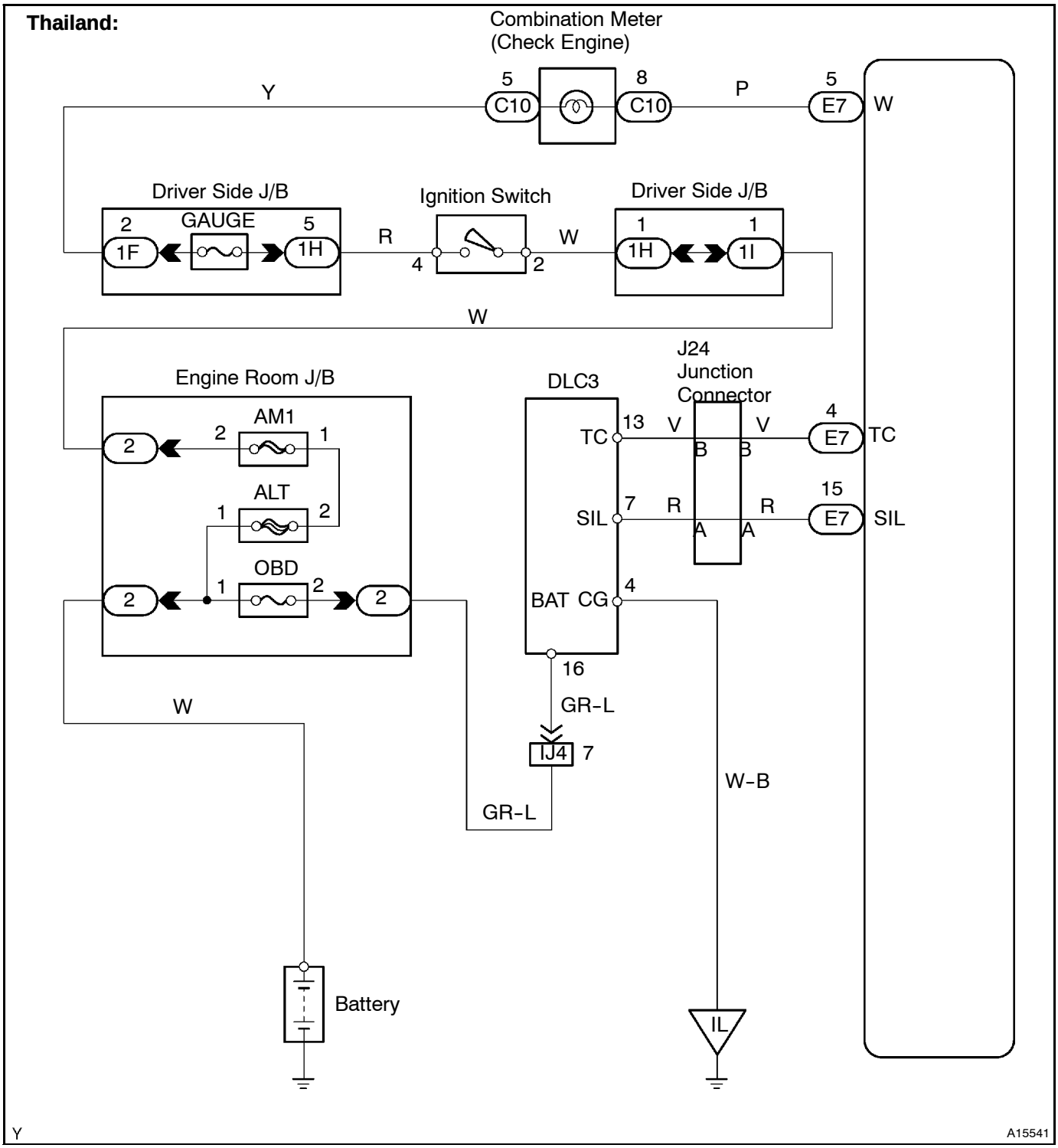
CIRCUIT DESCRIPTION

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, DTC 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 hand-held tester.

WIRING DIAGRAM

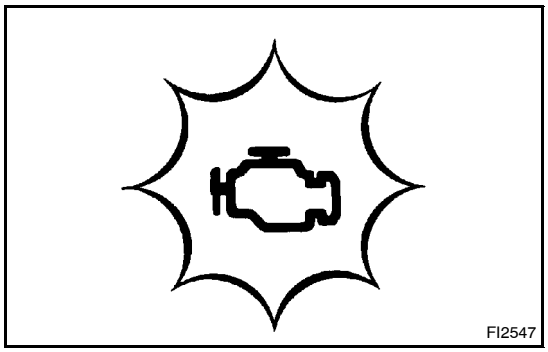



South Africa:
J3
Junction
Connector
Combination Meter
(Check Engine)
Y
C
C
Y
5
C8
8
C8
P
5
E5
W
Driver Side J/B
2
GAUGE
5
1F
1H
R
Ignition Switch
4
2
W
Driver Side J/B
1
1H
1
1I
W
J8
Junction
Connector
Engine Room J/B
AM1
2
1
2
ALT
1
2
OBD
1
2
2
2
DLC3
TC
13
V
B
V
B
4
E5
TC
SIL
7
R
A
R
A
15
E5
SIL
BAT
CG
4
16
GR-L
IA2
18
W
GR-L
W-B
Battery
IK
CONTINUED
Y
A15540


Thailand:
Combination Meter
(Check Engine)
Y
5
C10
8
C10
P
5
E7
W
Driver Side J/B
2
GAUGE
5
1F
1H
R
Ignition Switch
4
2
W
Driver Side J/B
1
1
1H
1I
W
J24
Junction
Connector
Engine Room J/B
AM1
2
1
2
ALT
1
2
OBD
1
2
2
2
DLC3
TC
13
V
B
V
B
4
E7
TC
SIL
7
R
A
R
A
15
E7
SIL
BAT
CG
4
16
GR-L
IJ4
7
GR-L
W-B
W
Battery
IL
Y
A15541

INSPECTION PROCEDURE

1	Check the check engine warning light condition.



PREPARATION:

(a) Turn the ignition switch ON.

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

SST 09843-18020

CHECK:

Check the check engine warning light condition.

OK:

Check engine warning light : Blinking

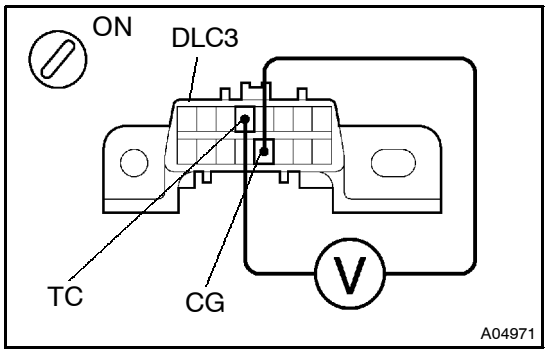
HINT:

If this inspection OK and there is no hand-held tester, do not need to do the following steps and this circuit is OK. Proceed to next circuit inspection shown on problem symptom table (See page DI-25).

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 DLC3.

OK:

Voltage : 9 - 14 V

CONTINUED

OK	Go to step 5.

NG

3	Check continuity terminal CG of DLC3 and body ground.

NG → Repair or replace harness or connector.

OK

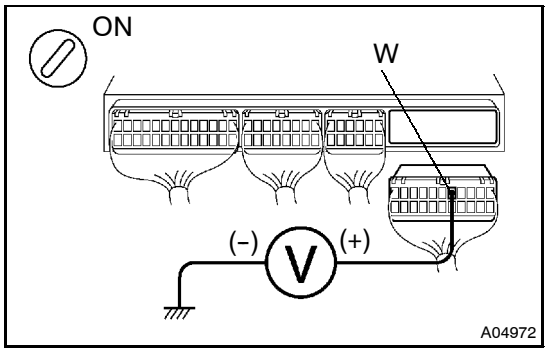
4	Check for open and short in harness and connector between terminal TC of DLC3 and terminal TC of engine ECU (See page IN-19).

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 connector of engine ECU.
(c) Turn the ignition switch ON.

CHECK:

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

OK:

Voltage : 9 - 14 V

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

CONTINUED

NG

6	Check the bulb of check engine warning light.

NG → Replace bulb.

OK →

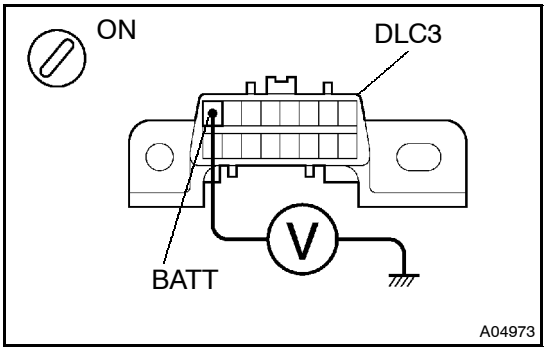
Check for open in harness and connector between terminal W of engine ECU and combination meter (See page IN-19).

7	Can you read the DTC (including normal DTC) using hand-held tester?

YES → Proceed to next circuit inspection shown on problem symptom table (See page DI-25).

NO →

8	Check voltage between terminal BATT of DLC3 and body ground.



CHECK:

Measure voltage between terminal BATT of DLC3 and body ground.

OK:

Voltage : 9 - 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).

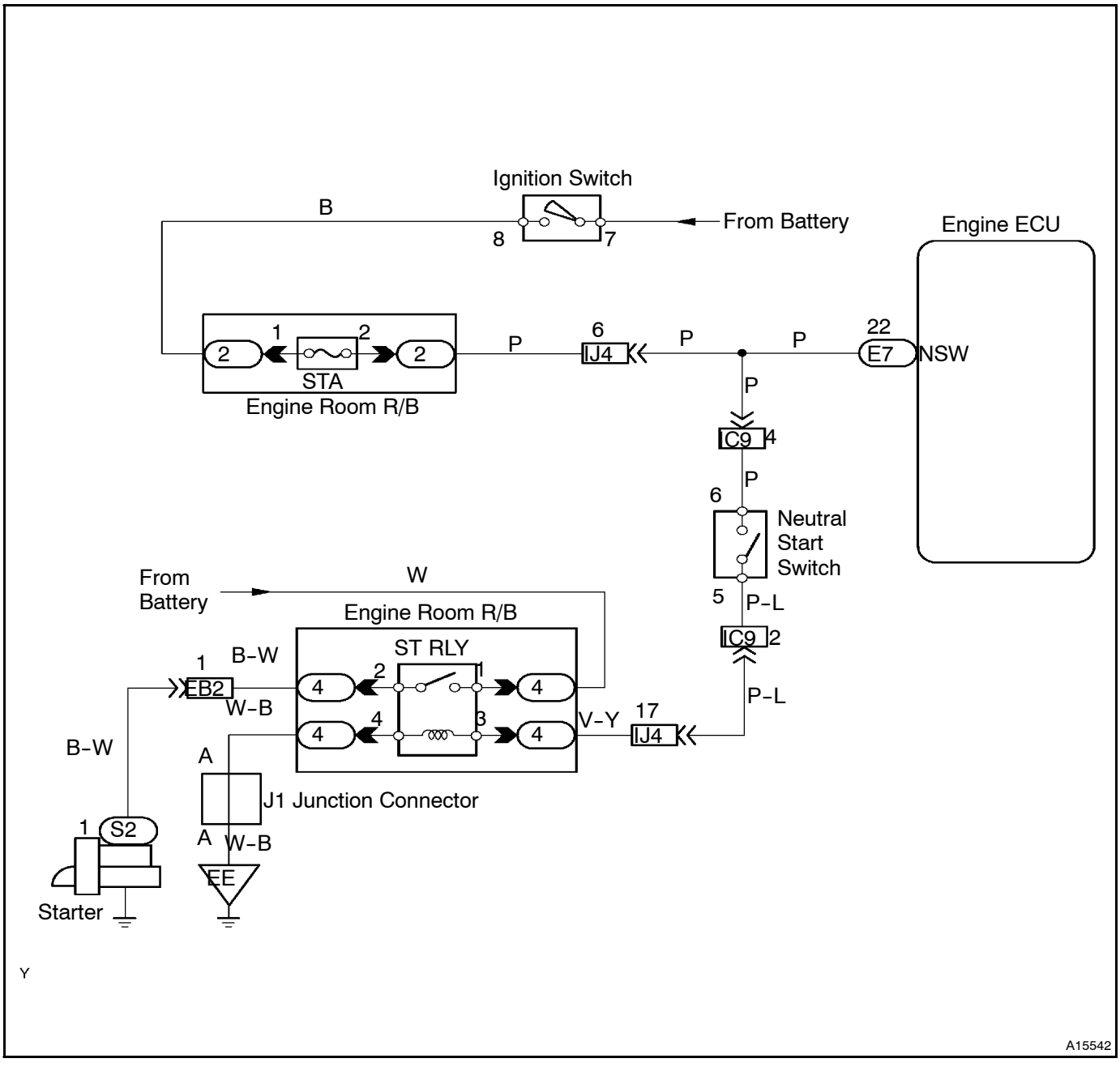
Neutral Start Switch Circuit (only for vehicles with A/T)

CIRCUIT DESCRIPTION

The neutral start switch goes on when the shift lever is in the N or P shift position. When it goes on the terminal NSW of the engine ECU is grounded to body ground via the starter relay thus the terminal NSW voltage becomes 0 V. When the shift lever is in the D, 2, L or R position, the neutral start switch goes off, so the voltage of the engine ECU terminal NSW becomes battery positive voltage, the voltage of the engine ECU internal power source.

If the shift lever is moved from the N position to the D position, this signal is used for air-fuel ratio correction, for idle speed control (estimated control), etc.

WIRING DIAGRAM

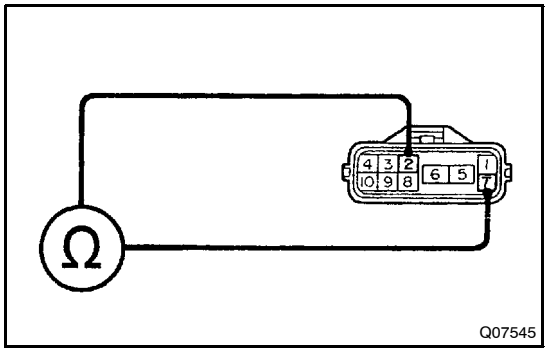


INSPECTION PROCEDURE

HINT:

This diagnosis 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-225.

1	Check neutral start switch.



PREPARATION:

Disconnect the neutral start switch connector.

CHECK:

Check continuity between each terminal shown below when the shift lever is shifted to each position.

OK:

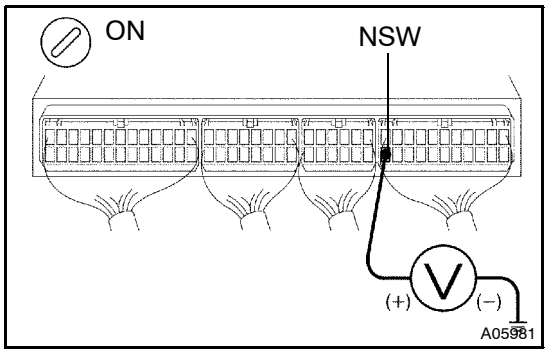
Shift position	Terminal No. to continuity	
P	5 - 6	2 - 7
R	2 - 8	-
N	5 - 6	2 - 9
D	2 - 10	-
2	2 - 3	-
L	2 - 4	-

NG → **Replace neutral start switch.**

OK

CONTINUED

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



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure voltage between terminal NSW of engine ECU connector and body ground after the shift lever is moved to the following positions.

OK:

Shift lever position	P or N	L, 2, D or R
Voltage	0 - 3 V	9 - 14 V

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

NG

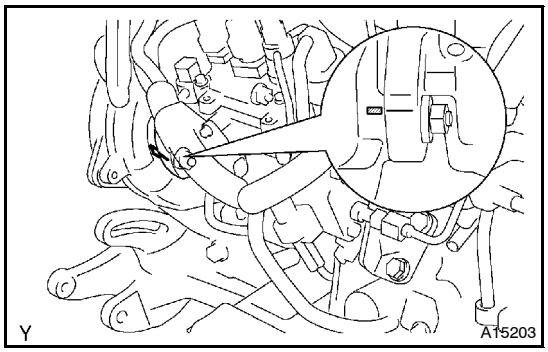
Check for open and short in harness and connector between neutral start switch and engine ECU (See page IN-19).

ENGINE MECHANICAL

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
2L, 3L Engine Repair Manual	RM520E
2L, 2L–T, 3L, 5L Engine Repair Manual Supplement (Aug., 1997)	RM582E

NOTE: The above pages contain only the points which differ from the above listed manuals.



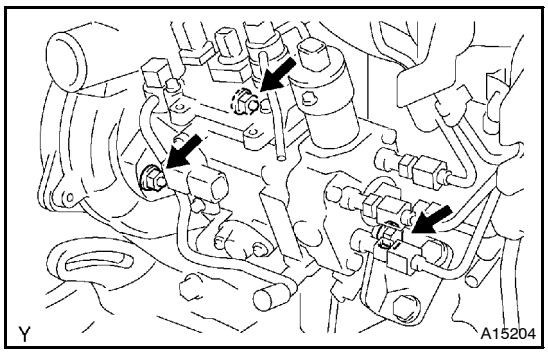
INJECTION TIMING

INSPECTION

EM0HS-02

1. INSPECT INJECTION TIMING

Using mirror, check that the punching line of the injection pump flange and the punching line of the timing belt case aligned.



2. ADJUST INJECTION TIMING

(a) Loosen these nuts and bolt:
- Bolt holding injection pump to injection pump stay.
- 2 nuts holding injection pump to timing belt case.

(b) Align the punching line by slightly tilting the injection pump.

(c) Tighten these nuts and bolt:
- 2 nuts holding injection pump to timinig belt case.

Torque: 20.5 N·m (210 kgf·cm, 15 ft·lbf)
- Bolt holding injection pump to injection pump stay.

Torque: 26 N·m (270 kgf·cm, 19 ft·lbf)

IDLE SPEED AND MAXIMUM SPEED

EM1MH-01

INSPECTION

1. INITIAL CONDITIONS

(a) Engine at normal operating temperature.
(b) Air cleaner installed.
(c) All pipes and hoses of air induction system connected.
(d) All accessories switched OFF.
(e) All vacuum lines properly connected.
(f) ECD system wiving connectors fully plugged.
(g) Valve clearance set correctly.
(h) Injection timing set correctly.

2. CONNECT TACHOMETER

3. INSPECT IDLE SPEED

(a) Start the engine.
(b) Check the idle speed.

Idle speed: 720 - 820 rpm

If the idle speed is not as specified, check the troubleshooting in DI section.

4. INSPECT MAXIMUM SPEED

(a) Depress the accelerator pedal all the way.
(b) Check the maximum speed.

