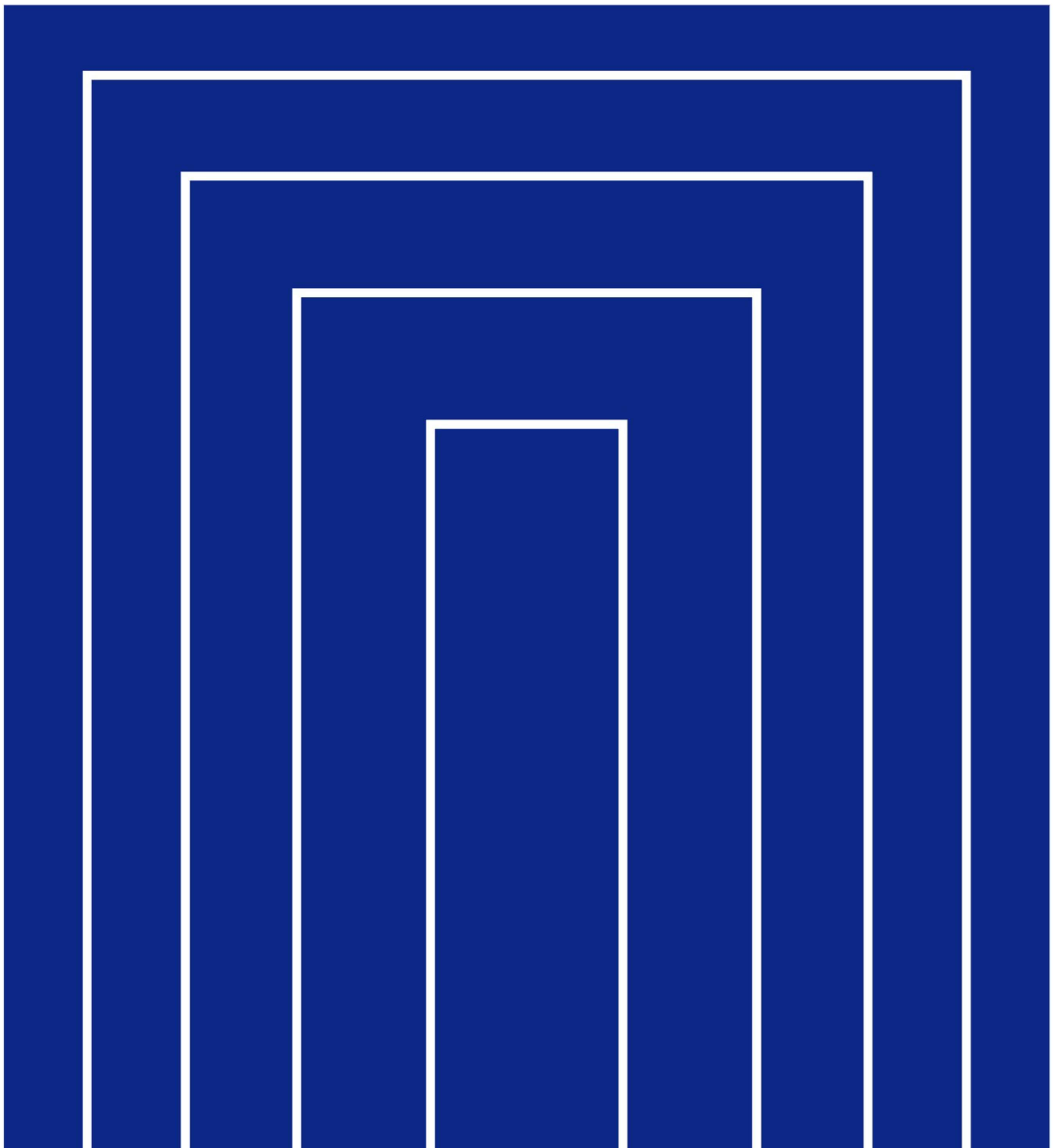
TOYOTA

5VZ-FE

ENGINE

REPAIR MANUAL SUPPLEMENT

Aug., 2001



Pub. No. RM898E

FOREWORD

This supplement has been prepared to provide information covering general service repairs for the 5VZ–FE engine equipped on the LAND CRUISER/LAND CRUISER PRADO.

Applicable models: VZJ90, 95 series

For the service specifications and repair procedures of the above model other than those listed in this supplement, refer to the following manuals.

Manual Name	Pub. No.
• 5VZ–FE Engine Repair Manual	RM519E
• 5VZ–FE Engine Repair Manual Supplement (Jun., 1999)	RM703E

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.

TOYOTA MOTOR CORPORATION

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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 a good understanding of 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.

INTRODUCTION

HOW TO USE THIS MANUAL

GENERAL INFORMATION

INOEU–01

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–9.
Be sure to read this before performing troubleshooting.

4. PREPARATION

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

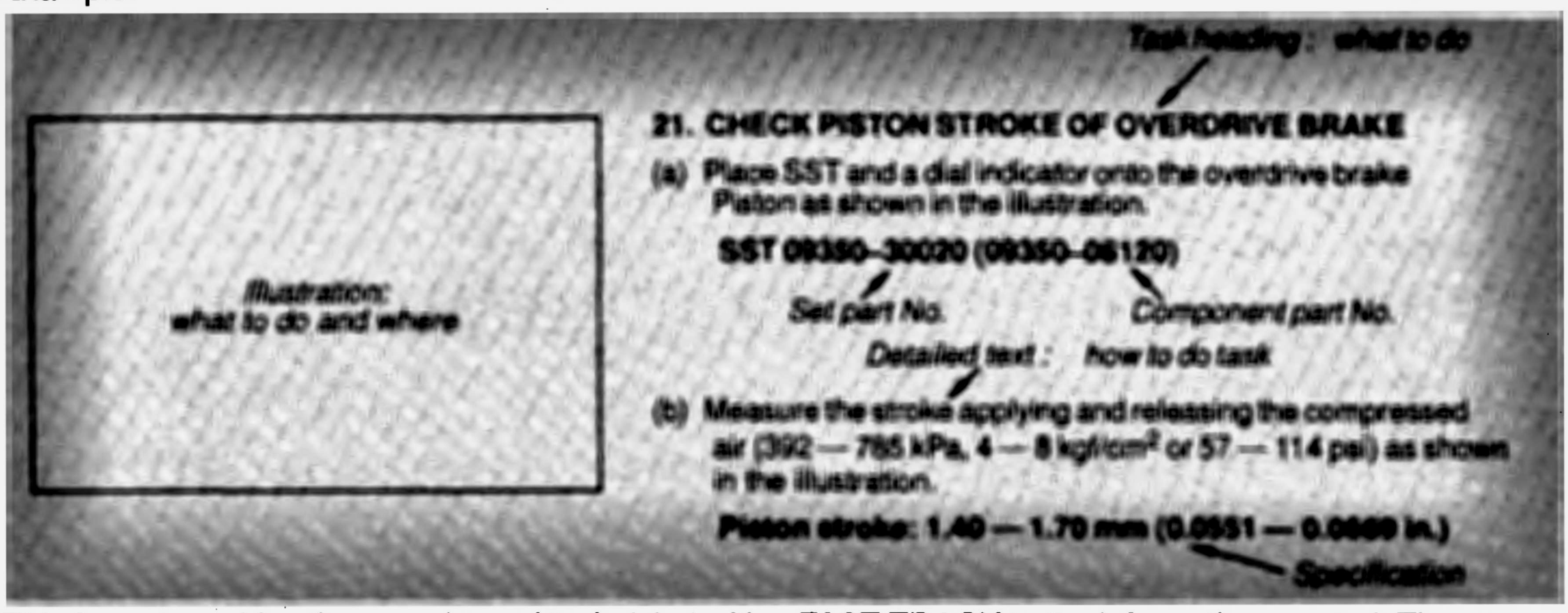
5. REPAIR PROCEDURES

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

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

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

Example:



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:

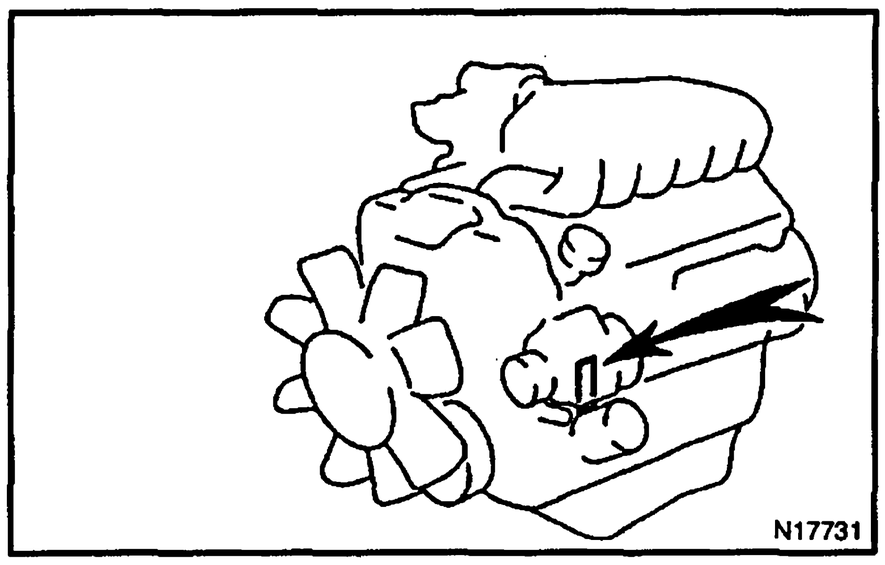
- CAUTIONS are presented in bold type, and indicate there is a possibility of injury to you or other people.
- NOTICES are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- HINTS are separated from the text but do not appear in bold. They provide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

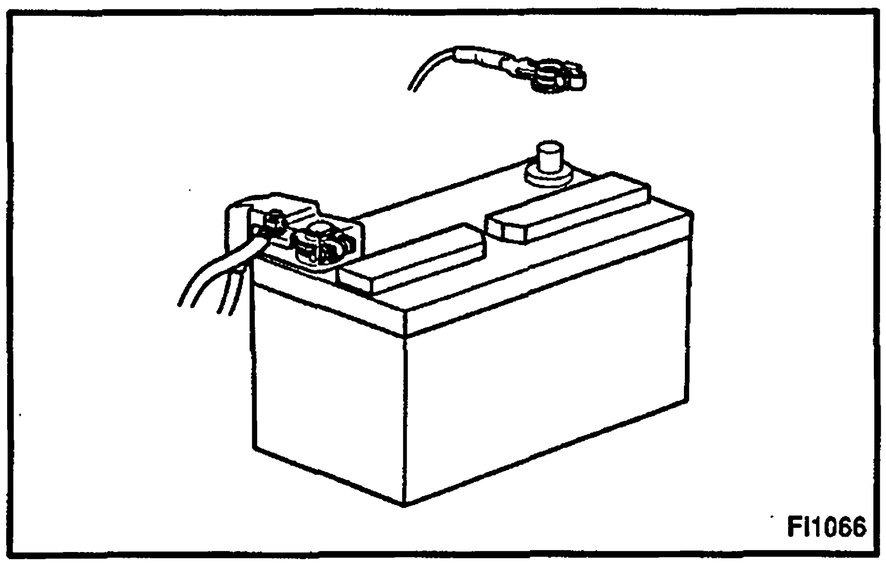


IDENTIFICATION INFORMATION

IN0EV-02

ENGINE SERIAL NUMBER

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

GENERAL INFORMATION

IN0EW–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, oil seals etc. with new ones.