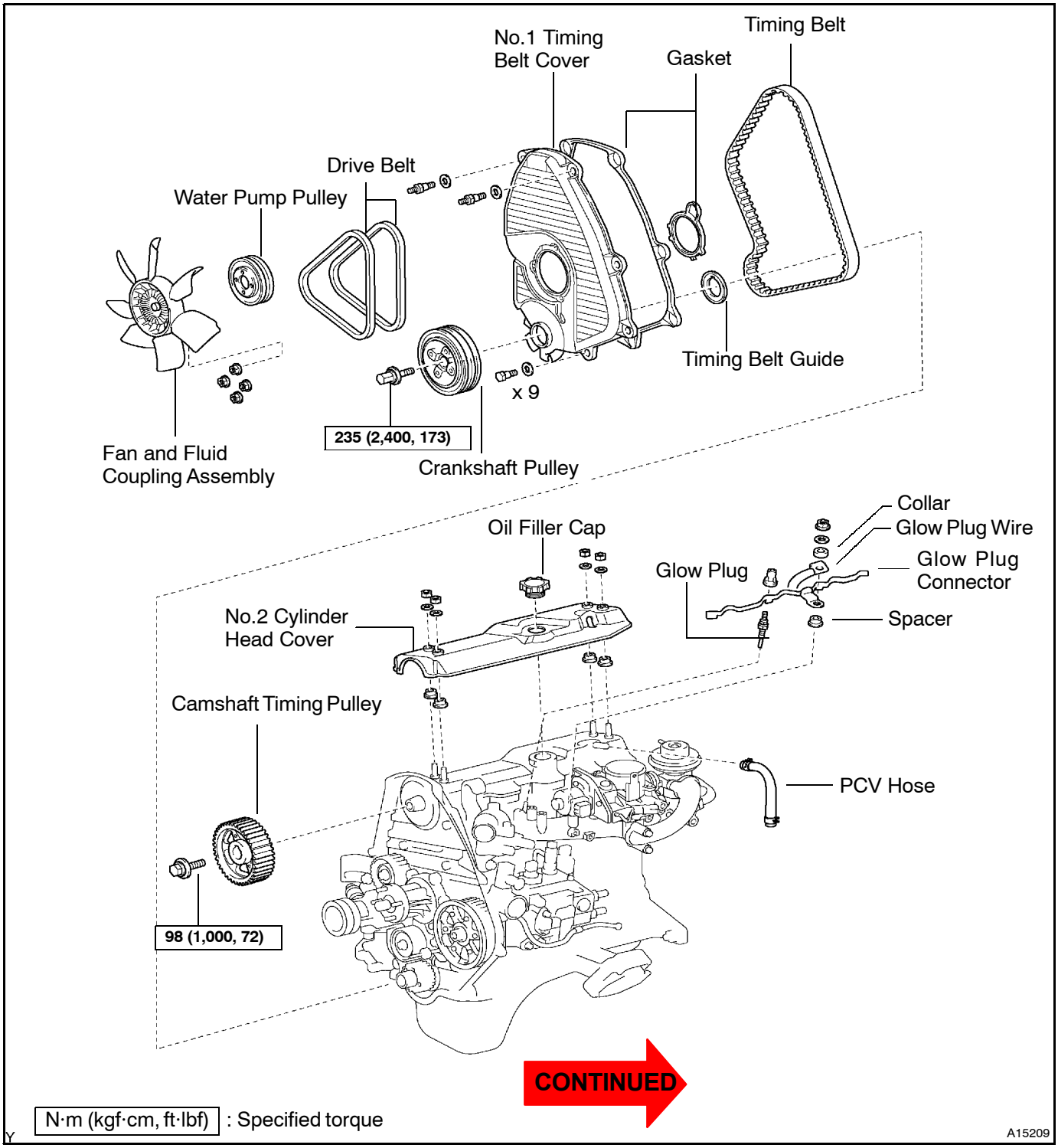
Maximum speed: 4,770 - 5,030 rpm

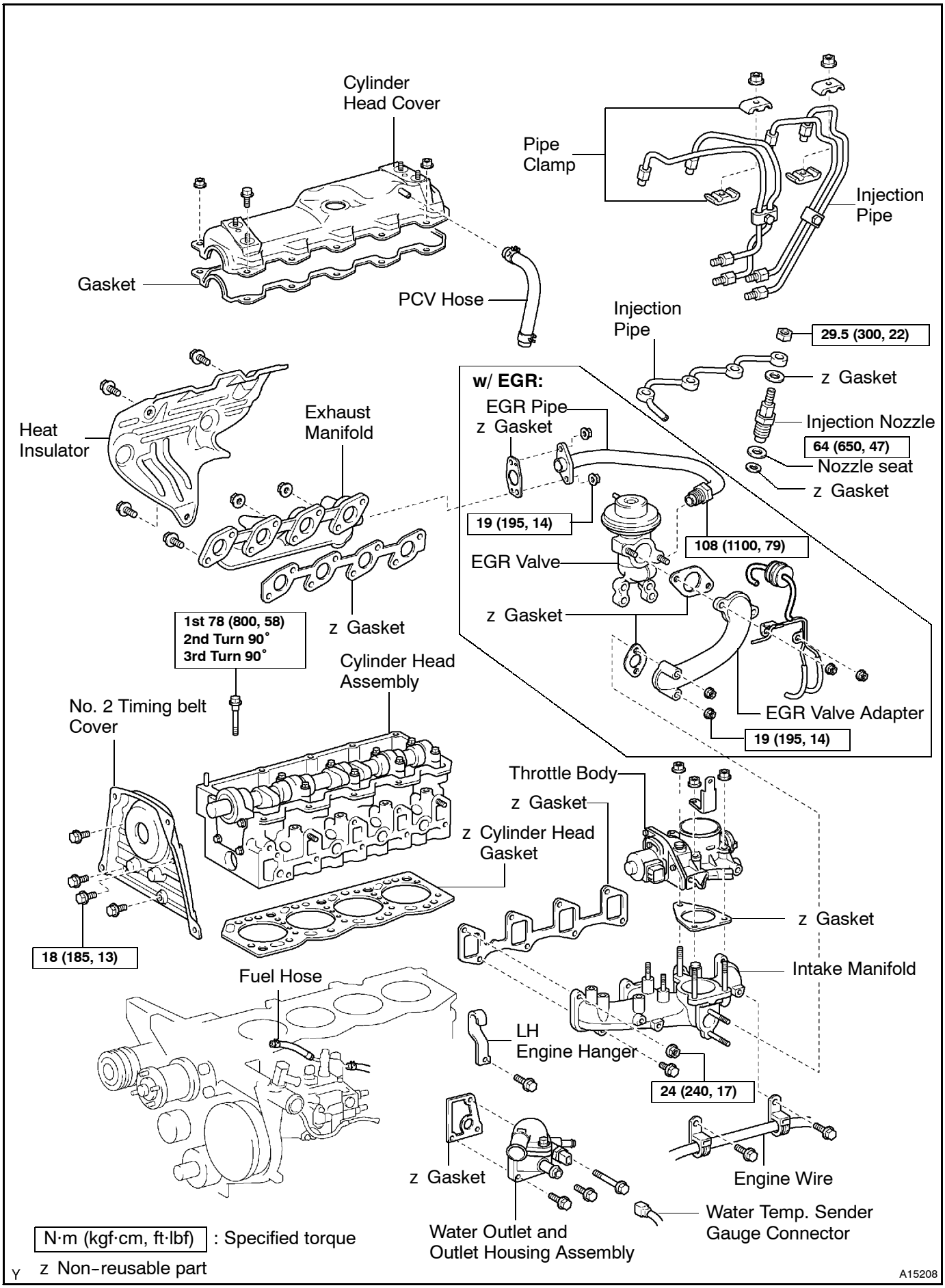
If the maximum speed is not as specified, replace the injection pump.

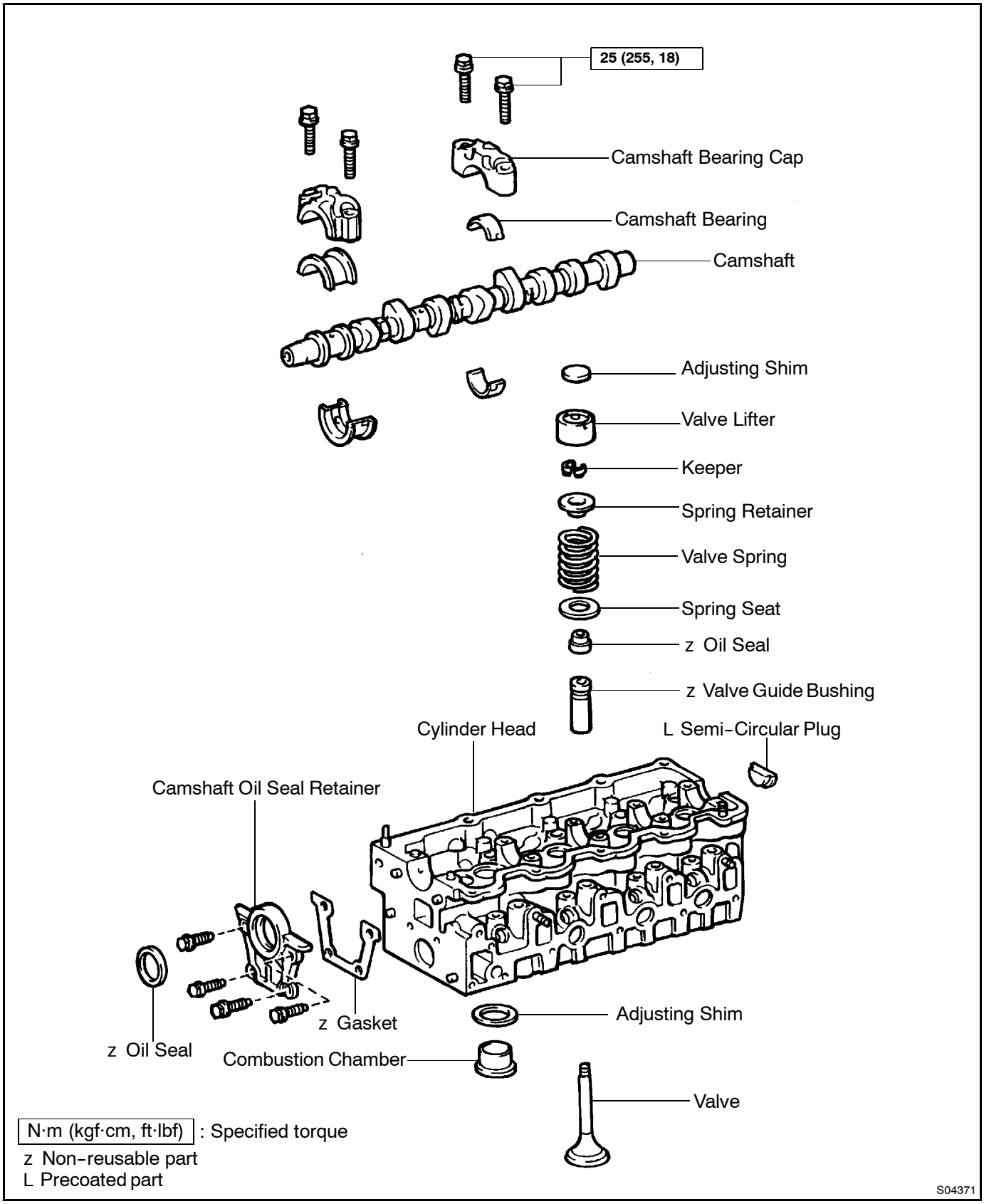
CYLINDER HEAD

COMPONENTS

EM1MI-01




Cylinder Head Cover
Gasket
PCV Hose
Pipe Clamp
Injection Pipe
Injection Pipe
29.5 (300, 22)
z Gasket
w/ EGR:
EGR Pipe
z Gasket
Injection Nozzle
64 (650, 47)
Nozzle seat
z Gasket
Heat Insulator
Exhaust Manifold
19 (195, 14)
108 (1100, 79)
EGR Valve
z Gasket
1st 78 (800, 58)
2nd Turn 90°
3rd Turn 90°
z Gasket
Cylinder Head Assembly
EGR Valve Adapter
19 (195, 14)
No. 2 Timing belt Cover
Throttle Body
z Gasket
z Cylinder Head Gasket
z Gasket
18 (185, 13)
Intake Manifold
Fuel Hose
LH Engine Hanger
24 (240, 17)
z Gasket
Engine Wire
Water Temp. Sender Gauge Connector
Water Outlet and Outlet Housing Assembly
N·m (kgf·cm, ft·lbf) : Specified torque
z Non-reusable part
A15208


25 (255, 18)
Camshaft Bearing Cap
Camshaft Bearing
Camshaft
Adjusting Shim
Valve Lifter
Keeper
Spring Retainer
Valve Spring
Spring Seat
z Oil Seal
z Valve Guide Bushing
Cylinder Head
L Semi-Circular Plug
Camshaft Oil Seal Retainer
z Gasket
Adjusting Shim
z Oil Seal
Combustion Chamber
Valve
N·m (kgf·cm, ft·lbf) : Specified torque
z Non-reusable part
L Precoated part
S04371

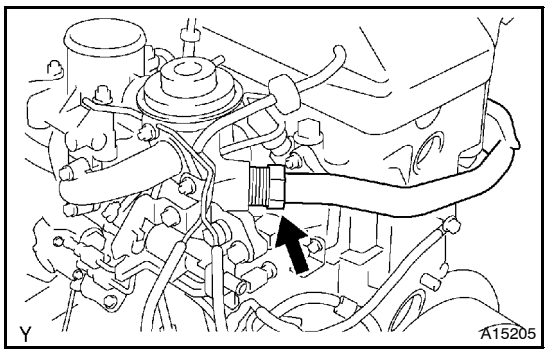
EM1MJ-01

REMOVAL

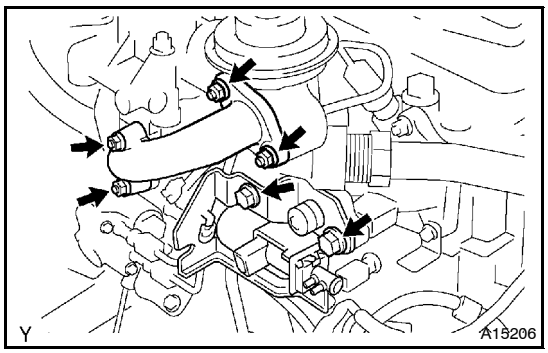
HINT:

If replacing the timing belt before the timing belt warning light comes on, (light comes on after 100,000 km of driving), be sure to reset the timing belt counter of the speedometer to zero.

1. DRAIN ENGINE COOLANT
2. REMOVE PCV HOSE
3. w/ EGR:
   REMOVE EGR VALVE AND EGR ADAPTER



(a) Loosen the union nut holding the EGR valve to the EGR pipe.



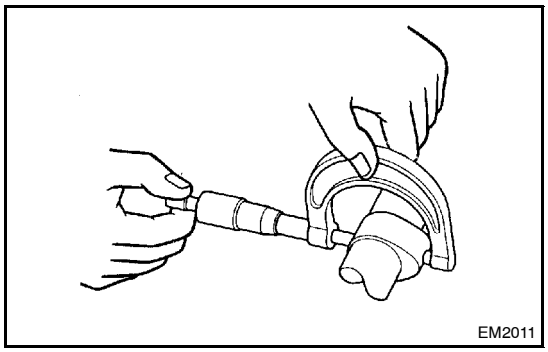
(b) Remove the 2 bolts, 4 nuts, EGR valve and EGR adapter and gasket.

4. REMOVE THROTTLE BODY
   (See page ED-5)
5. REMOVE NO.2 CYLINDER HEAD COVER
   (See Pub. No. RM520E on page EG-30)
6. REMOVE GLOW PLUGS
   (See Pub. No. RM520E on page EG-30)
7. REMOVE DRIVE BELTS, FAN, FLUID COUPLING ASSEMBLY AND WATER PUMP PULLEY
   (See Pub. No. RM520E on page EG-162)
8. REMOVE TIMING BELT
   (See Pub. No. RM520E on page EG-21)
9. REMOVE CAMSHAFT TIMING PULLEY
   (See Pub. No. RM520E on page EG-22a)
10. REMOVE INJECTION NOZZLES
    (See Pub. No. RM520E on page EG-91)
11. REMOVE NO.2 TIMING BELT COVER
    (See Pub. No. RM520E on page EG-31)
12. REMOVE WATER OUTLET AND HOUSING ASSEMBLY
    (See Pub. No. RM520E on page EG-31)

CONTINUED

13. REMOVE LH ENGINE HANGER
(See Pub. No. RM520E on page EG-31)
14. REMOVE INTAKE MANIFOLD ASSEMBLY
(See Pub. No. RM520E on page EG-31)
15. REMOVE EXHAUST MANIFOLD
(See Pub. No. RM520E on page EG-32)
16. REMOVE CYLINDER HEAD COVER
(See Pub. No. RM520E on page EG-32)
17. REMOVE CYLINDER HEAD ASSEMBLY
(See Pub. No. RM520E on page EG-32)

EM1MK-01



INSPECTION

INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

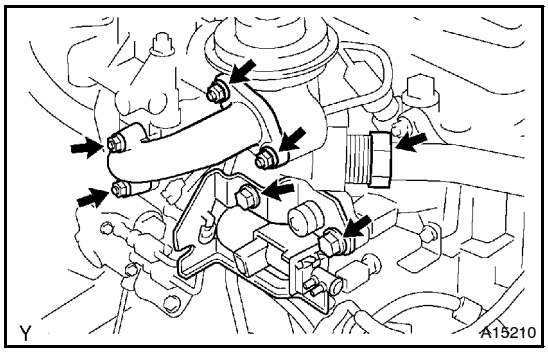
Standard cam lobe height:
Intake
54.890 - 54.910 mm (2.1610 - 2.1618 in.)
Exhaust
54.990 - 55.010 mm (2.1650 - 2.1657 in.)
Minimum cam lobe height:
Intake
54.39 mm (2.1413 in.)
Exhaust
54.49 mm (2.1453 in.)

If the cam lobe height is less than minimum, replace the camshaft.

EM1ML-01

INSTALLATION

1. CHECK PISTON PROTRUSION AND SELECT CYLINDER HEAD GASKET
(See Pub. No. RM520E on page EG-48)
2. SET NO. 1 CYLINDER TO 90° BTDC/COMPRESSION
(See Pub. No. RM520E on page EG-49)
3. INSTALL CYLINDER HEAD
(See Pub. No. RM520E on page EG-49)
4. INSTALL CYLINDER HEAD COVER
(See Pub. No. RM520E on page EG-50)
5. INSTALL EXHAUST MANIFOLD
(See Pub. No. RM520E on page EG-50)
6. INSTALL INTAKE MANIFOLD ASSEMBLY
(See Pub. No. RM520E on page EG-50)
7. INSTALL LH ENGINE HANGER
(See Pub. No. RM520E on page EG-51)
8. INSTALL WATER OUTLET AND OUTLET HOUSING ASSEMBLY
(See Pub. No. RM520E on page EG-51)
9. INSTALL NO. 2 TIMING BELT COVER
(See Pub. No. RM520E on page EG-51)
10. INSTALL INJECTION NOZZLES
(See Pub. No. RM520E on page EG-51)
11. INSTALL THROTTLE BODY
(See page ED-6)



12. w/ EGR:
INSTALL EGR VALVE AND EGR ADAPTER
Install the new gasket, EGR valve and EGR pipe with the 2 bolts, 4 nuts and union nut.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf) for bolts
19 N·m (195 kgf·cm, 14 ft·lbf) for nuts
108 N·m (1100 kgf·cm, 79 ft·lbf) for union nuts

13. INSTALL CAMSHAFT TIMING PULLEY
(See Pub. No. RM520E on page EG-25)
14. INSTALL TIMING BELT
(See Pub. No. RM520E on page EG-26)
15. INSTALL WATER PUMP PULLEY, FAN, FLUID COUPLING ASSEMBLY AND DRIVE BELTS
(See Pub. No. RM520E on page EG-164)
16. INSTALL GLOW PLUGS
(See Pub. No. RM520E on page EG-51)

CONTINUED

17. INSTALL NO. 2 CYLINDER HEAD COVER
(See Pub. No. RM520E on page EG-52)
18. INSTALL PCV HOSE
19. FILL WITH ENGINE COOLANT
20. START ENGINE AND CHECK FOR LEAKS
21. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL

CYLINDER BLOCK

EM1MM-01

DISASSEMBLY

REMOVE CRANK POSITION SENSOR

(a) Disconnect the connector.
(b) Remove the bolt, crank position sensor.