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

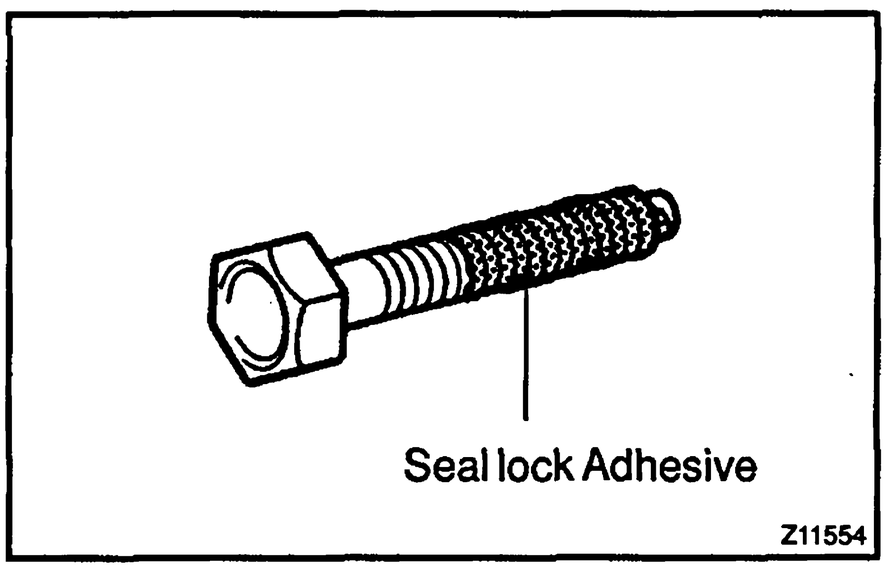
(f) Precoated parts

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

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

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

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

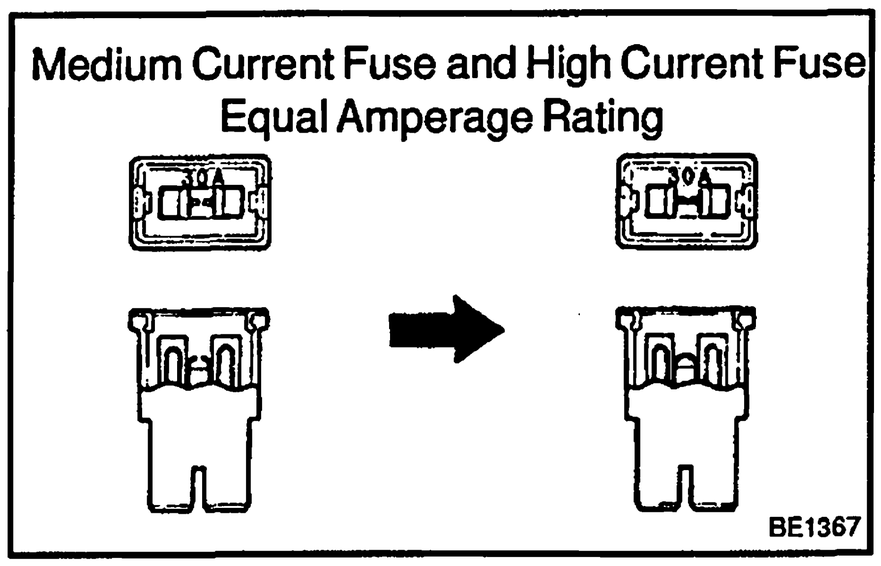


Z11554

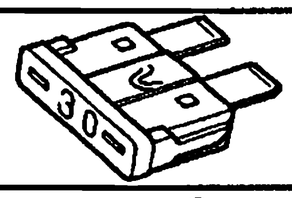
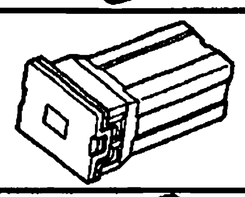
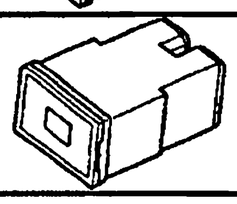
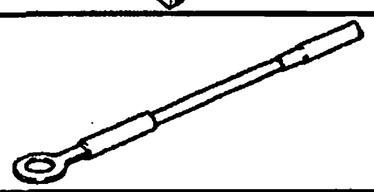
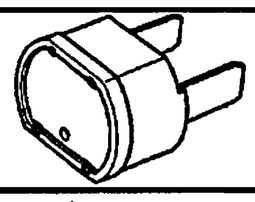
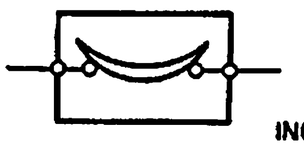
(g) When necessary, use a sealer on gaskets to prevent leaks.

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

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



(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

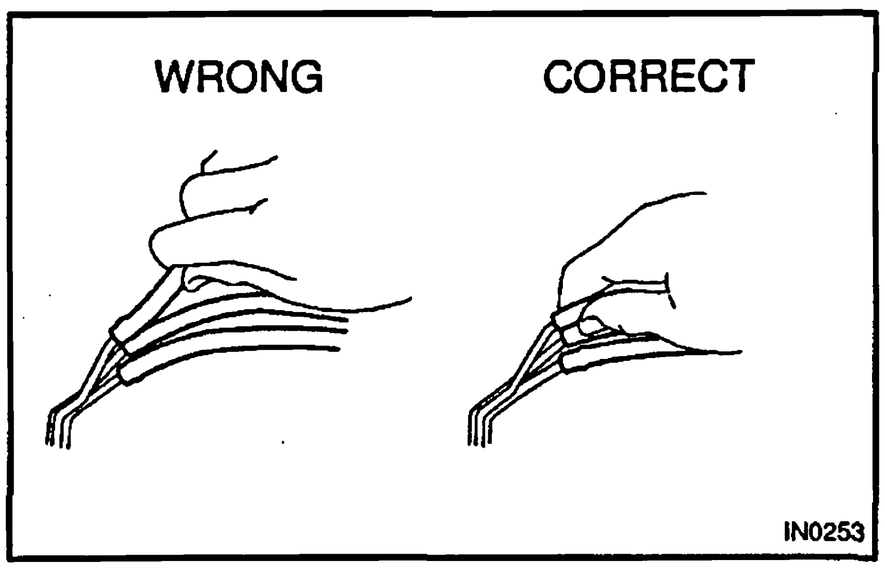
(k) Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.

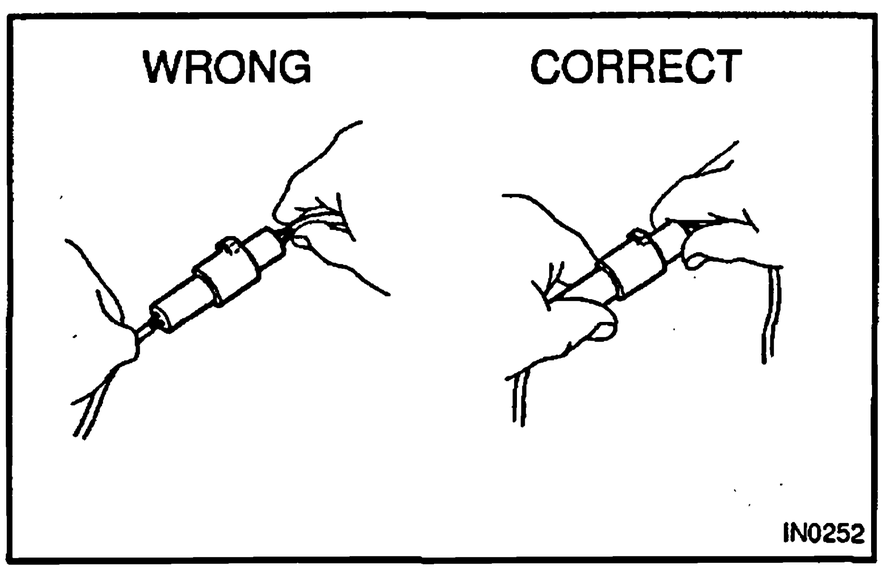
- Cancel the parking brake on the level place and shift the transmission in Neutral (or N range).
- When jacking up the front wheels of the vehicle, at first place stoppers behind the rear wheels.
- When jacking up the rear wheels of the vehicle, at first place stoppers behind the front wheels.

- When either the front or rear wheels only should be jacked up, set rigid racks and place stoppers in front and behind the other wheels on the ground.
- After the vehicle is jacked up, be sure to support it on rigid racks. It is extremely dangerous to do any work on a vehicle raised on a jack alone, even for a small job that can be finished quickly.

(l) Observe the following precautions to avoid damage to the following parts:

(1) Do not open the cover or case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)





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

(3) To pull apart electrical connectors, pull on the connector itself, not the wires.

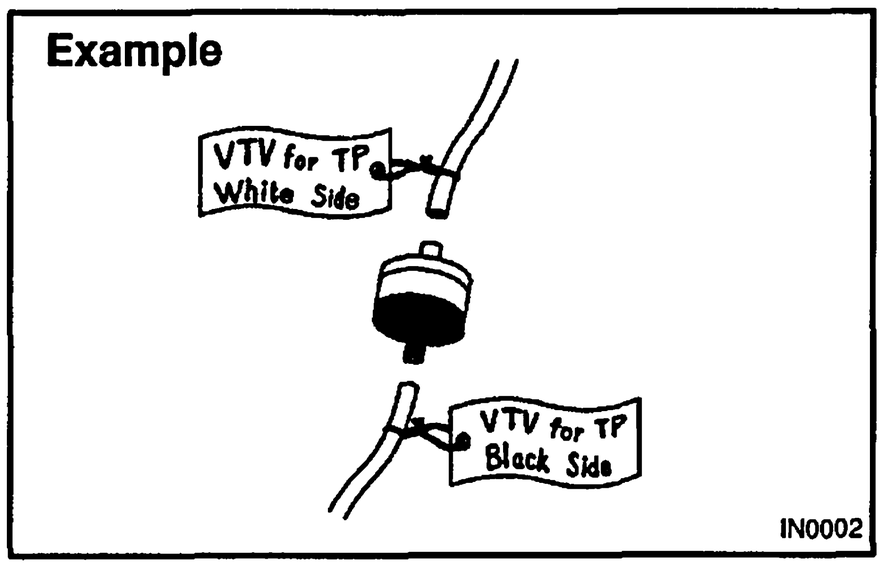
(4) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.

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

(6) Never use an impact wrench to remove or install temperature switches or temperature sensors.

(7) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.

(8) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step–down adapter for adjustment. Once the hose has been stretched, it may leak air.



(m) Installation and removal of vacuum hose:
  (1) When disconnecting vacuum hoses, use tags to identify how they should be reconnected to.
  (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, measurement should be made when the engine has cooled down.

FOR ALL OF VEHICLES

PRECAUTION

IN0EX–01

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.

(a) Install the antenna as far as possible away from the ECU and sensors of the vehicle's electronic system.

(b) Install the antenna feeder at least 20 cm (7.87 in.) away from the ECU and sensors of the vehicle's electronic systems. For details about ECU and sensors locations, refer to the section on the applicable component.

(c) Avoid winding the antenna feeder together with other wiring as much as possible, and also avoid running the antenna feeder parallel with other wire harnesses.

(d) Check that the antenna and feeder are correctly adjusted.

(e) Do not install powerful mobile communications system.

3. FOR USING HAND–HELD TESTER

CAUTION:

Observe the following items 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 the other person to operate the hand–held tester.**

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

GENERAL INFORMATION

IN0EY-01

A large number of ECU controlled systems are used in the LAND CRUISER/LAND CRUISER PRADO. 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:

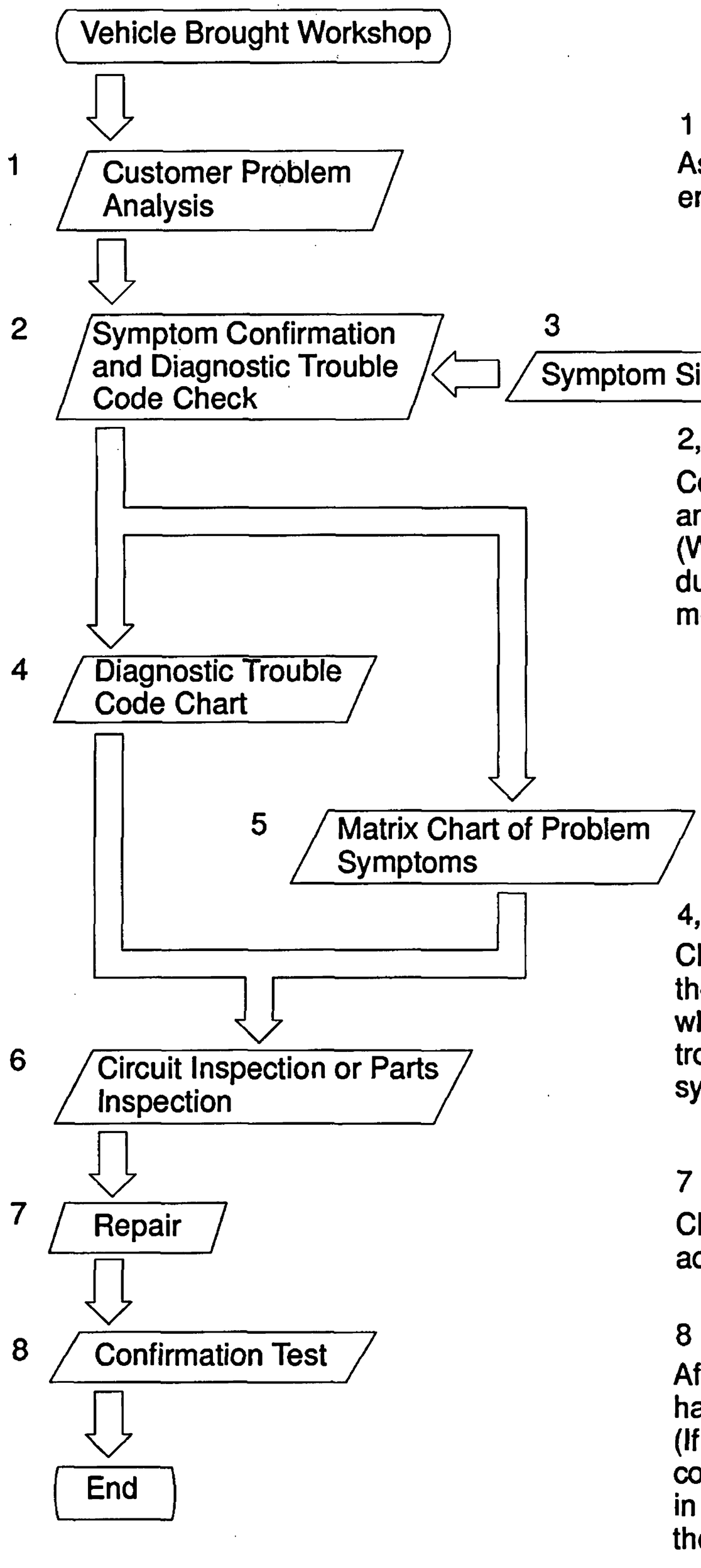
System	Page
1. Engine	DI–1

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

IN0EZ–01

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 Diagnostics 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 obtained 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 table.

7

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

8

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

1. CUSTOMER PROBLEM ANALYSIS

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

Important Point in the Problem Analysis:

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

2. SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE CHECK

The diagnostic system in the LAND CRUISER/LAND CRUISER PRADO fulfills various functions. The first function is the Diagnostic Trouble Code Check in which a malfunction in the signal circuits to the ECU is stored in code in the ECU memory at the time of occurrence, to be output by the technician during troubleshooting. Another function is the Input Signal Check which checks if the signals from various switches are sent to the ECU correctly.

By using these check functions, the problem areas can be narrowed down quickly and troubleshooting can be performed effectively. Diagnostic functions are incorporated in the following systems in the LAND CRUISER/LAND CRUISER PRADO.