EM1MN-01

REASSEMBLY

INSTALL CRANK POSITION SENSOR

(a) Install a new O-ring and crank position sensor with bolt.
Torque: 5 N·m (51 kgf·cm, 4 ft·lbf)

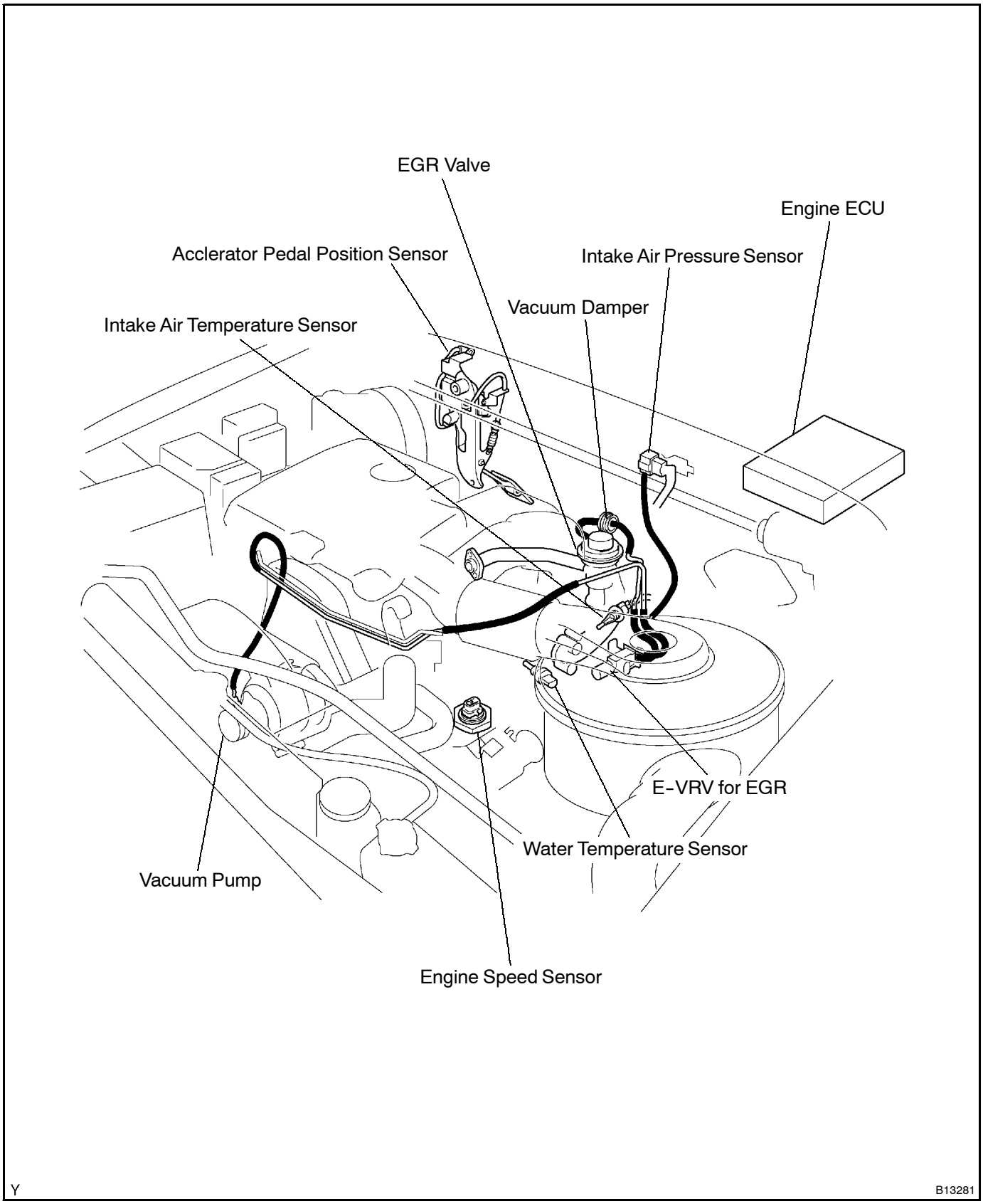
(b) Connect the connector.

EMISSION CONTROL

PARTS LAYOUT AND SCHEMATIC DRAWING

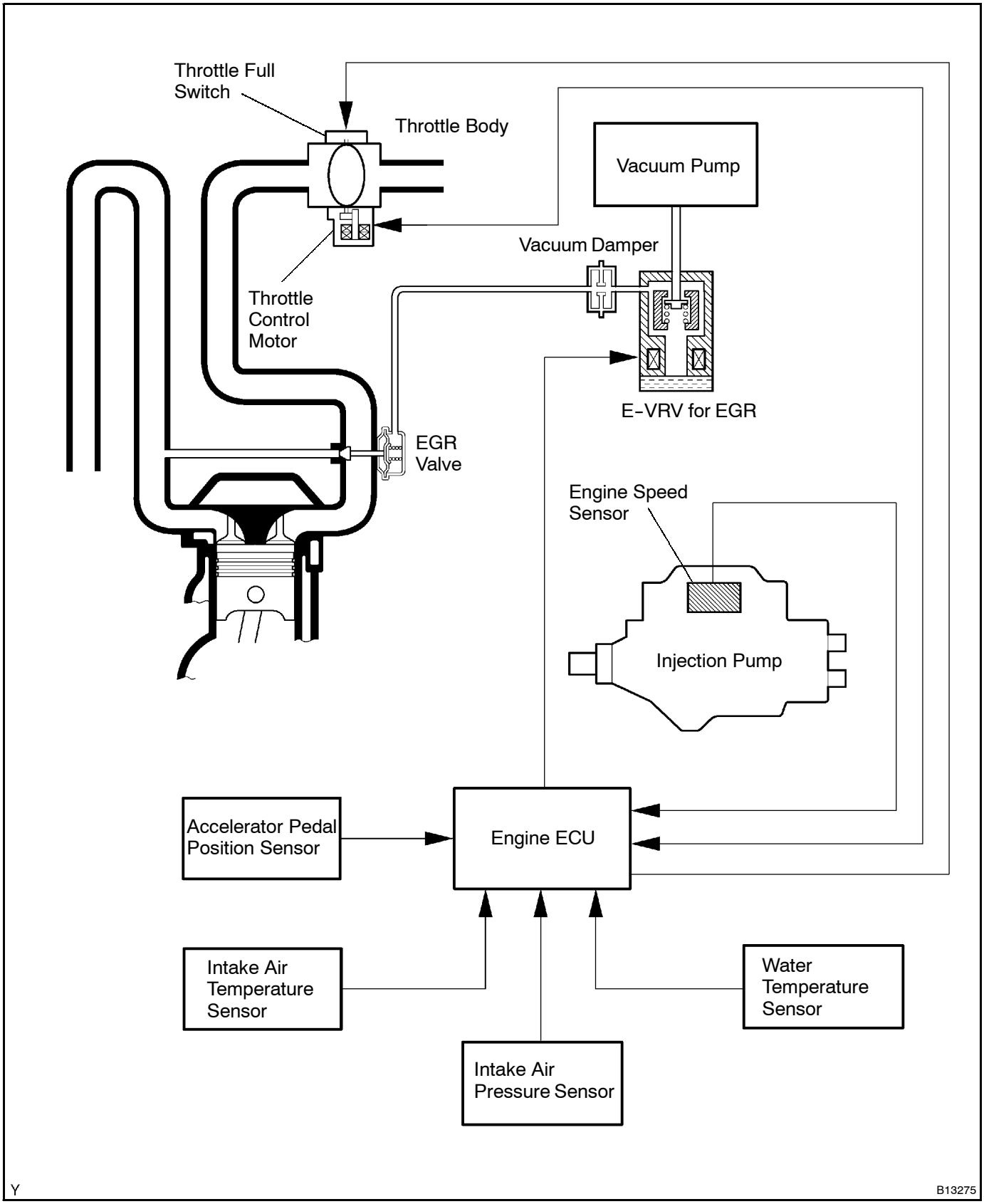
LOCATION

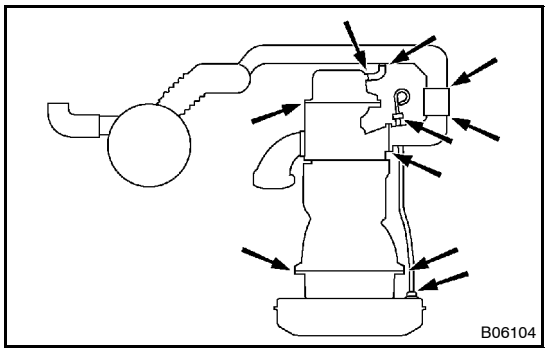
EC09A-02



EC09B-04

DRAWING





POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

EC09C-03

INSPECTION

VISUALLY INSPECT HOSE AND CONNECTION

Check for cracks, leaks or damage.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

ON-VEHICLE INSPECTION

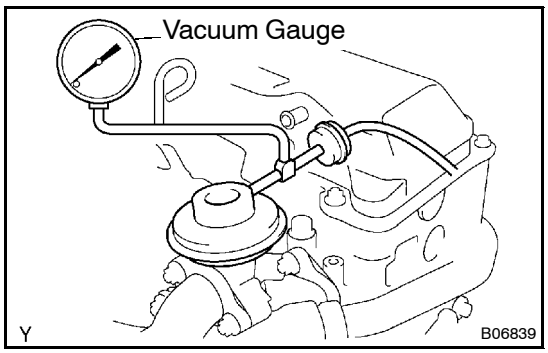
EC0J0-01

HINT:

In a malfunction where the EGR system is always on, black smoke or white smoke may be output from the exhaust pipe. If this occurs, inspect the EGR system also.

NOTICE:

Always stop the engine when installing or removing the vacuum gauges, or removing the vacuum hoses.



1. INSTALL VACUUM GAUGE

Using a 3 way connector, connect a vacuum gauge to the hose between the EGR valve and E-VRV.

2. INSPECT SEATING OF EGR VALVE

Start the engine and check that the engine starts and run at idle.

3. INSPECT COLD ENGINE CONDITION

(a) The coolant temperature should be below 20°C (64°F).

(b) Check that the vacuum gauge indicates 0 at idle.

4. INSPECT HOT ENGINE CONDITION

(a) Warm up the engine, the coolant temperature should be above 70°C (104°F) and below 96°C (205°F).

(b) Check that the vacuum gauge indicates about more than 28.0 kPa (210 mmHg, 8.3 in.Hg) at idle.

(c) Check that the vacuum gauge indicator increases about more than 28.0 kPa (210 mm Hg, 8.3 in.Hg) at 1,500 rpm.

(d) When the accelerator pedal is quickly depress to the full open, check that the vacuum gauge indicator drops momentarily.

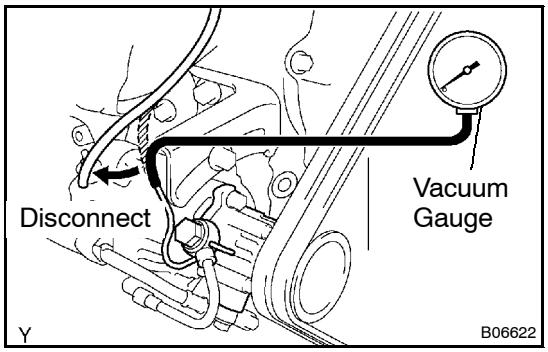
(e) Keep the engine speed at more than 4,000 rpm.

(f) Check that the vacuum gauge indicates 0.

(g) When the accelerator pedal is releaced, check that the vacuum gauge indicator drops momentarily while the engine speed decreases from more than 4,000 rpm to idle.

5. REMOVE VACUUM GAUGE

CONTINUED



6. CHECK OUTPUT VACUUM WITH VACUUM GAUGE

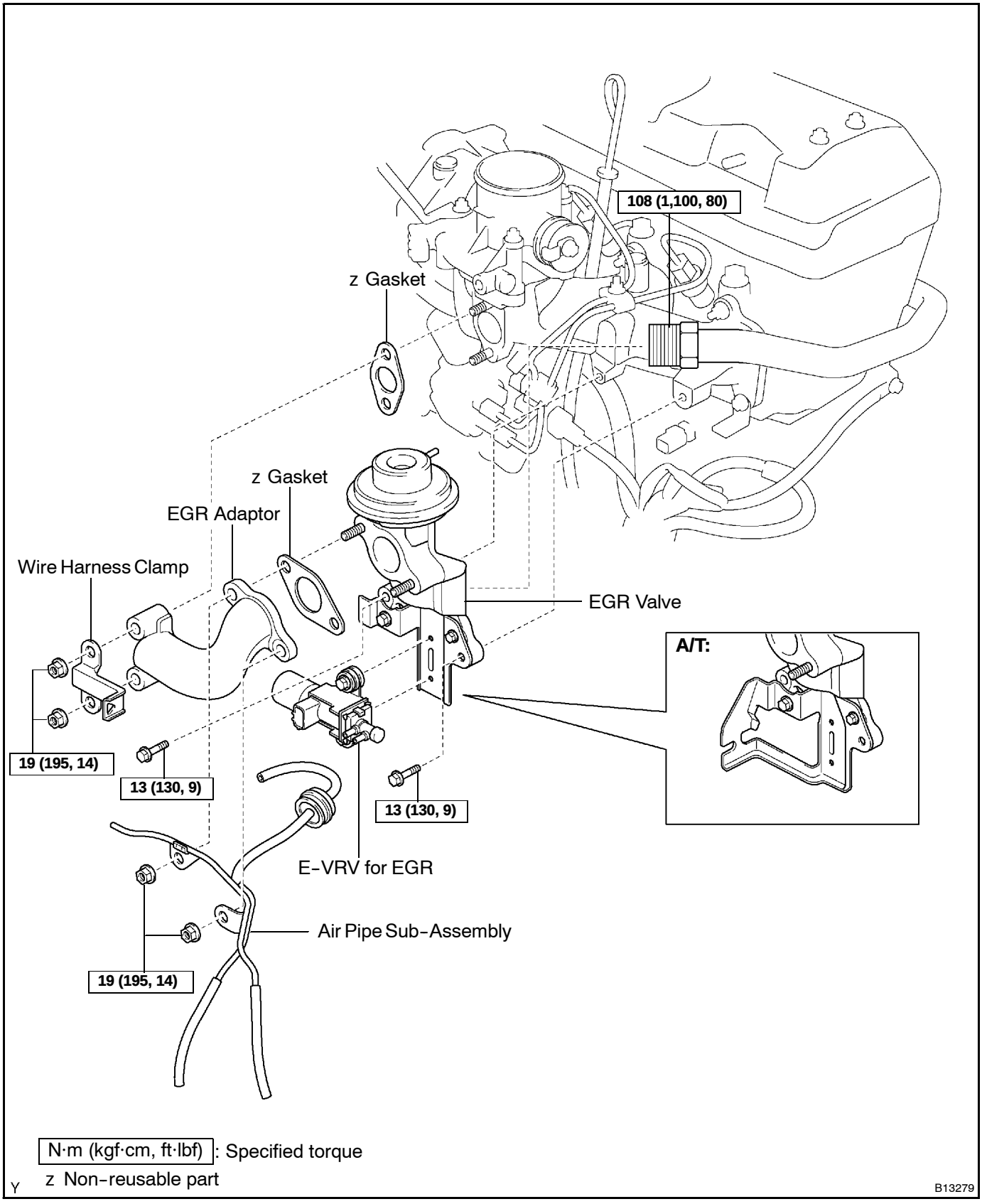
(a) Connect a vacuum gauge to the output pipe.

(b) Warm up the engine and check that the vacuum gauge indicates above 86.7 kPa (650 mmHg, 25.59 in.Hg).

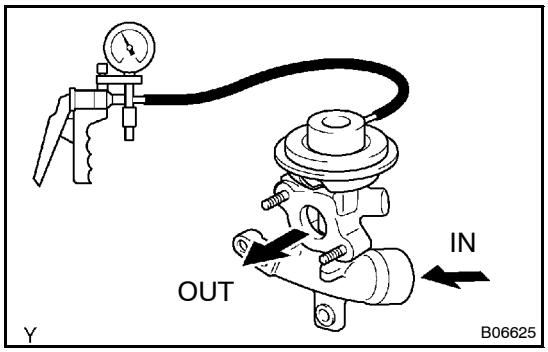
If a problem is found, repair the vacuum pump.

EC09G-03

COMPONENTS



EC0J1-01



INSPECTION

1. INSPECT EGR VALVE

(a) Remove the EGR valve.

(b) When a vacuum of 26.7 kPa (200 mmHg, 7.88 in. Hg) is applied to the diaphragm chamber, check that the shaft rises up and that air flows from IN to OUT.

(c) When applying more than 67 kPa (500 mmHg, 19 in. Hg) of the vacuum, check if there is any leakage of the vacuum.

(d) Check the valve for sticking and heavy carbon deposits. If a problem is found, replace it.

(e) Reinstall the EGR valve with the new gasket.

2. INSPECT E-VRV FOR EGR (See page ED-11)

3. INSPECT ACCELERATOR PEDAL POSITION SENSOR (See page DI-40)

4. INSPECT ENGINE SPEED SENSOR (See page ED-17)

5. INSPECT INTAKE AIR TEMPERATURE SENSOR (See page ED-14)

6. INSPECT WATER TEMPERATURE SENSOR (See page ED-12)

7. INSPECT THROTTLE FULL SWITCH (See page ED-3)

8. INSPECT THROTTLE CONTROL MOTOR (See page ED-3)

ELECTRONIC CONTROL DIESEL

ECD SYSTEM

PRECAUTION

ED00I-04

HINT:

- Any DTC code retained by the computer will be erased when the negative (-) terminal cable is removed from the battery.
- Therefore, if necessary, read the diagnosis before removing the negative (-) terminal cable from the battery.

1. BEFORE WORKING ON FUEL SYSTEM, DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

2. DO NOT SMOKE OR WORK NEAR AN OPEN FLAME WHEN WORKING ON FUEL SYSTEM

3. KEEP DIESEL FUEL AWAY FROM RUBBER OR LEATHER PARTS

4. AIR INDUCTION SYSTEM

(a) Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.

(b) Disconnection, looseness or cracks in the parts of the air induction system between the throttle body and cylinder head will allow air suction and cause the engine to run out of tune.

5. ELECTRONIC CONTROL SYSTEM

(a) Before removing ECD wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the negative (-) terminal cable from the battery.

HINT:

Always check the DTC before disconnecting the negative (-) terminal cable from the battery.

(b) When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (-) cables.

(c) Do not permit parts to receive a severe impact daring removal or installation. Handle all ECD parts carefully, especially the engine ECU.

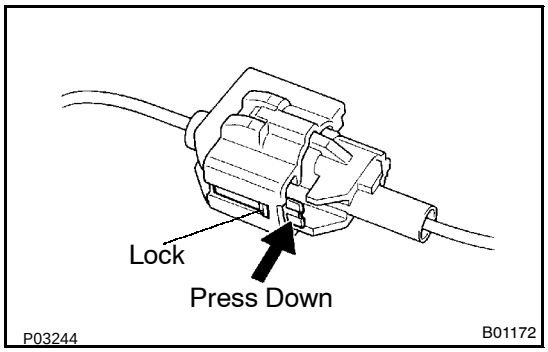
(d) Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can further troubles.

(e) Do not open the engine ECU cover.

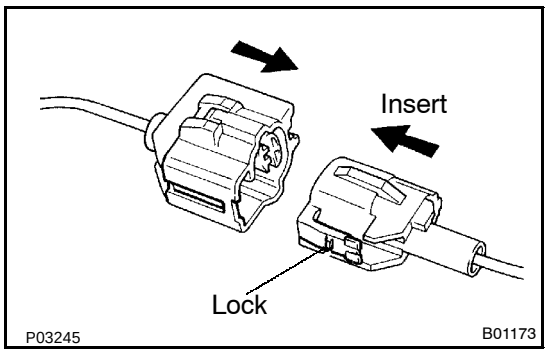
(f) When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the ECD parts and wiring connectors.

(g) Parts should be replaced as an assembly.

CONTINUED



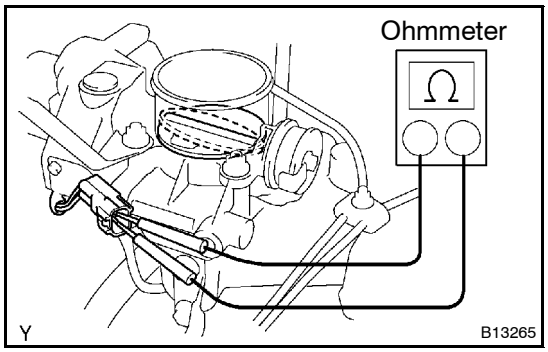
(h) Care is required when pulling out and inserting wiring connectors.
(1) Release the lock and pull out the connector, pulling on the connectors.



(2) Fully insert the connector and check that it locked.

(i) When inspecting a connector with a volt/ohmmeter.
(1) Carefully take out the water-proofing rubber if it is a water-proof type connector.
(2) Insert the test probe in to the connector from the wiring side when checking the continuity, amperage or voltage.
(3) Do not apply unnecessary force to the terminal.
(4) After checking, install the water-proofing rubber on the connector securely.

ELECTRONIC CONTROL DIESEL:



THROTTLE BODY

ON-VEHICLE INSPECTION

ED02R-03

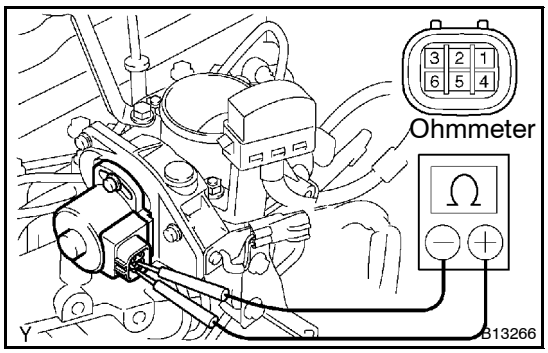
1. INSPECT THROTTLE FULL SWITCH

(a) Disconnect the throttle full switch connector.

(b) Using an ohmmeter, check the continuity between the terminals.

Throttle Valve	Continuity
Fully closed	No continuity
Fully open	Continuity

(c) Reconnect the throttle full switch connector.



2. INSPECT THROTTLE CONTROL MOTOR

(a) Disconnect the throttle control motor connector.

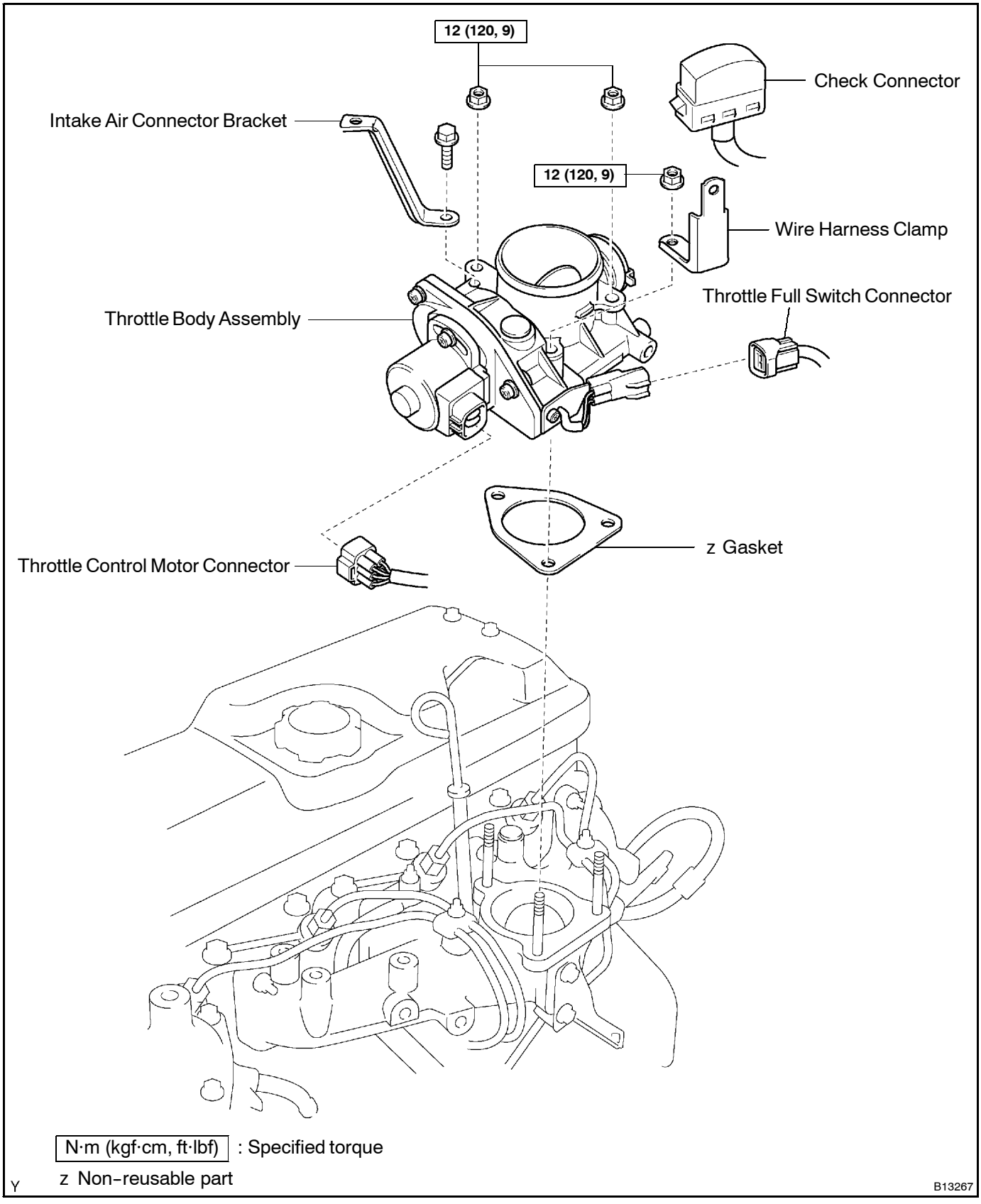
(b) Using an ohmmeter, measure the resistance between terminals 1 and 2, 3 and 2, 4 and 5, and 6 and 5.

Resistance: 18 - 22 Ω at 20°C (68°F)

(c) Reconnect the throttle control motor connector.

ED04H-01

COMPONENTS



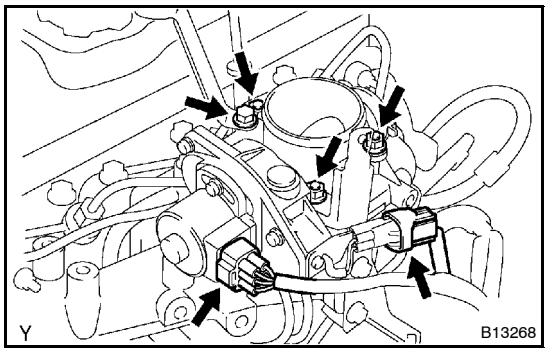
N·m (kgf·cm, ft·lbf) : Specified torque

z Non-reusable part

Y

B13267

ED04I-01

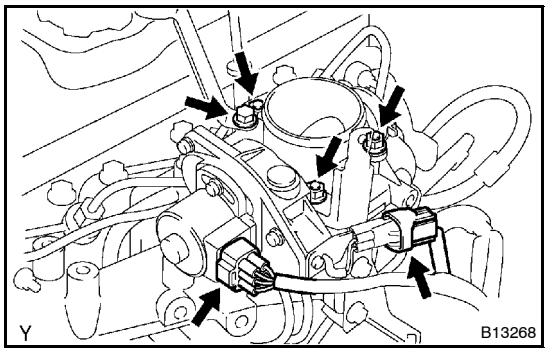


REMOVAL

REMOVE THROTTLE BODY ASSEMBLY

(a) Disconnect the check connector from the throttle body assembly.
(b) Remove the bolt and intake air connector bracket.
(c) Disconnect the 2 connectors.
(d) Remove the 3 nuts and wire harness clamp.
(e) Remove the throttle body assembly and gasket.

ED04J-01



INSTALLATION

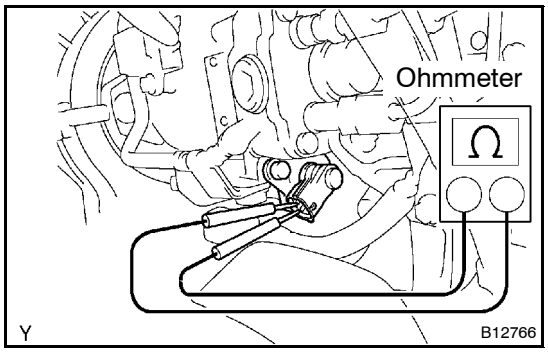
INSTALL THROTTLE BODY ASSEMBLY

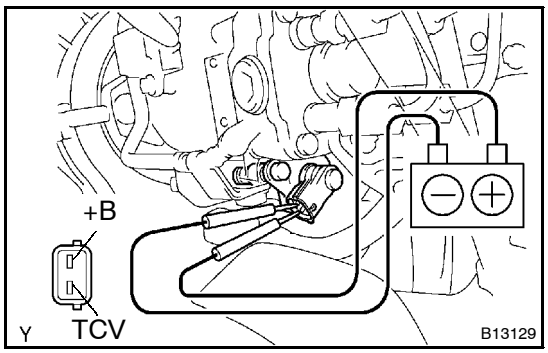
(a) Install the gasket, throttle body assembly and wire harness clamp with the 3 nuts.
Torque: 12 N·m (120 kgf·cm, 18 ft·lbf)

(b) Connect the 2 connectors.

(c) Install the intake air connector bracket with the bolt.

(d) Connect the check connector.





TIMING CONTROL VALVE

INSPECTION

ED04K-01

INSPECT TIMING CONTROL VALVE

(a) Disconnect the timing control valve connector.

(b) Using an ohmmeter, measure the resistance between the terminals.

Resistance: 10 - 14 Ω at 20°C (68°F)

If the resistance is not specified, replace the injection pump assembly (See page FU-11).

(c) Inspect the timing control valve solenoid operation.

(1) Connect the battery positive the terminal to the timing control valve terminal +B.

(2) Connect the battery negative terminal to the timing control valve terminal TCV.

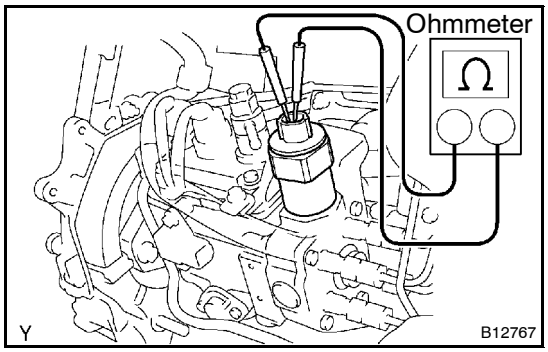
(3) Check that the solenoid makes a ”clicks” sound.

If operation is not as specified , replace the timing control valve.

NOTICE:

- **Do not apply voltage for more than 30 seconds to avoid burning out the timing control valve solenoid.**
- **If repeating this step, wait until the solenoid coils become cool enough that it can be touched by hand.**

(d) Reconnect the timing control valve connector.



SPILL CONTROL VALVE

INSPECTION

ED02U-03

INSPECT SPILL CONTROL VALVE

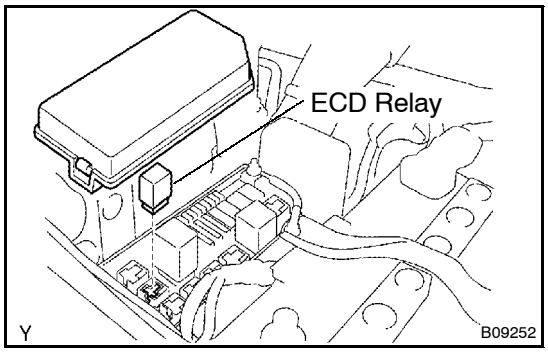
(a) Disconnect spill valve connector.

(b) Using an ohmmeter, measure the resistance between the terminals.

Resistance: 1 - 2 Ω at 20°C (68°F)

If the resistance is not specified, replace the injection pump assembly (See page FU-11).

(c) Reconnect the spill valve connector.

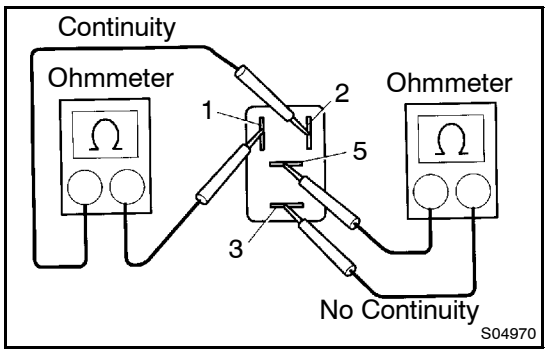


ECD MAIN RELAY

ED04L-01

INSPECTION

1. REMOVE ECD RELAY



2. INSPECT ECD RELAY

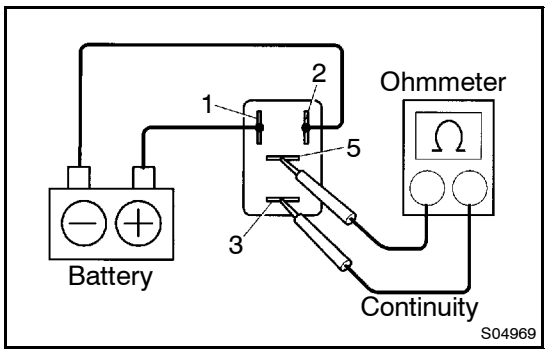
(a) Inspect the ECD relay continuity.

(1) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the ECD relay.

(2) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the ECD relay.

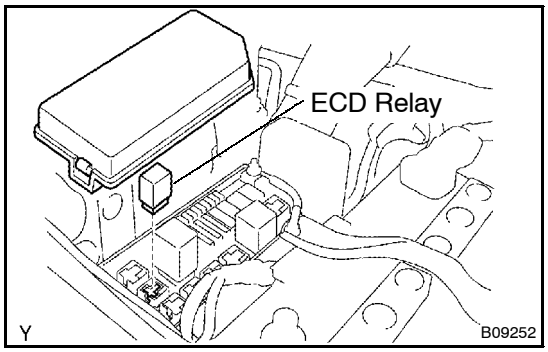


(b) Inspect the ECD relay operation.

(1) Apply battery positive voltage across terminals 1 and 2.

(2) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the ECD relay.

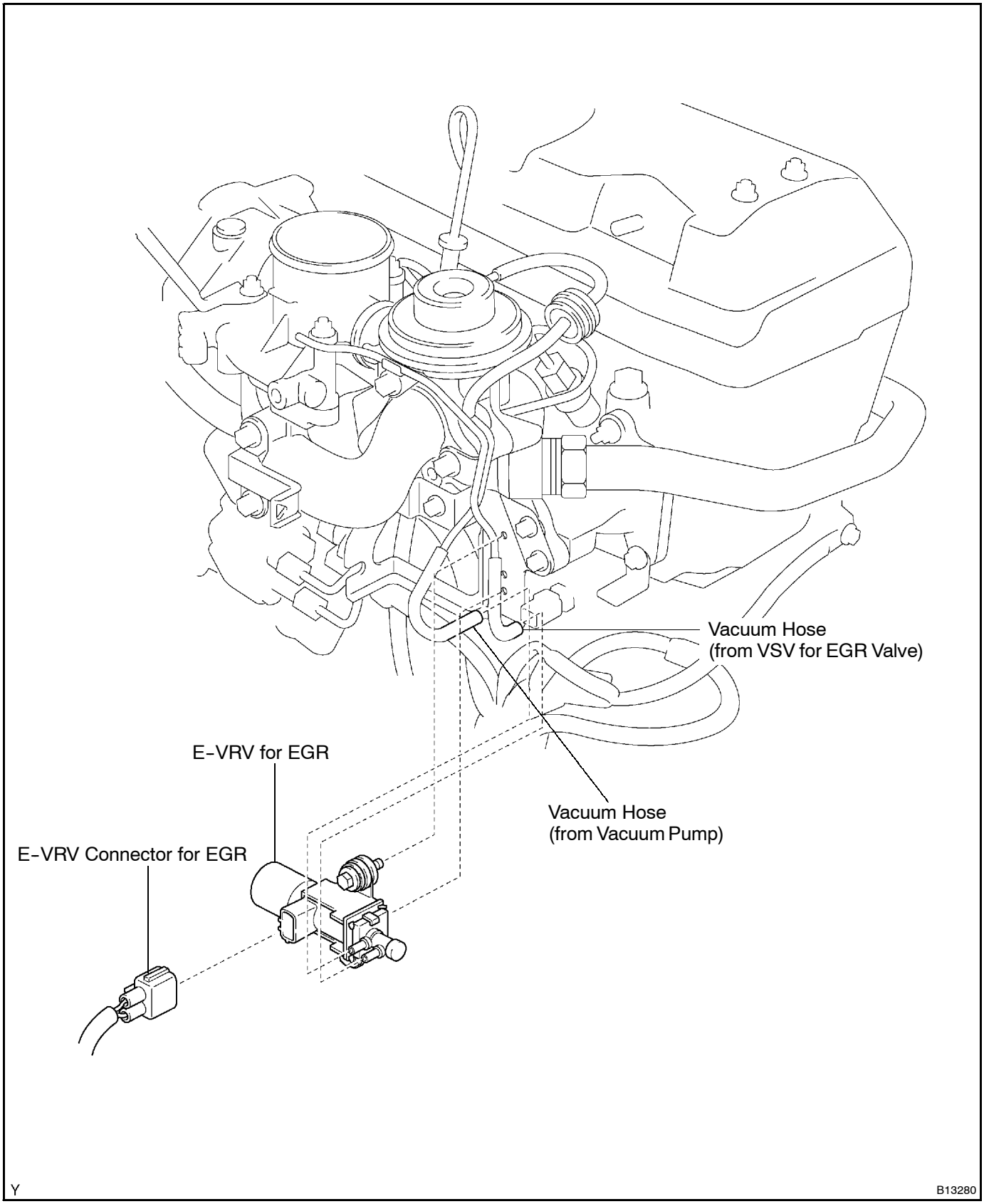


3. REINSTALL ECD RELAY

E-VRV FOR EGR

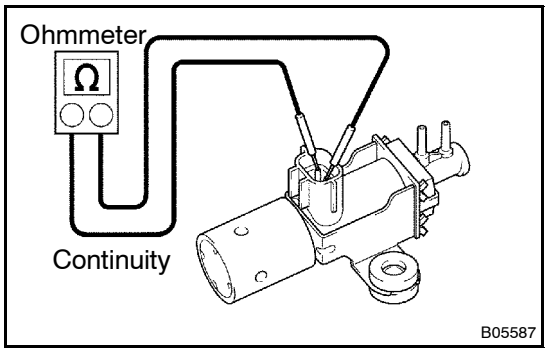
COMPONENTS

ED02X-02



EC0DA-02

INSPECTION



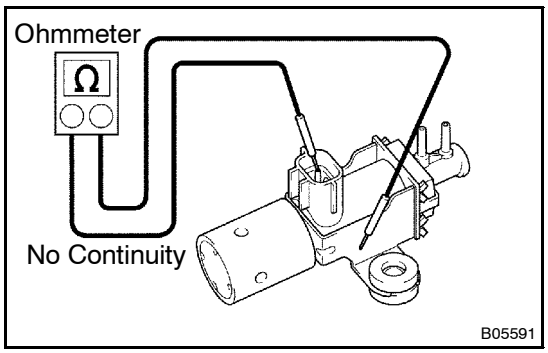
1. REMOVE E-VRV

2. INSPECT E-VRV FOR OPEN CIRCUIT

Using an ohmmeter, measure the resistance between terminals as shown.