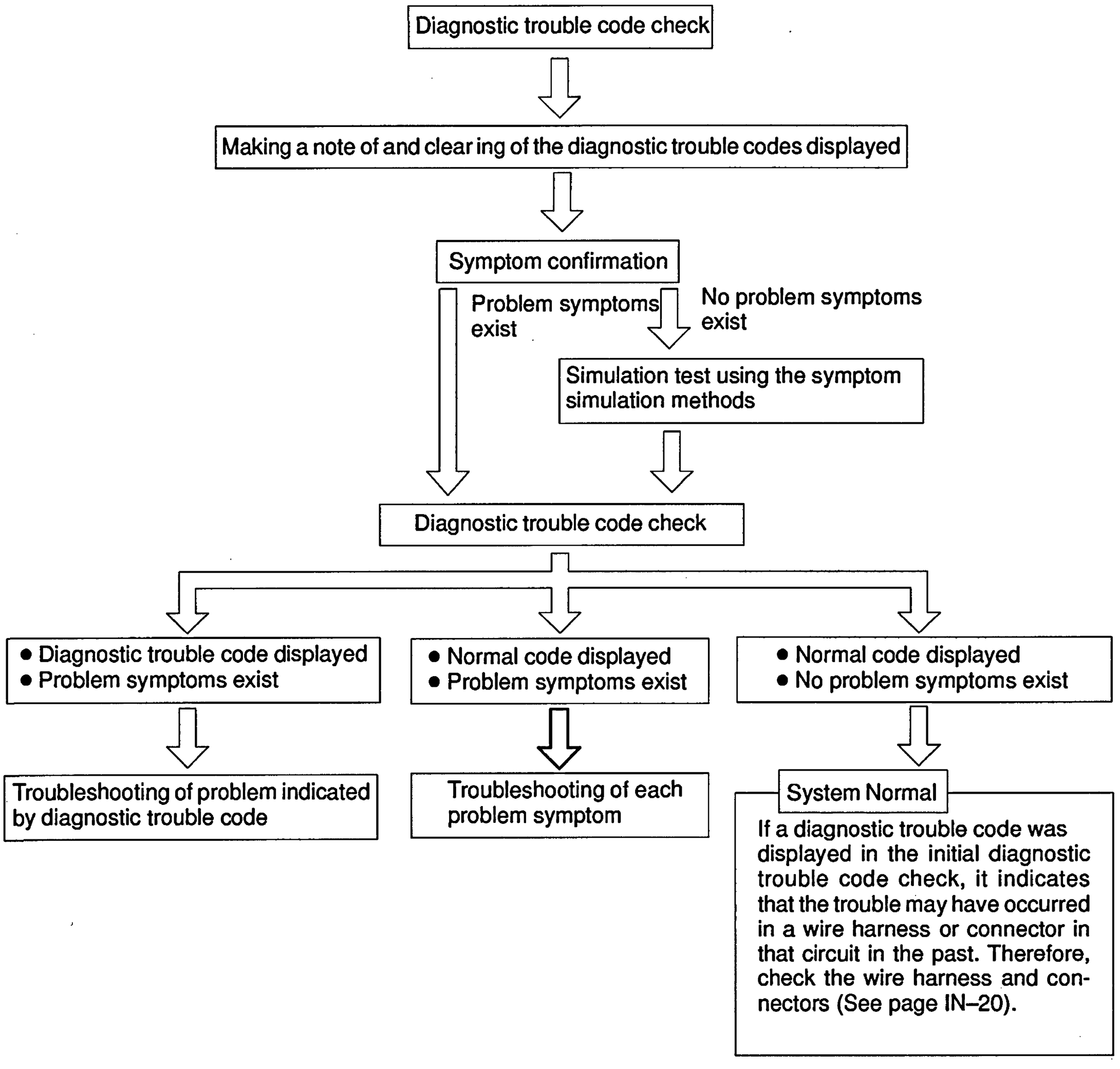
System	Diagnostic Trouble Code Check	Input Signal Check (Sensor Check)	Other Diagnosis Function
Engine	○ (with Check Mode)	○	Diagnostic Test Mode

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

DIAGNOSTIC TROUBLE CODE CHECK PROCEDURE

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

Taking into account the points on the previous page, 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 table.

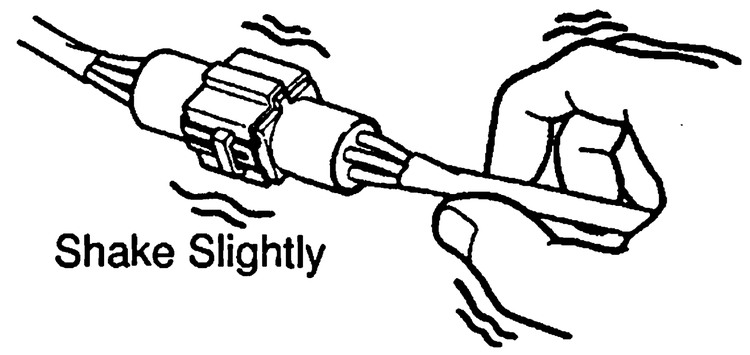
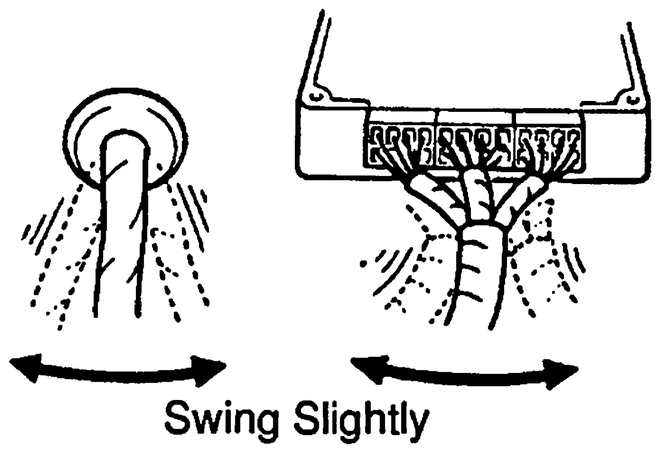
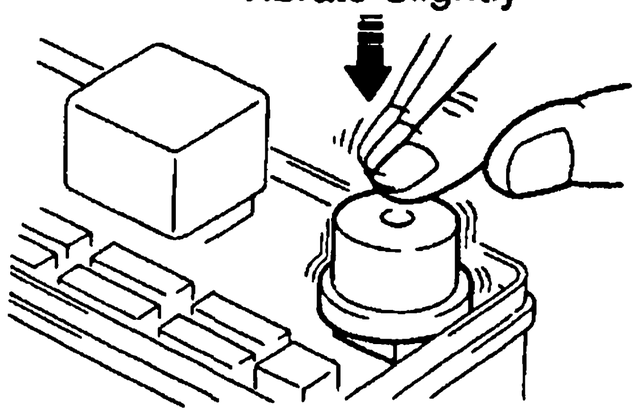


3. SYMPTOM SIMULATION

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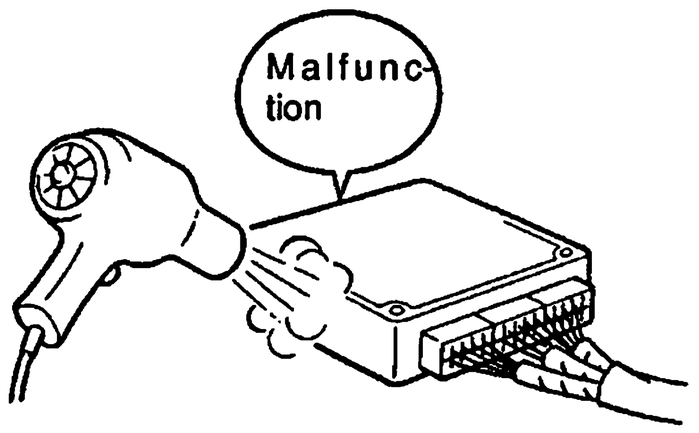
2	**HEAT METHOD: When the problem seems to occur when the suspect area is heated.**

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.

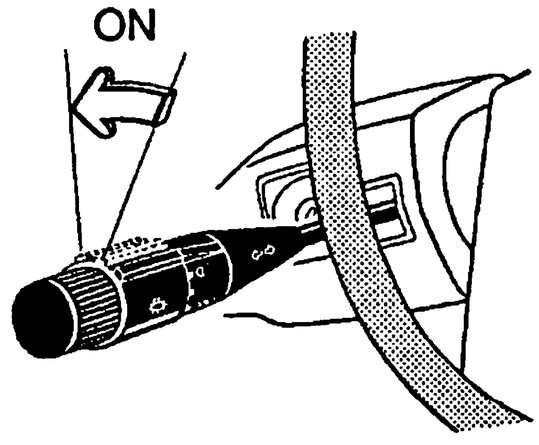
(2) Never apply water directly onto the electronic components.

(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.

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

- Trouble Area
  Indicates the suspect area of the problem.

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

DTC CHART (SAE Controlled)

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

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

DTC No. (See page)	Detection Item	Trouble Area	CHK ENG *1	*Memory
P0105/31 (DI–12)	Vacuum Sensor Circuit Malfunction	● Open or short in vacuum sensor circuit ● Vacuum sensor ● Engine ECU	○	○
P0110/24 (DI–28)	Intake Air Temp. Circuit Malfunction	● Open or short in intake air temp. sensor circuit ● Intake air temp. sensor ● Engine ECU	–	○
P0115/22 (DI–31)	Water Temp. Circuit Malfunction	● Open or short in water temp. sensor circuit ● Water temp. sensor ● Engine ECU	○	○
P0120/41 (DI–32)	Throttle Position Sensor Circuit Malfunction	● Open or short in throttle position sensor circuit ● Throttle position sensor ● Engine ECU	–	○
		● Open or short in Oxygen sensor circuit ● Oxygen sensor		

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.

- Page
  Indicates the page where the flow chart for each circuit is located.
- Circuit Inspection, Inspection Order
  Indicates the circuit which needs to be checked for each problem symptom. Check in the order indicated by the numbers.
- Problem Symptom
- 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	

6. CIRCUIT INSPECTION

How to read and use each page is shown below.

● Diagnostic Trouble Code No. and Detection Item

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

DTC	P0325/52	Knock Sensor Circuit Malfunction

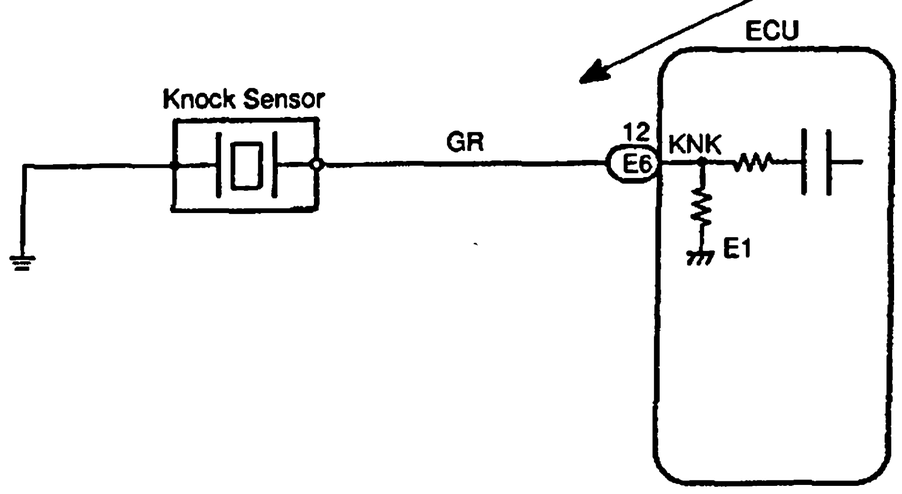
CIRCUIT DESCRIPTION

Knock sensor are 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.

DTC No.	Detection Item	Trouble Area
P0325/52	No knock sensor 1 signal to engine ECU with engine speed between 1,700 rpm and 5,200 rpm	● Open or short in knock sensor circuit ● Knock sensor (Looseness) ● Engine ECU

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

WIRING DIAGRAM



● 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, SB = Sky Blue
The first letter indicates the basic wire color and the second letter indicates the color of the stripe.

V08423

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

LOCK
Ignition Switch LOCK (OFF)

ON
Ignition Switch ON

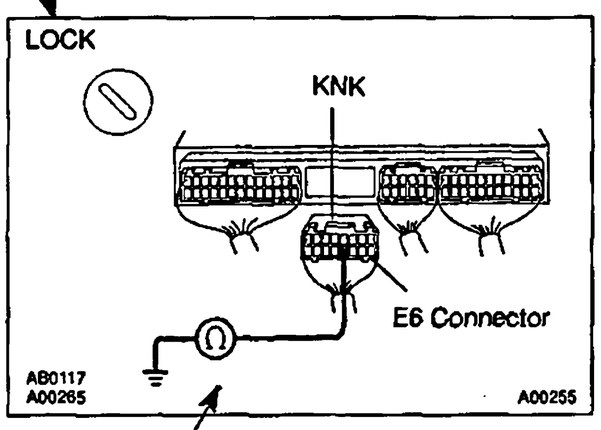
START
Ignition Switch START

ACC
Ignition Switch ACC

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

INSPECTION PROCEDURE

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



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

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

OK:
Resistance: 1 MΩ or higher

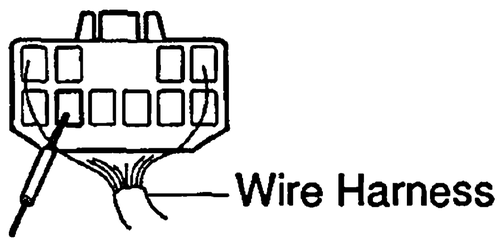
OK → **Go to step 3.**

NG

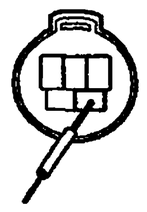
2	**Check knock sensor (See page FI–34).**

OK → **Replace knock sensor.**

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

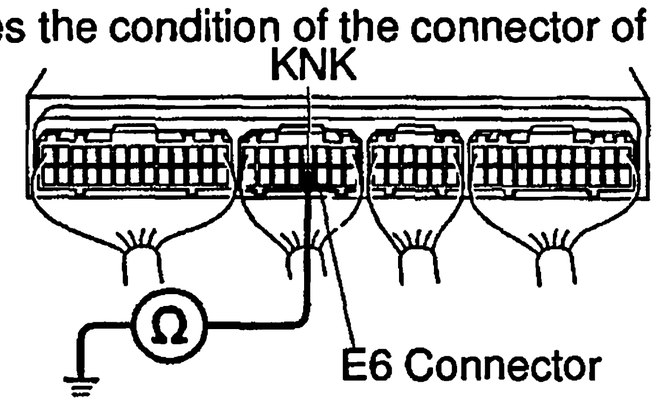


Check from the connector back side. (with harness)

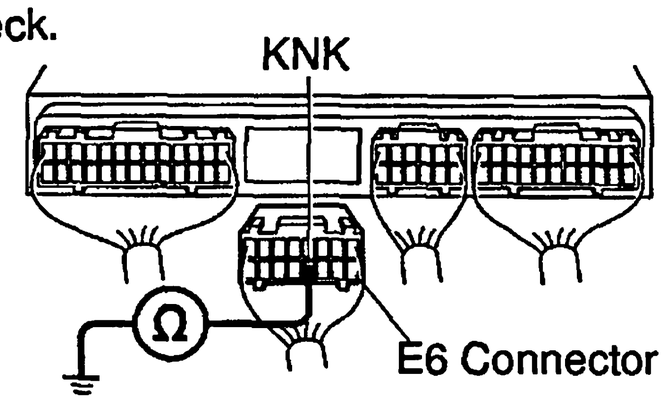


Check from the connector front side. (without harness)
In this case, care must be taken not to bend the terminals.