Resistance: 46 - 50 Ω at 20°C (68°F)

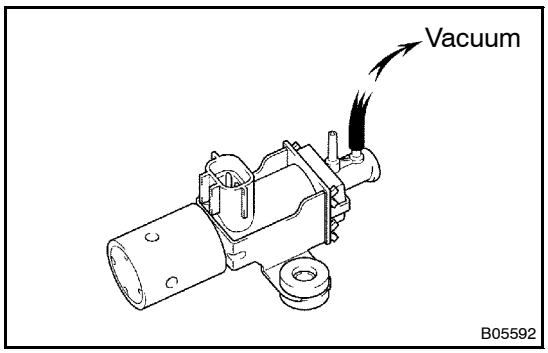
If the resistance is not specified, replace the E-VRV.



3. INSPECT E-VRV FOR GROUND

Using an ohmmeter, check that there is no continuity between terminals and E-VRV body.

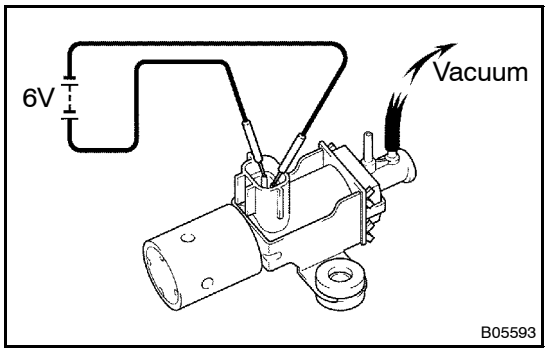
If there is continuity, replace the E-VRV.



4. INSPECT E-VRV FOR AIR TIGHTNESS

Check that when vacuum is applied to the vacuum outlet port shown, the needle of vacuum pump indicates an increase of 66.7 kPa (500 mmHg, 19.7 in. Hg) or more.

If a problem is found, replace the E-VRV



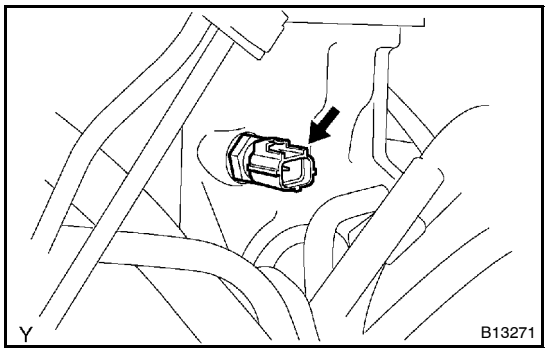
5. INSPECT E-VRV OPERATION

(a) Apply about 6 V of DC power to the terminals.

(b) Check that when vacuum is applied to the vacuum outlet port shown, the need does not move.

If operation is not as specified, replace the E-VRV.

6. REINSTALL E-VRV



WATER TEMPERATURE SENSOR

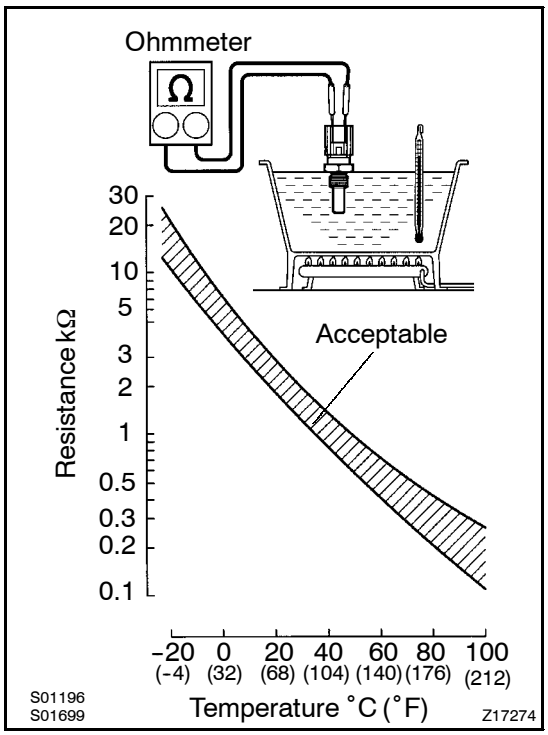
ED00M-04

INSPECTION

1. DRAIN ENGINE COOLANT
2. REMOVE WATER TEMPERATURE SENSOR

(a) Disconnect the water temperature sensor connector.

(b) Using a 19 mm deep socket wrench, remove the water temperature sensor and gasket.



3. INSPECT WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance: Refer to the chart graph

If the resistance is not as specified, replace the water temperature sensor.

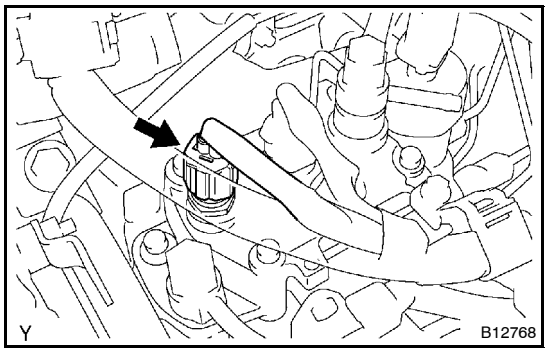
4. REINSTALL WATER TEMPERATURE SENSOR

(a) Using a 19 mm deep socket wrench, install a new gasket and the water temperature sensor.

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

(b) Connect the water temperature sensor connector.

5. REFILL WITH ENGINE COOLANT



FUEL TEMPERATURE SENSOR

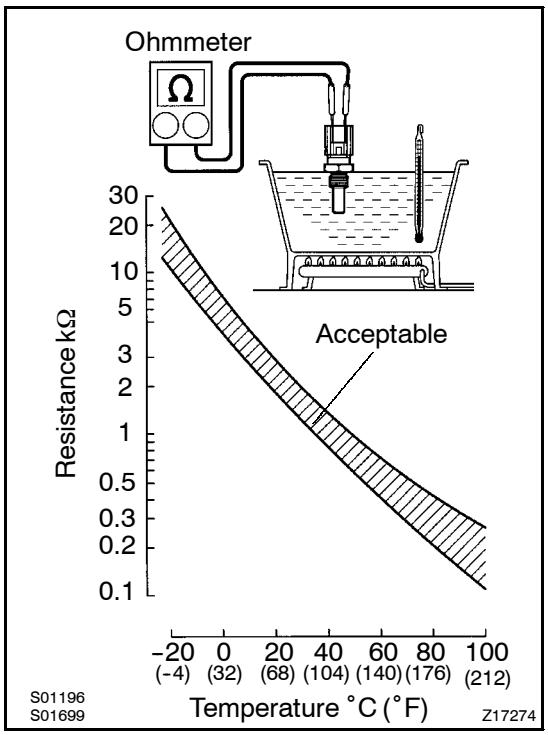
ED04M-01

INSPECTION

1. REMOVE FUEL TEMPERATURE SENSOR

(a) Disconnect the fuel temperature sensor connector.

(b) Using a 19 mm deep socket wrench, remove the fuel temperature sensor and O-ring.



2. INSPECT FUEL TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance: Refer to the chart graph

If the resistance is not as specified, replace the fuel temperature sensor.

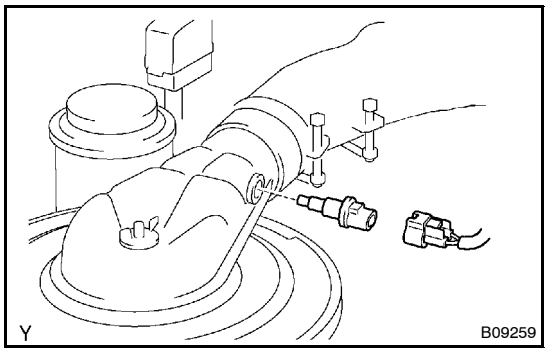
3. REINSTALL FUEL TEMPERATURE SENSOR

(a) Install a new O-ring to the fuel temperature sensor.

(b) Using a 19 mm deep socket wrench, install the fuel temperature sensor.

Torque: 22.1 N·m (225 kgf·cm, 16 ft·lbf)

(c) Connect the fuel temperature sensor connector.



INTAKE AIR TEMPERATURE SENSOR

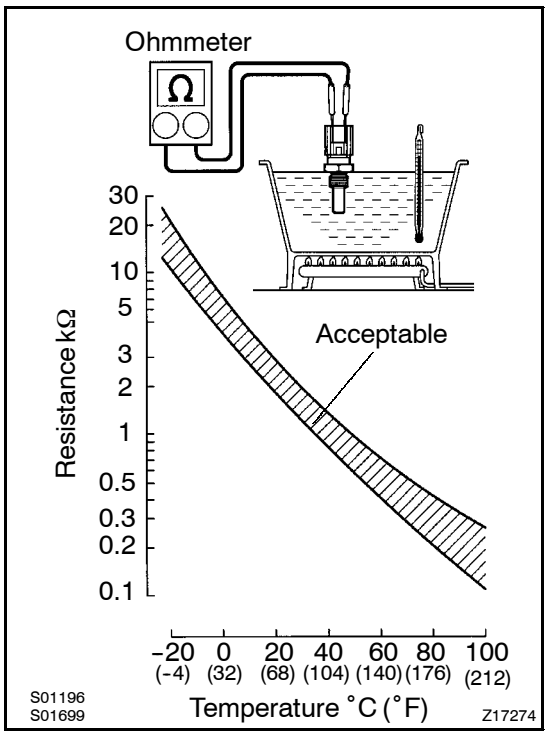
INSPECTION

ED031-02

1. REMOVE INTAKE AIR TEMPERATURE SENSOR

(a) Disconnect the intake air temperature sensor connector.

(b) Remove the intake air temperature sensor.



2. INSPECT INTAKE AIR TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

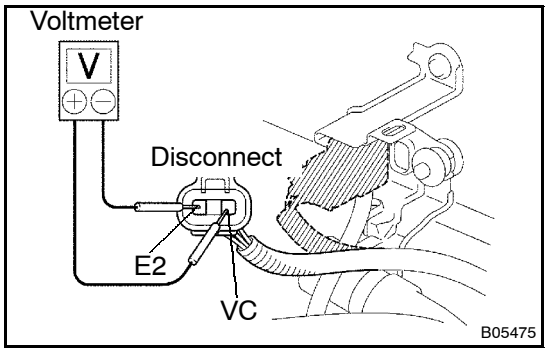
Resistance: Refer to the chart graph

If the resistance is not as specified, replace the intake air temperature sensor.

3. REINSTALL INTAKE AIR TEMPERATURE SENSOR

(a) Install the intake air temperature sensor.

(b) Connect the intake air temperature sensor connector.



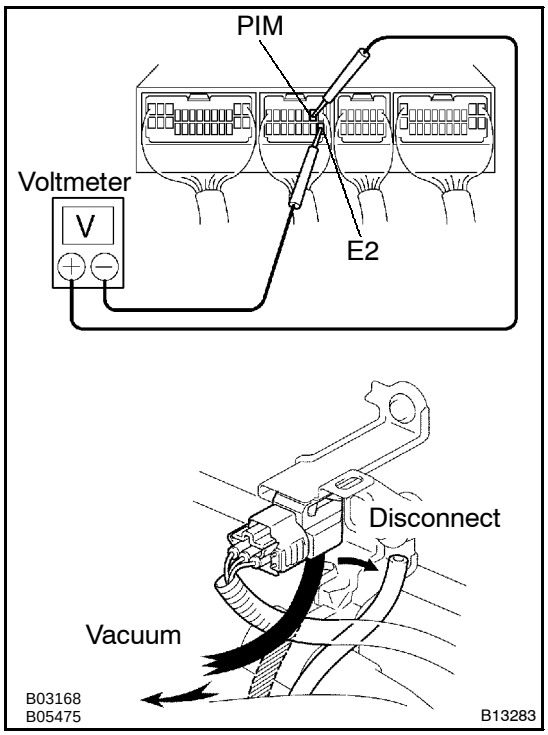
INTAKE AIR PRESSURE SENSOR

ED04N-01

INSPECTION

1. INSPECT POWER SOURCE VOLTAGE OF TURBO PRESSURE SENSOR

(a) Disconnect the intake air pressure sensor connector.
(b) Turn the ignition switch ON.
(c) Using a voltmeter, measure the voltage between connector terminals VC and E2 of the wiring harness side.
Voltage: 4.75 - 5.25 V
(d) Turn the ignition switch OFF.
(e) Reconnect the intake air pressure sensor connector.

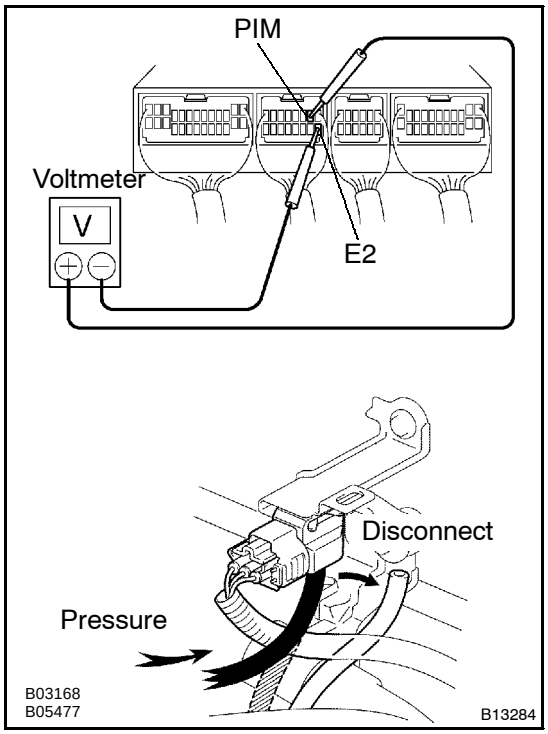


2. INSPECT SUPPLY POWER OF TURBO PRESSURE SENSOR

(a) Turn the ignition switch ON.
(b) Disconnect the vacuum hose from the intake air pressure sensor.
(c) Connect a voltmeter to terminals PIM and E2 of the engine ECU, and measure the output voltage under ambient atmospheric pressure.
(d) Apply vacuum to the intake air pressure sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 40.0 kPa (300 mmHg, 11.81 in.Hg).
(e) Measure the voltage drop from step (c) above for each segment.
Voltage drop:

Applied vacuum kPa (mmHg, in.Hg)	Voltage drop V
13.3 (100, 3.94)	0.3 - 0.5
26.7 (200, 7.87)	0.6 - 0.8
40.0 (300, 11.81)	0.95 - 1.15

CONTINUED



(f) Using SST (turbocharger pressure gauge), apply pressure to the intake air pressure sensor in 19.6 kPa (0.20 kgf/cm^2, 2.84 psi) segments to 98.0 kPa (1.00 kgf/cm^2, 14.2 psi).

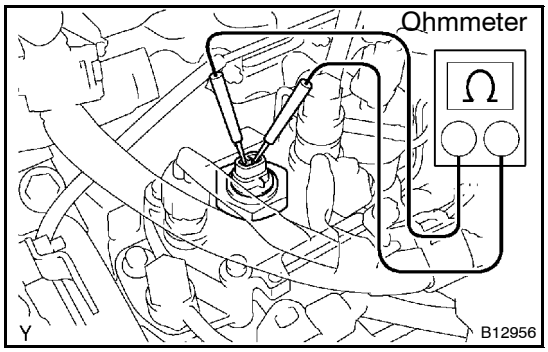
SST 09992-00242

(g) Measure the voltage up from step (c) above for each segment.

Voltage up:

Applied pressure kPa (kgf/cm^2, psi)	Voltage up V
19.6 (0.20, 2.84)	0.4 - 0.7
39.2 (0.40, 5.69)	0.8 - 1.2
58.8 (0.60, 8.53)	1.4 - 1.8
78.5 (0.80, 11.4)	2.0 - 2.3
98.0 (1.00, 14.2)	2.5 - 2.8

(h) Reconnect the vacuum hose to the intake air pressure sensor.



ENGINE SPEED SENSOR

INSPECTION

ED03F-03

INSPECT ENGINE SPEED SENSOR

(a) Disconnect the engine speed sensor connector.

(b) Using an ohmmeter, measure the resistance between the terminals.

Resistance: 205 - 255 Ω at 20°C (68°F)

If the resistance is not specified, replace the injection pump assembly (See page FU-11).

(c) Reconnect the engine speed sensor connector.

CRANKSHAFT POSITION SENSOR

ED035-02

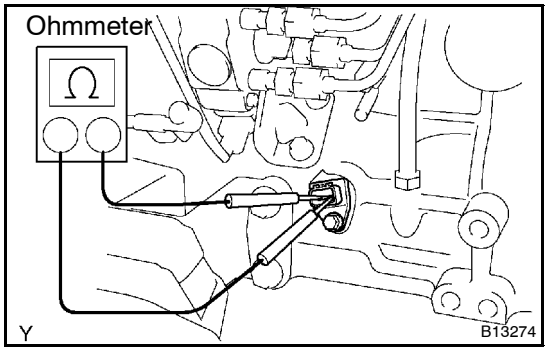
INSPECTION

NOTICE:

"Cold" and "Hot" in the following sentences express the temperature of the sensors themselves. "Cold" is from -10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

INSPECT CRANKSHAFT POSITION SENSOR

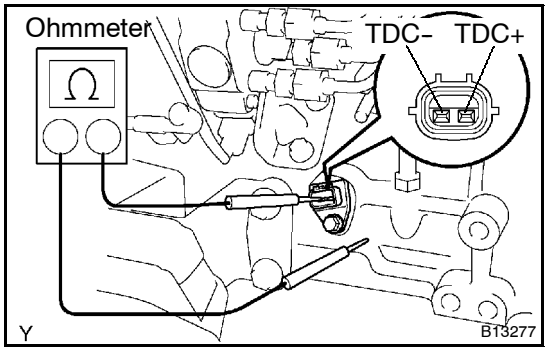
(a) Disconnect the crankshaft position sensor connector.



(b) Using an ohmmeter, measure the resistance between the terminals.

Resistance:

Cold	19 - 32 Ω
Hot	24 - 37 Ω



(c) Using an ohmmeter, measure the resistance between TDC- terminal and body.

Resistance: 10 MΩ or more

If the resistance is not as specified, replace the crankshaft position sensor.

Torque: 5 N·m (50 kgf·cm, 43 in.·lbf)

HINT:

Apply engine oil to a new O-ring on the crankshaft position sensor, and install them.

NOTICE:

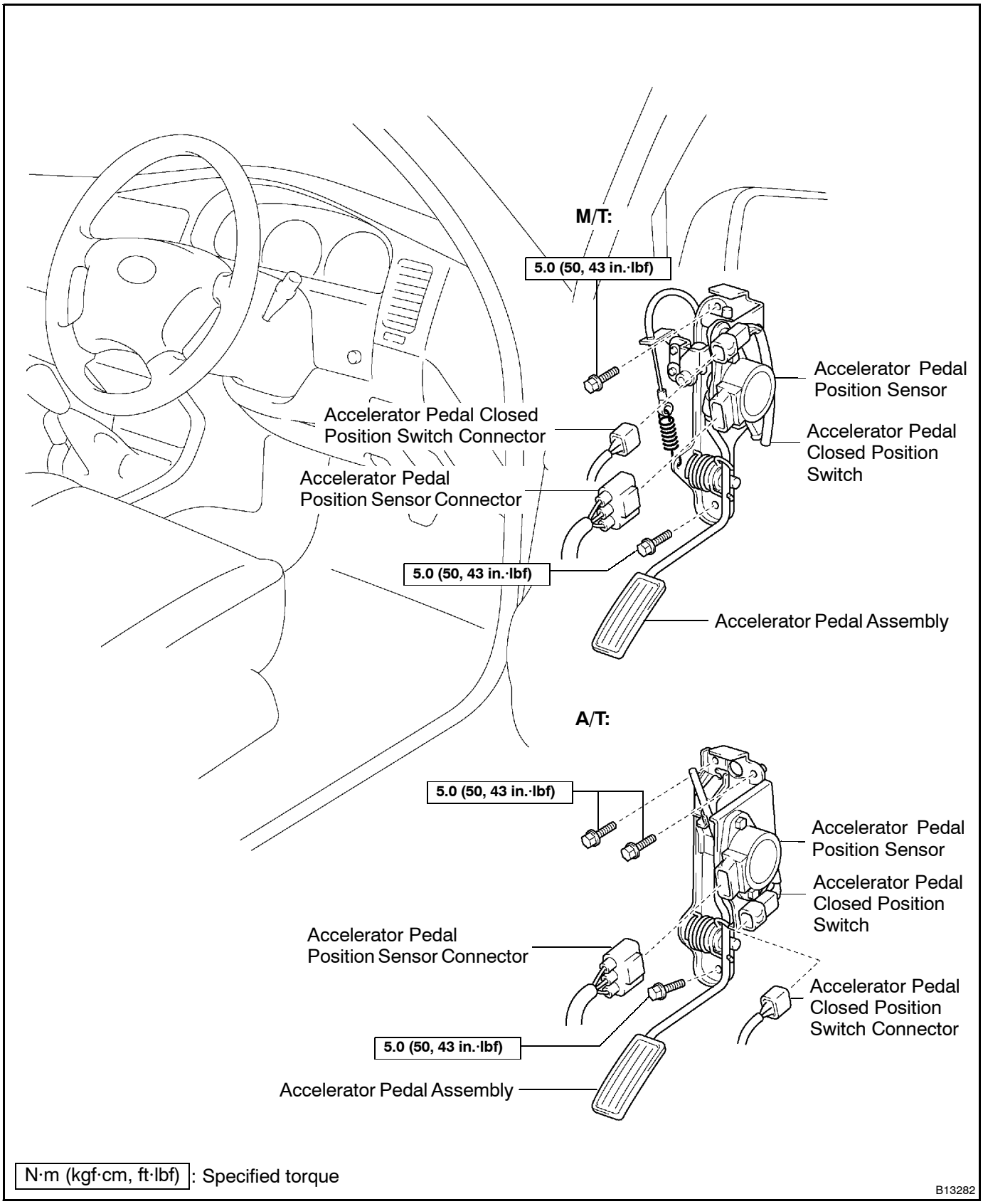
Be careful not drop and shock the sensor.

(d) Reconnect the crankshaft position sensor connector.

ACCELERATOR PEDAL POSITION SENSOR

COMPONENTS

ED04O-01



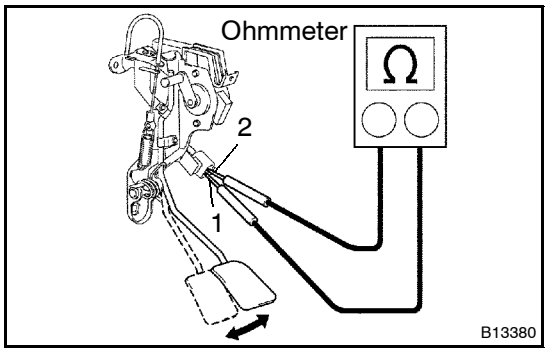
N·m (kgf·cm, ft·lbf) : Specified torque

B13282

ED037-01

INSPECTION

INSPECT ACCELERATOR PEDAL POSITION SENSOR (See page DI-40)



ACCELERATOR PEDAL CLOSED POSITION SWITCH

ED038-04

INSPECTION

INSPECT ACCELERATOR PEDAL CLOSED POSITION SWITCH

(a) Disconnect the accelerator pedal closed position switch connector.

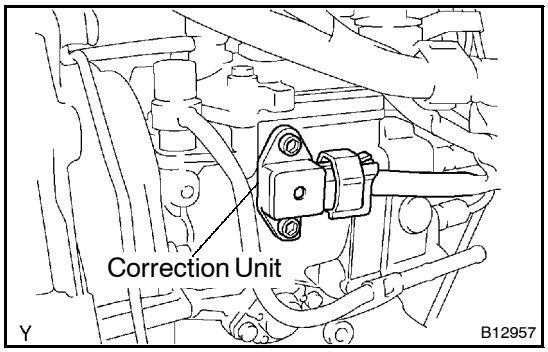
(b) Using an ohmmeter, check the continuity between the accelerator pedal closed position switch terminals.

Continuity:

Accelerator Pedal	Continuity
Fully closed	No continuity
Fully open	Continuity (0 - 20 Ω)

If the is not as continuity, replace the accelerator pedal closed position switch. (See page ED-19).

(c) Reconnect the accelerator pedal closed position switch connector.



INJECTION PUMP CORRECTION UNIT

ED03B-03

INSPECTION

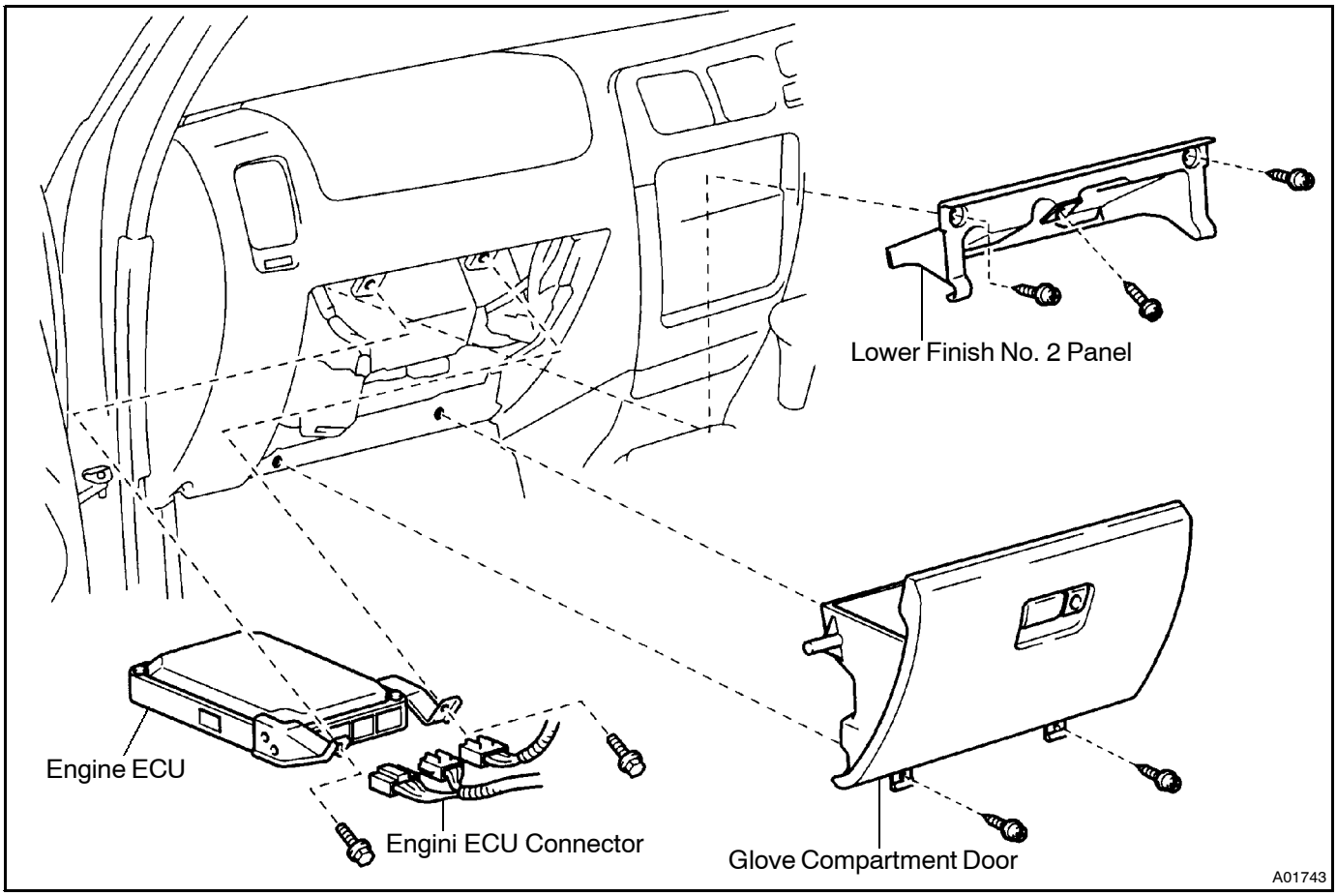
INSPECT INJECTION PUMP CORRECTION UNIT (See page DI-66)

ELECTRONIC CONTROL DIESEL:

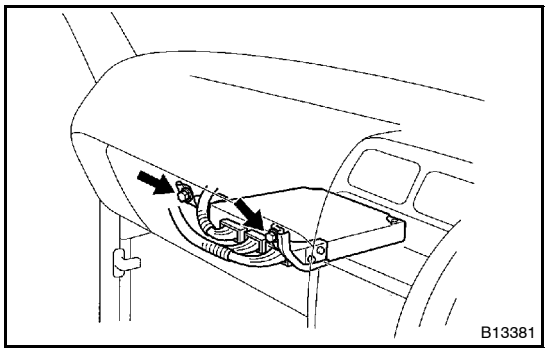
ENGINE ECU

COMPONENTS

FI01Z-02



FI020-02



REMOVAL

1. REMOVE GLOVE COMPARTMENT DOOR
2. REMOVE LOWER FINISH NO.2 PANEL
3. REMOVE ENGINE ECU

(a) Disconnect the 4 engine ECU connector.

(b) Remove the 2 bolts and engine ECU.

FI021-02

INSPECTION

(See page DI-17)

FI022-02

INSTALLATION

Installation is in the reverse order of removal (See page ED-24).

ENGINE FUEL

REFER TO FOLLOWING REPAIR MANUALS:

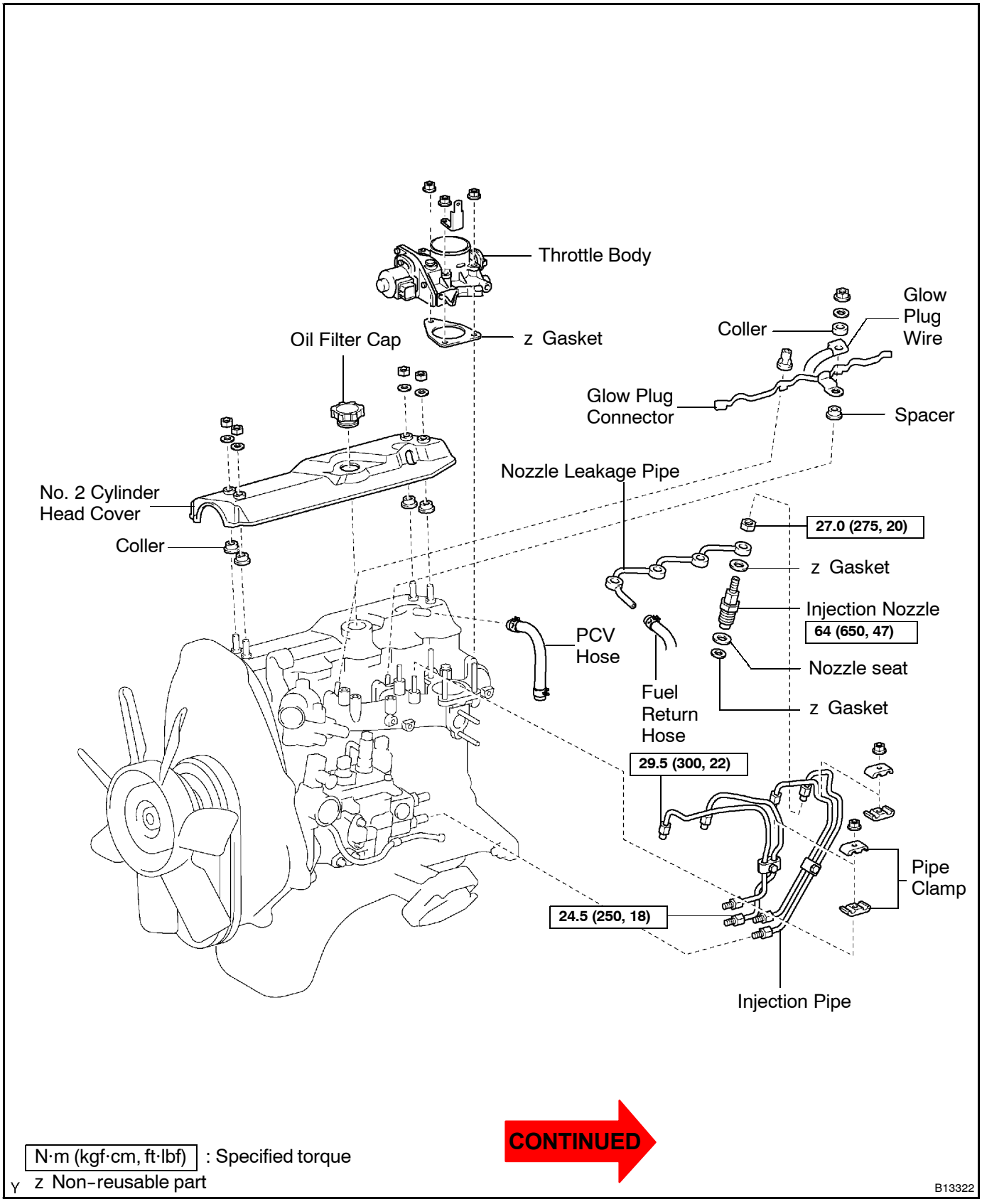
Manual Name	Pub. No.
2L, 3L Engine Repair Manual	RM520E
2L, 2L–T, 3L, 5L Engine Repair Manual Supplement (Aug., 1997)	RM582E

NOTE: The above pages contain only the points which differ from the above listed manuals.

INJECTION NOZZLE

COMPONENTS

FU00P-02

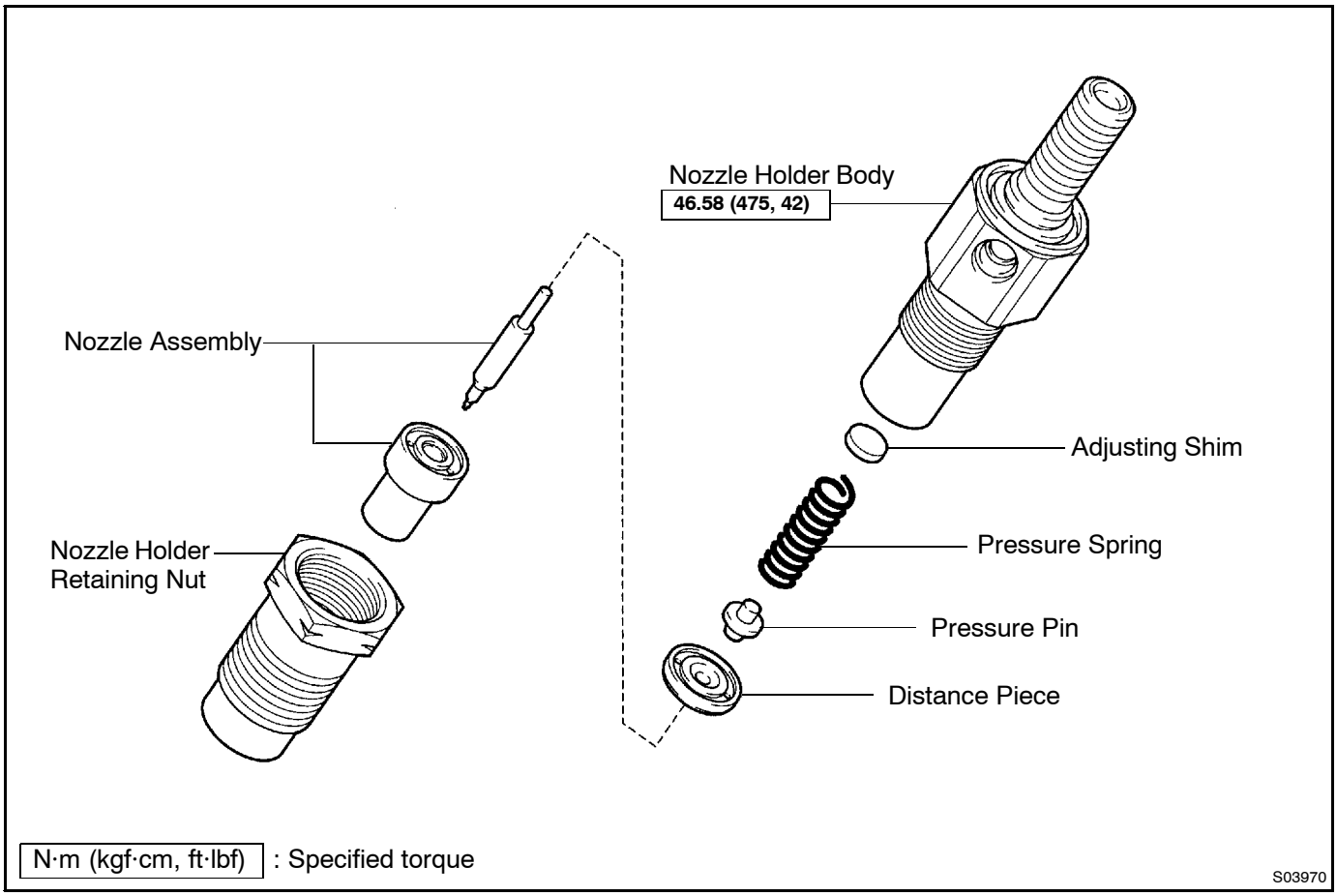


CONTINUED

N·m (kgf·cm, ft·lbf) : Specified torque

z Non-reusable part

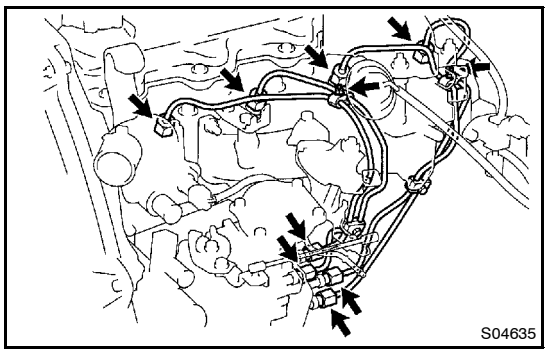
B13322


Nozzle Holder Body
46.58 (475, 42)
Nozzle Assembly
Adjusting Shim
Pressure Spring
Nozzle Holder
Retaining Nut
Pressure Pin
Distance Piece
N·m (kgf·cm, ft·lbf) : Specified torque
S03970

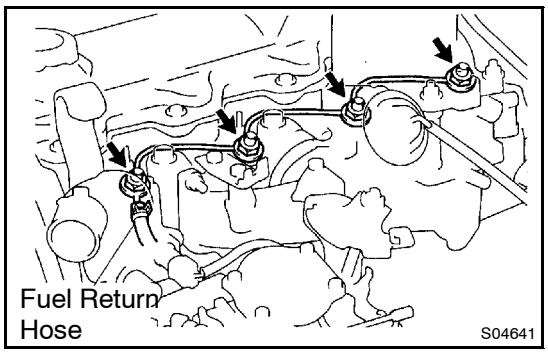
FU093-01

REMOVAL

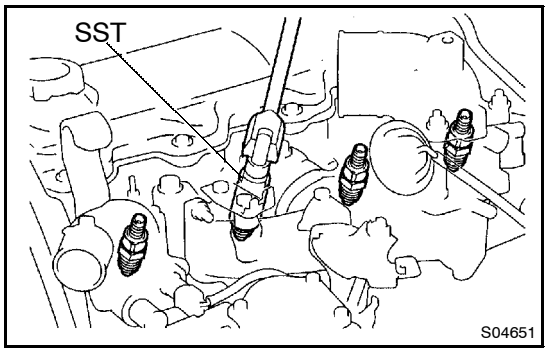
1. w/ EGR:
   REMOVE EGR VALVE AND EGR ADAPTER
   (See page EM-6)
2. REMOVE THROTTLE BODY (See page ED-5)
3. REMOVE GLOW PLUG CONNECTOR
   (See Pub. No. RM520E on page EG-30)



4. REMOVE INJECTION PIPES
   (a) Loosen the 8 union nuts of the 4 injection pipes.
   (b) Remove the 2 nuts, 2 upper pipe clamps, 4 injection pipes and lower pipe clamps.

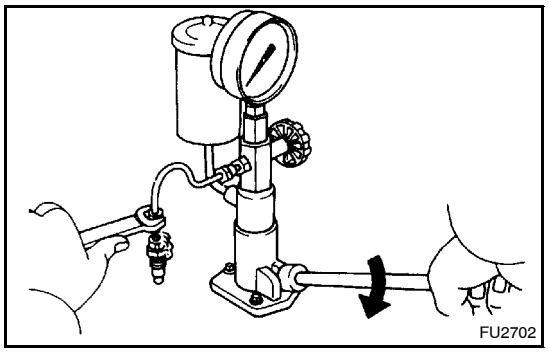


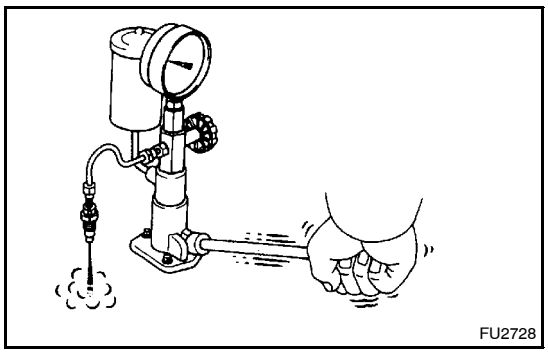
5. REMOVE NOZZLE LEAKAGE PIPE
   (a) Disconnect the fuel return hose from the leakage pipe.
   (b) Remove the 4 nuts, leakage pipe and 4 gaskets.



6. REMOVE INJECTION NOZZLE
   Using SST, remove the 4 injection nozzles, 4 seats and 4 gaskets.
   SST 09268-64010 (09268-64020)
   HINT:
   Arrange the injection nozzles in correct order.

FU00U-03





TEST

1. INJECTION PRESSURE TEST

(a) Install the injection nozzle to the injection nozzle hand tester and bleed air from the union nut.

CAUTION:

Do not plate your finger over the nozzle injection hole.

(b) Pump the tester handle a few times as fast as possible to discharge the carbon from the injection hole.

(c) Pump the tester handle slowly and observe the pressure gauge.

(d) Read the pressure gauge just as the injection pressure begins to drop.

Opening pressure:
new nozzle
15,790 - 16,570 kPa
(161 - 169 kgf/cm^2, 2,290 - 2,404 psi)
Reused nozzle
15,200 - 16,180 kPa
(155 - 165 kgf/cm^2, 2,205 - 2,347 psi)

HINT:

Proper nozzle operation can be determined by a switching sound.

If the opening pressure is not as specified, disassemble the nozzle holder and change the adjusting shim on the top of the pressure spring.

Adjusting opening pressure
15,200 - 16,180 kPa
(155 - 165 kgf/cm^2, 2,205 - 2,347 psi)
Adjusting shim thickness:

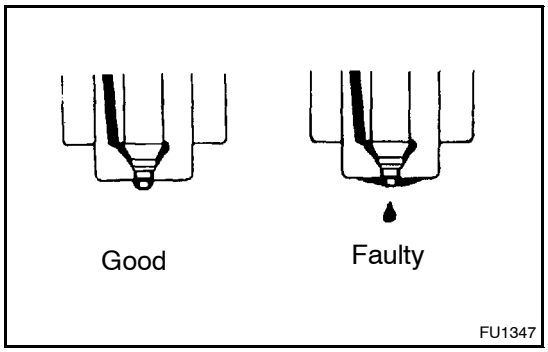
0.900(0.0354)	1.300(0.0512)	1.700(0.0669)
0.950(0.0374)	1.350(0.0531)	1.750(0.0689)
1.000(0.0394)	1.400(0.0551)	1.800(0.0709)
1.050(0.0413)	1.450(0.0571)	1.850(0.0728)
1.100(0.0433)	1.500(0.0591)	1.900(0.0748)
1.150(0.0453)	1.550(0.0610)	1.950(0.0768)
1.200(0.0472)	1.600(0.0630)	-
1.250(0.0492)	1.650(0.0650)	-

HINT:

- Varying the adjusting shim thickness by 0.05 mm (0.0020 in.) changes the injection pressure by about 628 kPa (6.4 kgf·cm^2, 91 psi)
- Only one adjusting shim should be used.

(e) There should be dripping after injection.

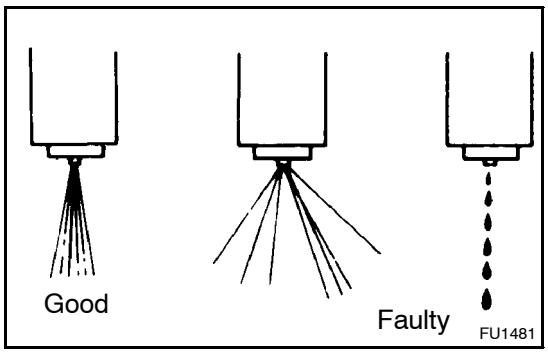
CONTINUED



2. LEAKAGE TEST

While maintaining pressure at about 981 – 1,961 kPa (10 – 20 kgf·cm^2, 142 – 284 psi) below opening pressure (adjust by tester handle), check that there is no dripping for 10 seconds from the injection hole or around the retaining nut.

If the nozzle drips with in 10 seconds, replace or clean and overhaul the nozzle assembly.



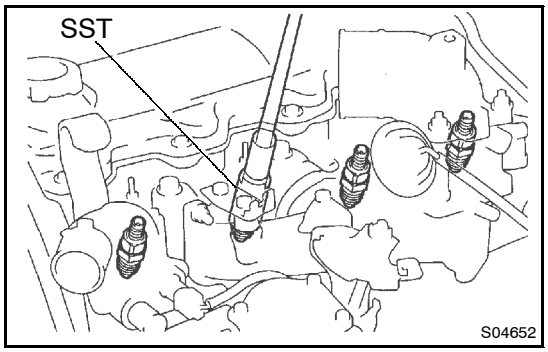
3. SPRAY PATTERN TEST

(a) The injection nozzle should shudder at a certain pumping speed between 15 – 60 times (old nozzle) or 30 60 times (new nozzle) per minute.

(b) Check the spray pattern during shuddering.

If the spray pattern is not correct during shuddering, the nozzle must be replaced or cleaned.

FU094-01



INSTALLATION

1. INSTALL INJECTION NOZZLES

(a) Place 4 new gaskets and the 4 nozzle seats into the injection nozzle holes of the cylinder head.

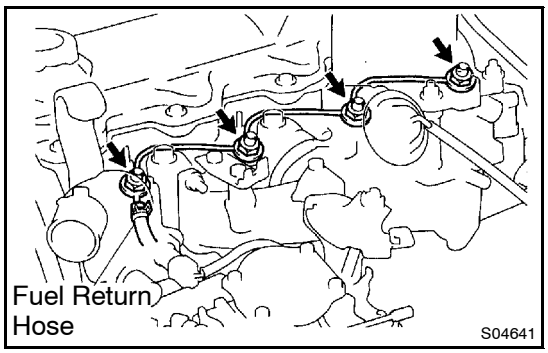
(b) Using SST, install the 4 injection nozzles.

SST 09268-64010 (09268-64020)

Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)

NOTICE:

Over torquing could cause nozzle deformation and needle adhesion or other defects.

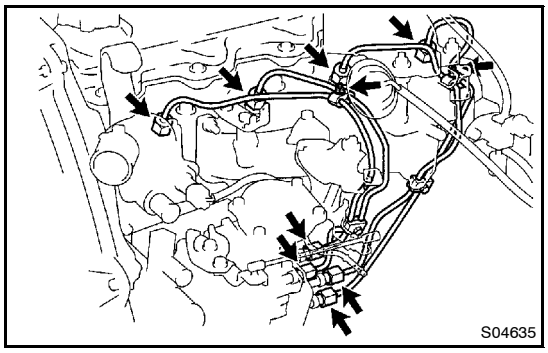


2. INSTALL NOZZLE LEAKAGE PIPE

(a) Install 4 new gaskets and the leakage pipe with the 4 nuts.

Torque: 27.0 N·m (275 kgf·cm, 20 ft·lbf)

(b) Connect the fuel hose to the leakage pipe.



3. INSTALL INJECTION PIPES

(a) Place the 2 lower clamps on the intake manifold.

(b) Install the 4 injection pipes.

Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf)

(c) Secure the injection pipes with the 2 upper pipe clamps and 2 bolts.

Torque: 29.5 N·m (300 kgf·cm, 22 ft·lbf)

4. INSTALL GLOW PLUG CONNECTOR
(See Pub. No. RM520E on page EG-51)

5. INSTALL THROTTLE BODY (See page ED-6)

6. w/ EGR:
INSTALL EGR VALVE AND EGR ADAPTER
(See page EM-9)

7. START ENGINE AND CHECK FOR LEAKS

INJECTION PUMP

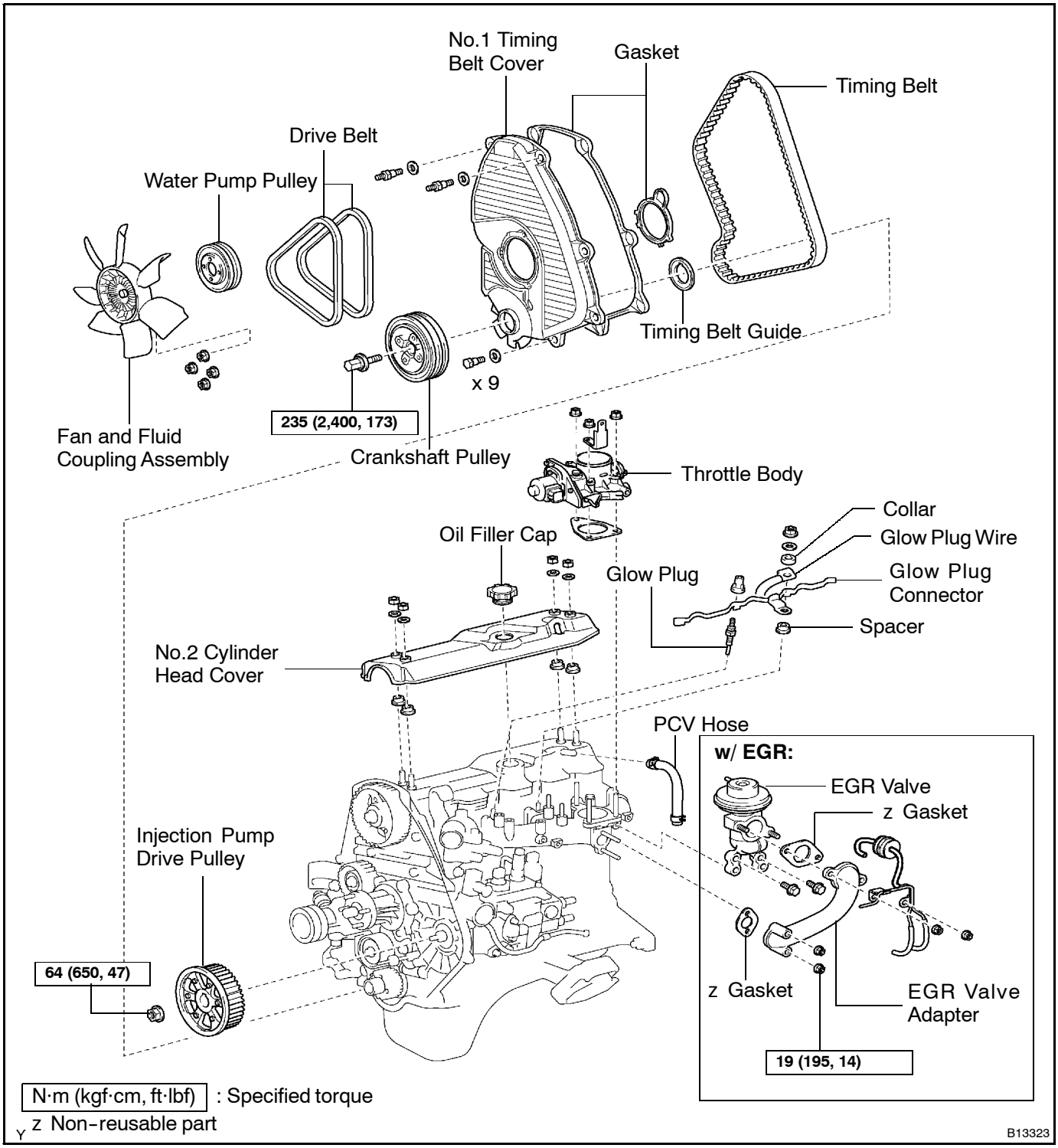
FU095-01

ON-VEHICLE INSPECTION

1. INSPECT ENGINE SPEED SENSOR (See page ED-17)
2. INSPECT SPILL CONTROL VALVE (See page ED-8)
3. INSPECT INJECTION PUMP CORRECTION RESISTORS (See page ED-22)
4. INSPECT TIMING CONTROL VALVE (See page ED-7)

FU096-01

COMPONENTS



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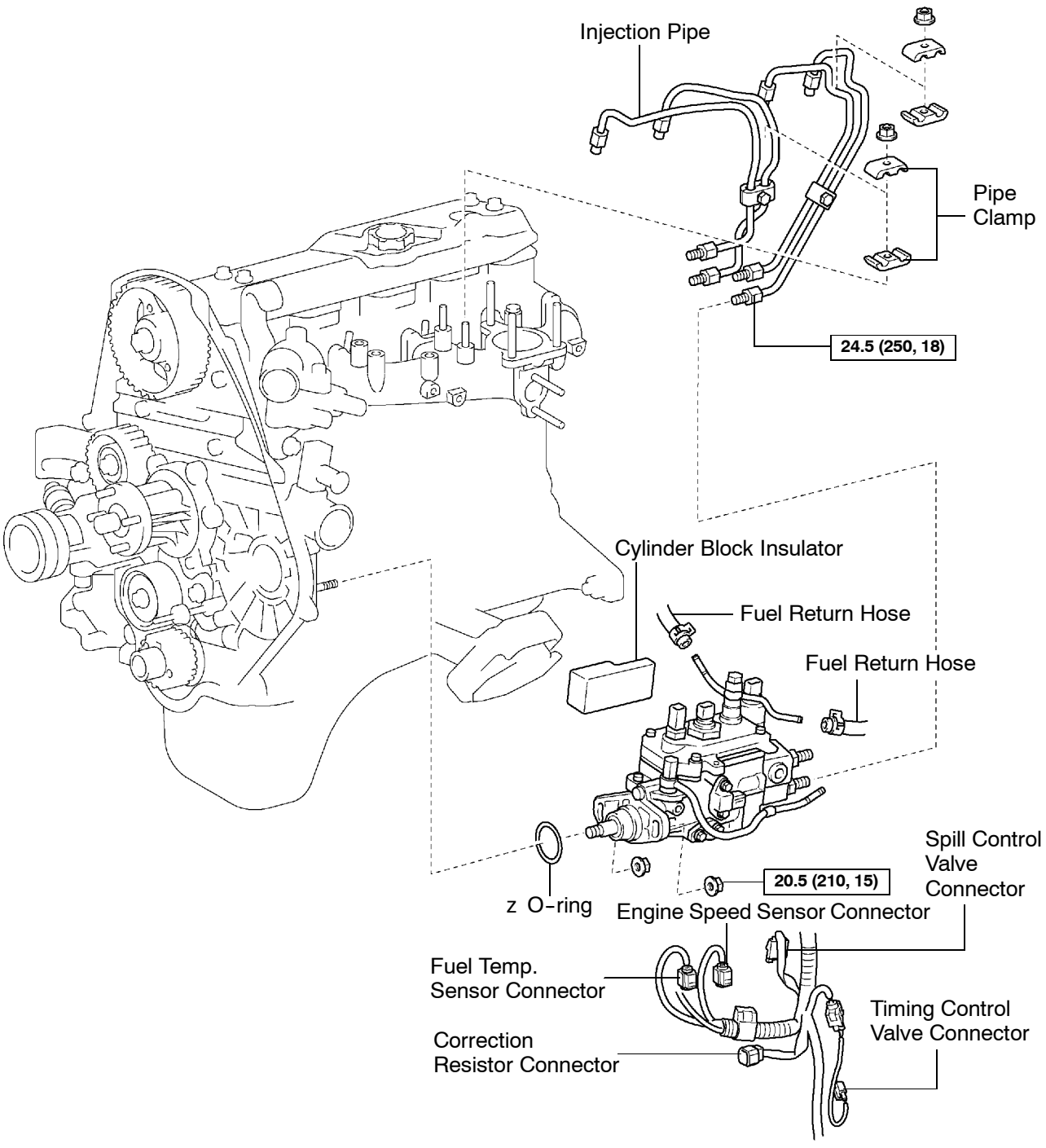

Y N·m (kgf·cm, ft·lbf) : Specified torque

z Non-reusable part

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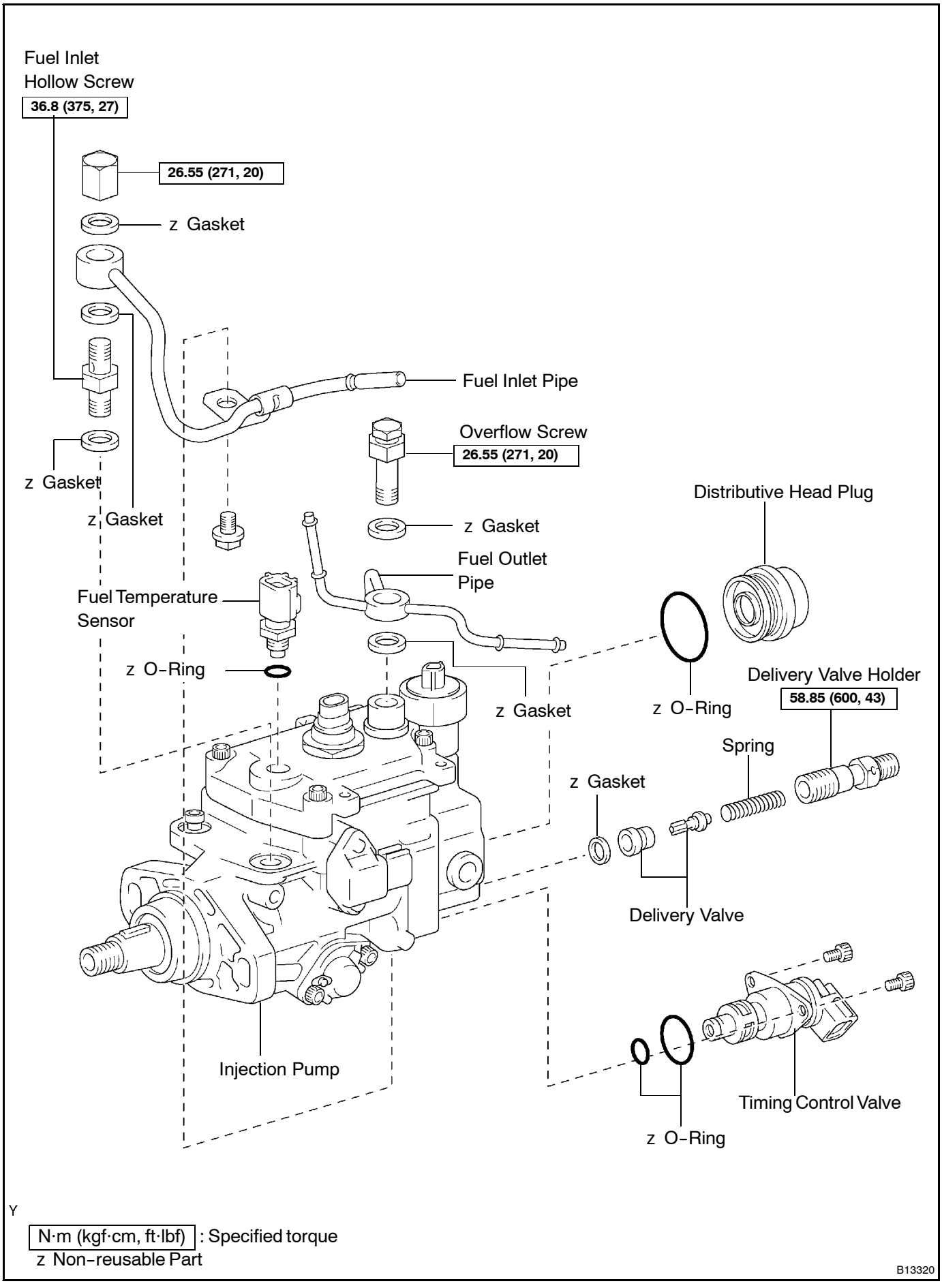
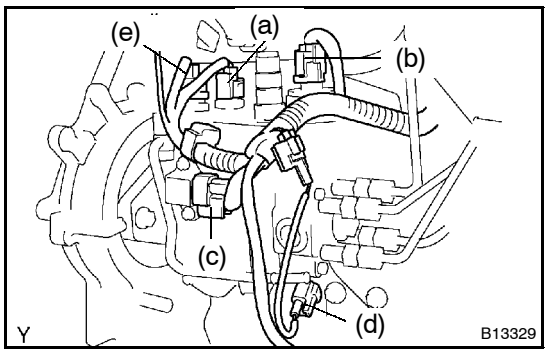
B13324


Fuel Inlet
Hollow Screw
36.8 (375, 27)
26.55 (271, 20)
z Gasket
Fuel Inlet Pipe
Overflow Screw
26.55 (271, 20)
z Gasket
z Gasket
z Gasket
z Gasket
Distributive Head Plug
Fuel Outlet
Pipe
Fuel Temperature
Sensor
z O-Ring
z Gasket
z O-Ring
Delivery Valve Holder
58.85 (600, 43)
Spring
z Gasket
Delivery Valve
Injection Pump
Timing Control Valve
z O-Ring
Y
N·m (kgf·cm, ft·lbf) : Specified torque
z Non-reusable Part
B13320

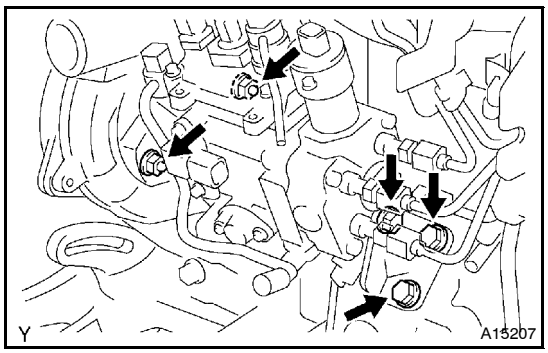
FU097-01

REMOVAL

1. REMOVE INJECTION PIPE
(See page FU-3)
2. REMOVE INJECTION PUMP DRIVE PULLEY
(See Pub. No. RM520E on page EG-22a)

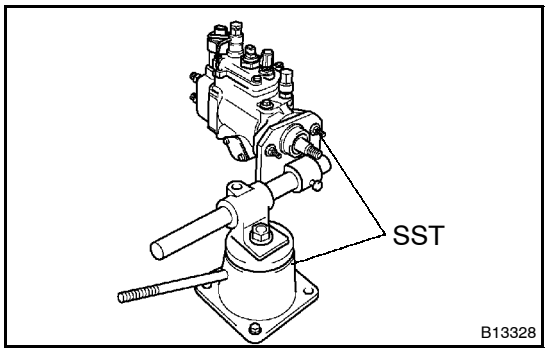


3. REMOVE INJECTION PUMP
(a) Disconnect the engine speed sensor connector.
(b) Disconnect the spill control valve connector.
(c) Disconnect the correction resistor connector.
(d) Disconnect the timing control valve connector.
(e) Disconnect the fuel temperature sensor connector.
(f) Disconnect the engine wire clamp and fuel hose.



(g) Remove the 3 bolts and injection pump stay.
(h) Remove the 2 nuts and injection pump and cylinder block insulator.

FU098-01

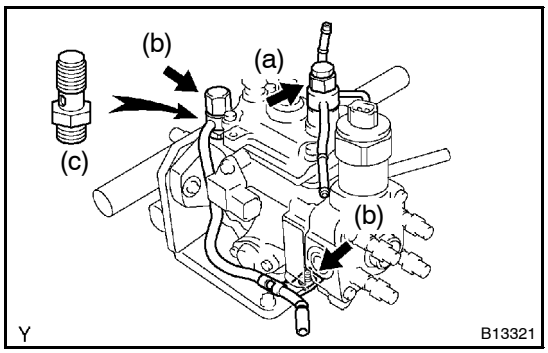


DISASSEMBLY

1. MOUNT PUMP ASSEMBLY TO SST (STAND)

SST 09241-76022, 09245-54010

2. REMOVE SET KEY OF DRIVE PULLEY FROM DRIVE SHAFT

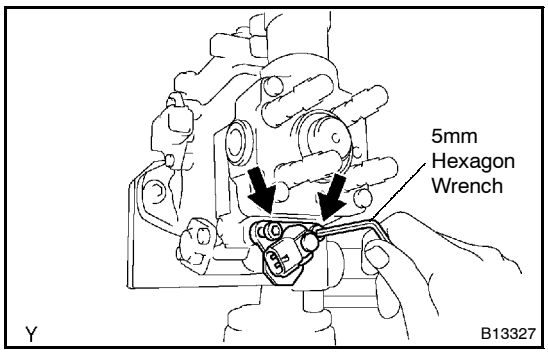


3. REMOVE FUEL PIPES AND INLET HOLLOW SCREW

(a) Remove the overflow screw, fuel outlet pipe and 2 gaskets.

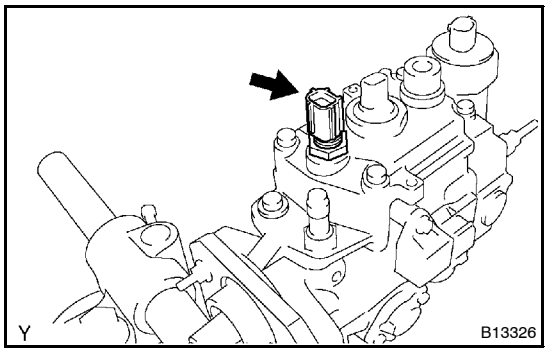
(b) Remove the cap nut, bolt, fuel inlet pipe and 2 gaskets.

(c) Remove the fuel inlet hollow screw and gasket.



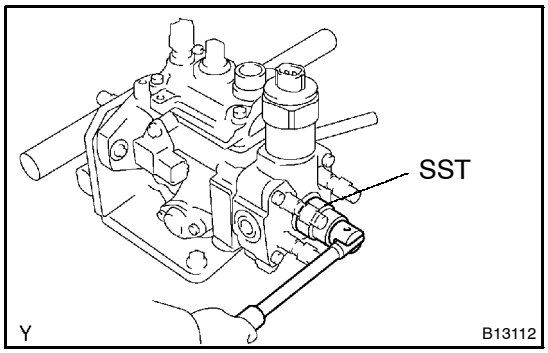
4. REMOVE TIMING CONTROL VALVE

Using a 5 mm hexagon wrench, remove the 2 bolts and timing control valve.



5. REMOVE FUEL TEMPERATURE SENSOR

Using a 19 mm deep socket wrench, remove the fuel temperature sensor.

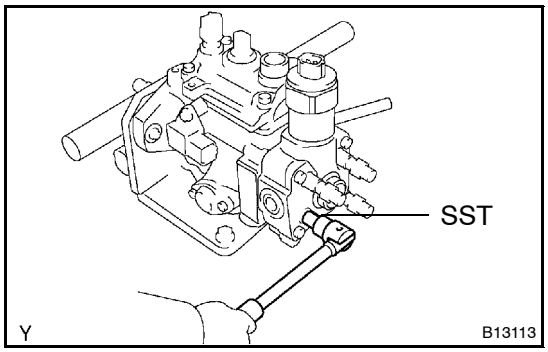


6. REMOVE DISTRIBUTIVE HEAD PLUG

Using SST, remove the distributive head plug.

SST 09260-54012 (09262-54010)

CONTINUED



7. REMOVE DELIVERY VALVE HOLDERS

(a) Using SST, remove the 4 delivery valve holders and springs.

SST 09260-54012 (09269-54020)

(b) Remove the 4 delivery valves and gaskets.

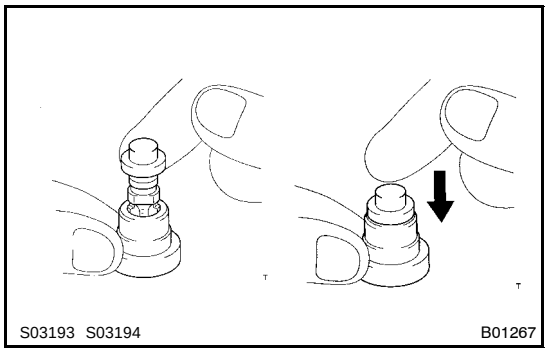
NOTICE:

Do not touch the sliding surfaces of the delivery valve with your hand.

HINT:

Arrange the delivery valves, springs, and holders in order.

FU099-01



S03193 S03194 B01267

INSPECTION

NOTICE:

Do not touch the sliding surfaces of the delivery valves.

INSPECT DELIVERY VALVES

(a) Pull up the valve, release it.

(b) Check that it sinks smoothly to the valve seat.

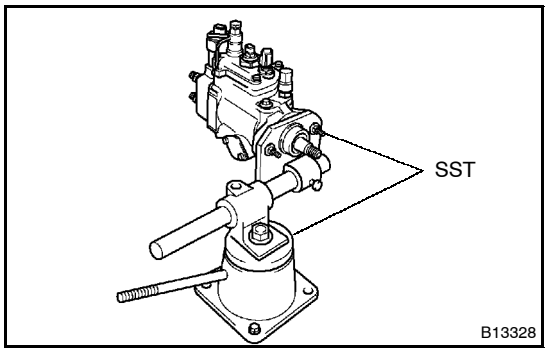
If operation is not as specified, replace the valve as a set.

HINT:

Before using a new valve set, wash off the rust prevention compound with diesel fuel. Then re-wash with diesel fuel and perform the above test.

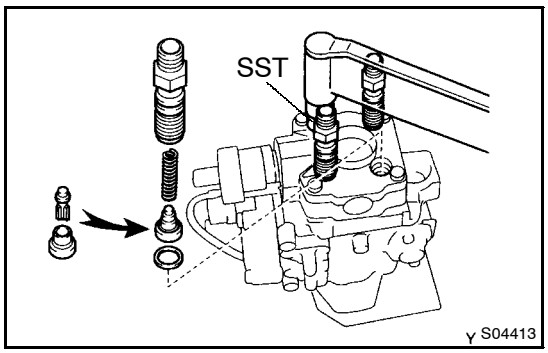
FU09A-01

REASSEMBLY



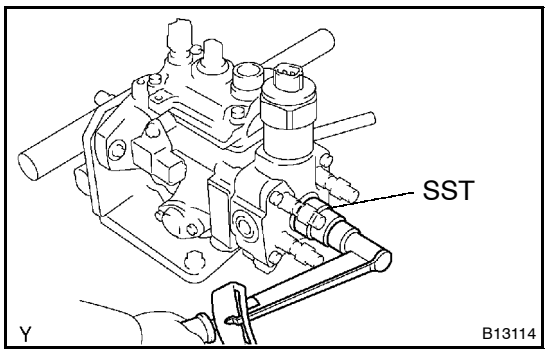
1. MOUNT PUMP BODY TO SST (STAND)

SST 09241-76022, 09245-54010



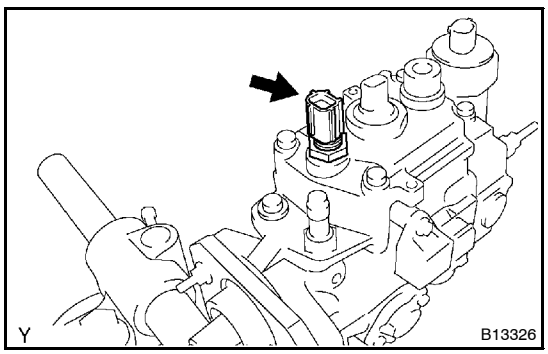
2. INSTALL DELIVERY VALVE HOLDERS

(a) Install new gaskets and the valves into distributive head.
(b) Install the springs into the delivery valve holders.
(c) Using SST, install the delivery valve holders.
SST 09260-54012 (09269 - 54020)
Torque: 58.85 N·m (600 kgf·cm, 43 ft·lbf)



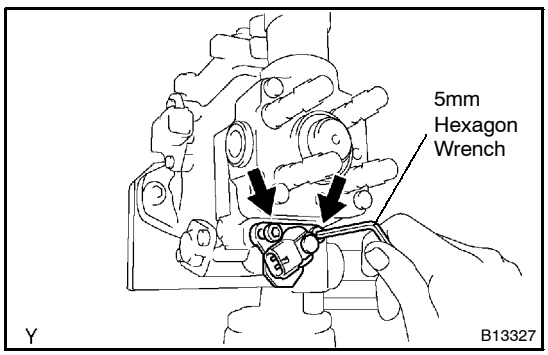
3. INSTALL DISTRIBUTIVE HEAD PLUG

(a) Install a new O-ring to the distributive head plug.
(b) Using SST, install the head plug.
SST 09260-54012 (09262-54010)
Torque: 88 N·m (900 kgf·cm, 65 ft·lbf)



4. INSTALL FUEL TEMPERATURE SENSOR

(a) Install a new O-ring to the fuel temperature sensor.
(b) Using a 19 mm deep socket wrench, install the fuel temperature sensor.
Torque: 21.6 N·m (220 kgf·cm, 16.5 ft·lbf)



5. INSTALL TIMING CONTROL VALVE

Using a 5 mm hexagon wrench, install the timing control valve with the 2 bolts.

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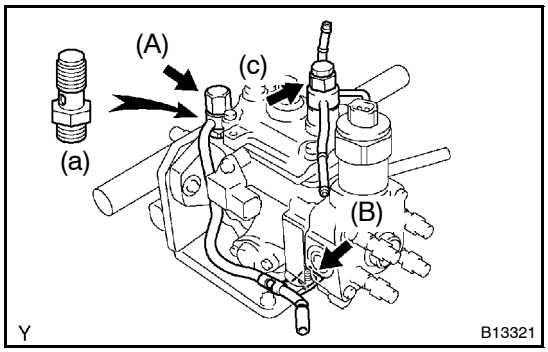


6. INSTALL FUEL INLET HOLLOW SCREW FUEL PIPES

(a) Install a new gasket and the hollow screw.
Torque: 36.8 N·m (375 kgf·cm, 27 ft·lbf)

(b) Install the fuel inlet pipe with 2 new gaskets, the cap nut (A) and bolt (B) .
Torque:
26.55 N·m (271 kgf·cm, 20 ft·lbf) for (A)
24.5 N·m (250 kgf·cm, 18 ft·lbf) for (B)

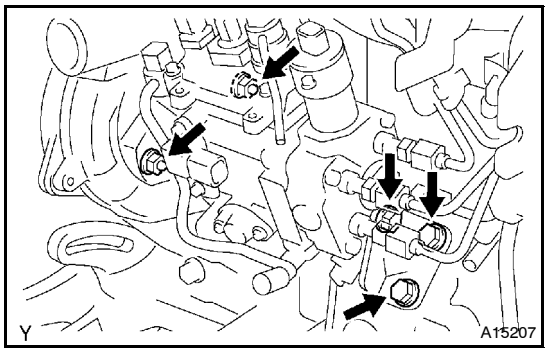
(c) Install the fuel outlet pipe with a new gasket and the overflow screw.
Torque: 26.55 N·m (271 kgf·cm, 20 ft·lbf)

7. REMOVE INJECTION PUMP FROM SST (STAND)
SST 09241-76022, 09245-54010

8. INSTALL SET KEY OF INJECTION PUMP DRIVE PULLEY ON DRIVE SHAFT

FU012-02

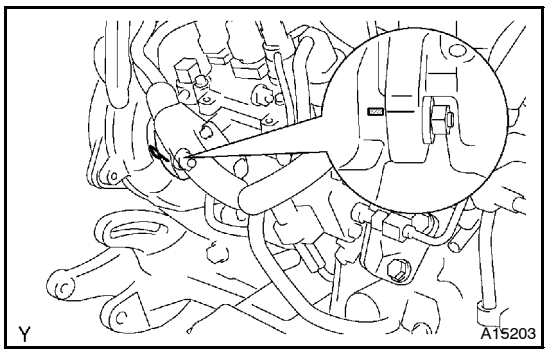
INSTALLATION



1. INSTALL INJECTION PUMP

(a) Install injection pump to timing belt case, and temporary tightening two nuts.

(b) Install injection pump stay to injection pump rear end, and temporary tightening three bolts.

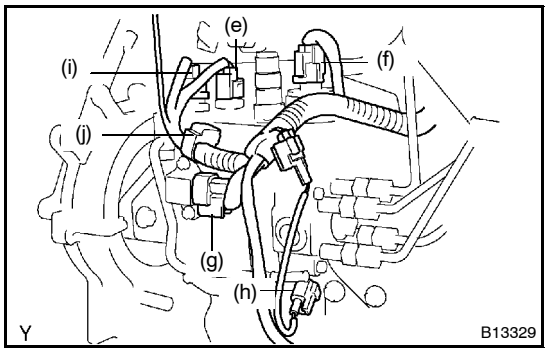


(c) Rotate the pump body to make the marking of pump flange conform to the marking of timing belt case.

(d) Tighten the fixing nuts and bolts to secure the pump body.Installing order of injection pump stay (after temporary tightening) .
Block side bolts tightening

pump side bolt tightening
Torque:
Injection pump

Belt case: 20.5 N·m (210 kgf·cm, 15 ft·lbf)
Block side bolts: 26 N·m (270 kgf·cm, 19.6 ft·lbf)
Pump side bolt: 26 N·m (270 kgf·cm, 19.6 ft·lbf)



(e) Connect the engine speed sensor connector.
(f) Connect the spill control valve connector.
(g) Connect the correction resistor connector.
(h) Connect the timing cotrol valve connector.
(i) Connect the fuel temperature sensor connector.
(j) Connect the engine wire clamp and fuel hose.

2. INSTALL INJECTION PUMP DRIVE PULLY

(See Pub. No. RM520E on page EG-24)

3. INSTALL INJECTION PIPE

(See page FU-6)

ALPHABETICAL INDEX

A

C

D

E

F

G

H

I

P

R

S

T

W