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

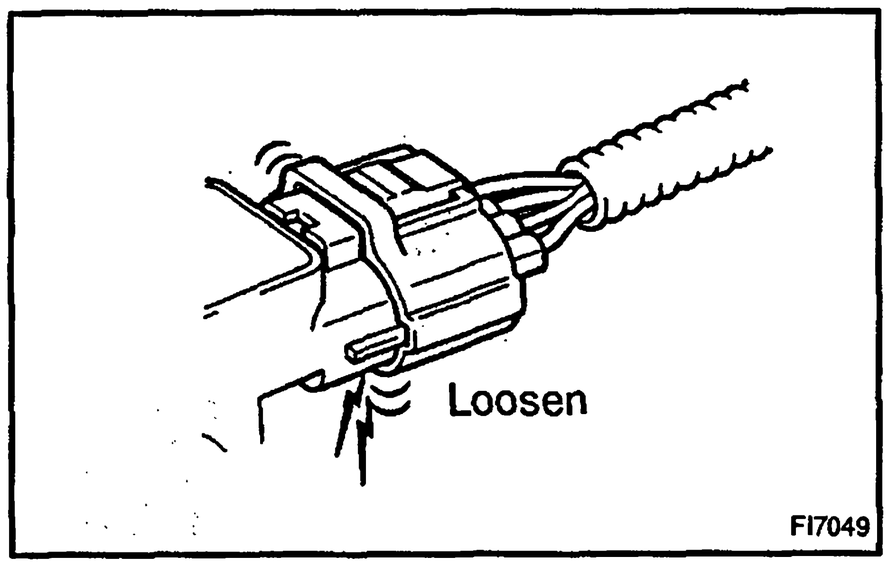


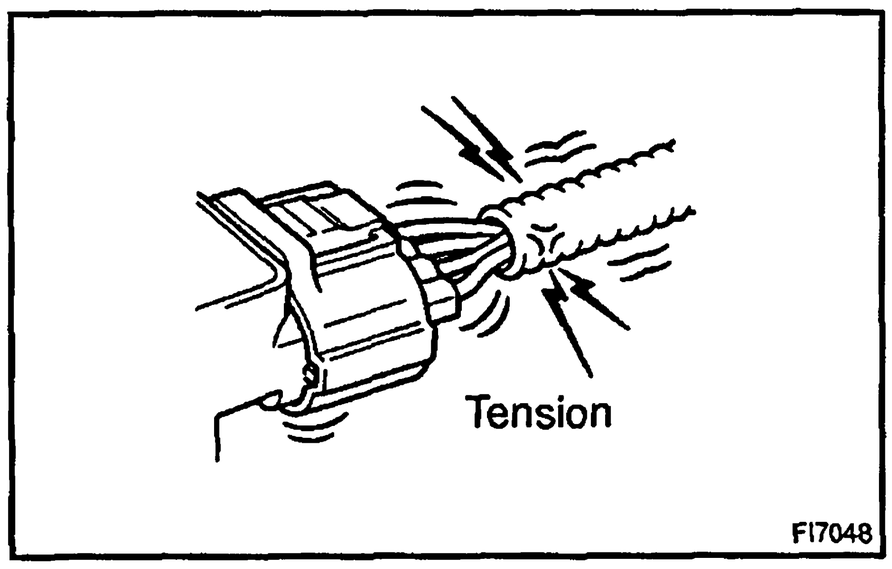
Connector being checked is connected.



Connector being checked is disconnected.

V08425





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HOW TO USE THE DIAGNOSTIC CHART AND INSPECTION PROCEDURE

1. CONNECTOR CONNECTION AND TERMINAL INSPECTION

- For troubleshooting, diagnostic trouble code charts or problem symptom table 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:

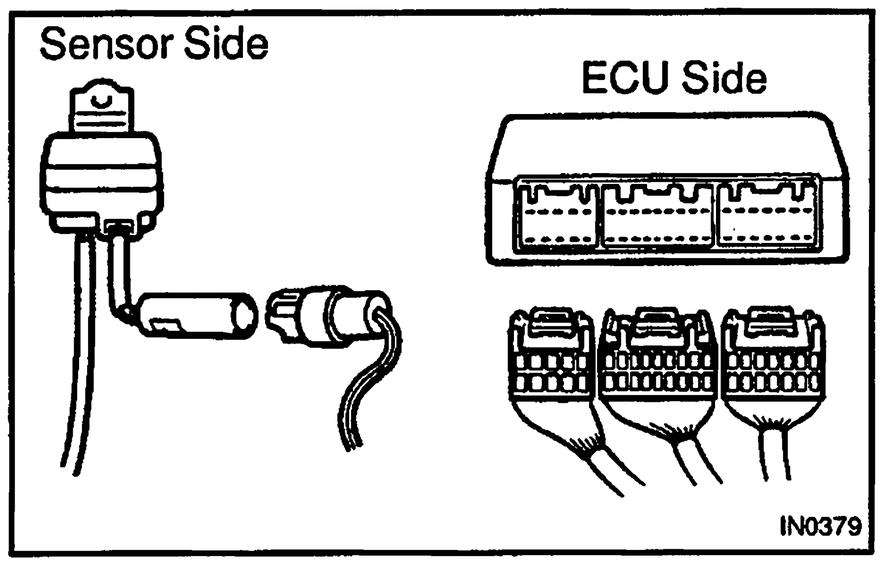
- It is rarely the case that a wire is broken in the middle of it. Most cases occur at the connector. In particular, carefully check the connectors of sensors and actuators.
- Faulty contact could be due to rusting of the connector terminals, to foreign materials entering terminals or a drop in the contact 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.

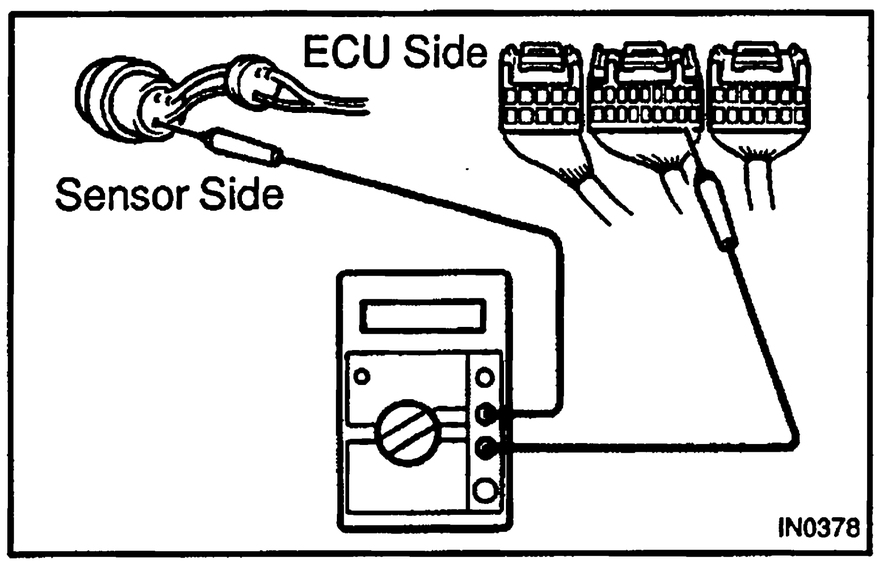
SHORT CIRCUIT:

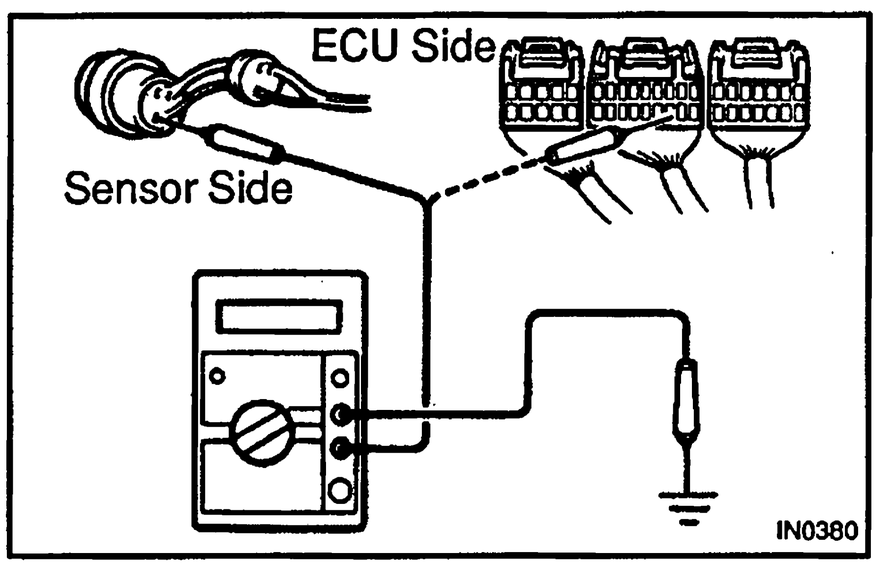
This could be due to a short circuit between the wire harness and the body ground or to a short inside the switch etc.

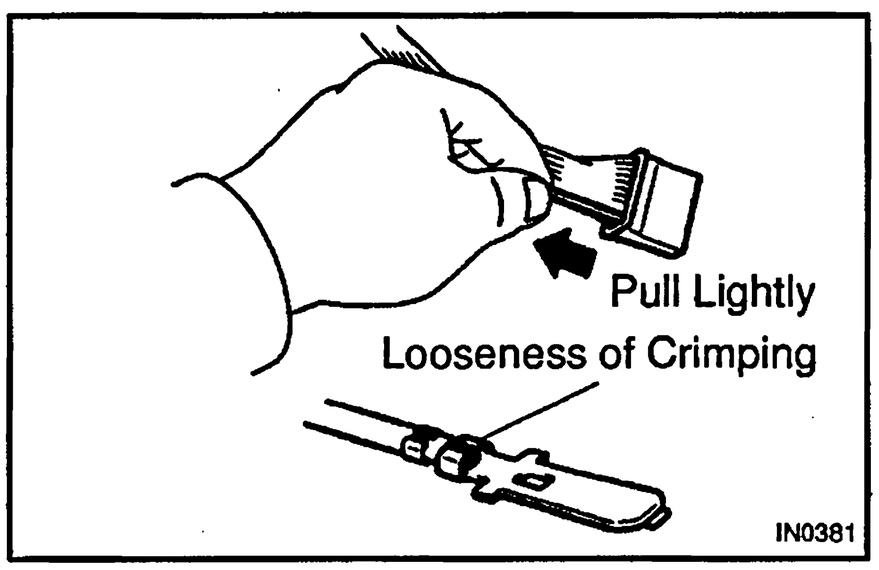
HINT:

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









2. CONTINUITY CHECK (OPEN CIRCUIT CHECK)

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

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

Resistance: 1 Ω or less

HINT:

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

3. RESISTANCE CHECK (SHORT CIRCUIT CHECK)

(a) Disconnect the connectors at both ends.

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

Resistance: 1 MΩ or higher

HINT:

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

4. VISUAL CHECK AND CONTACT PRESSURE CHECK

(a) Disconnect the connectors at both ends.

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

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

HINT:

The terminals should not come out when pulled lightly.

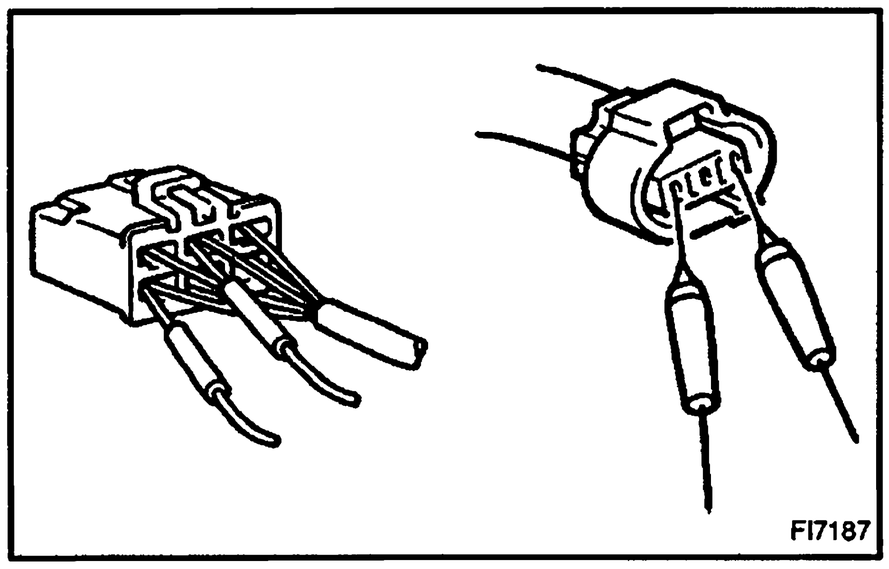
(d) Prepare a test male terminal and insert it in the female terminal, then pull it out.

NOTICE:

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

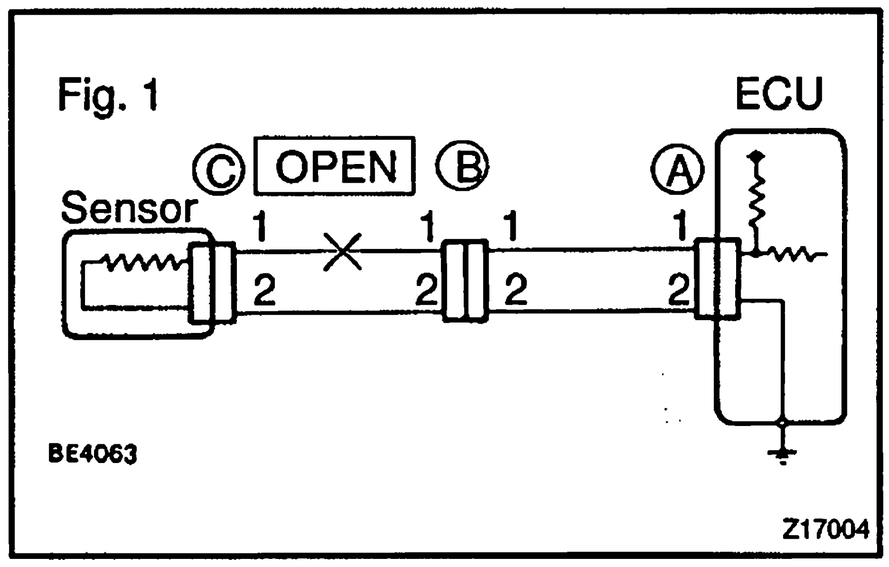
HINT:

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



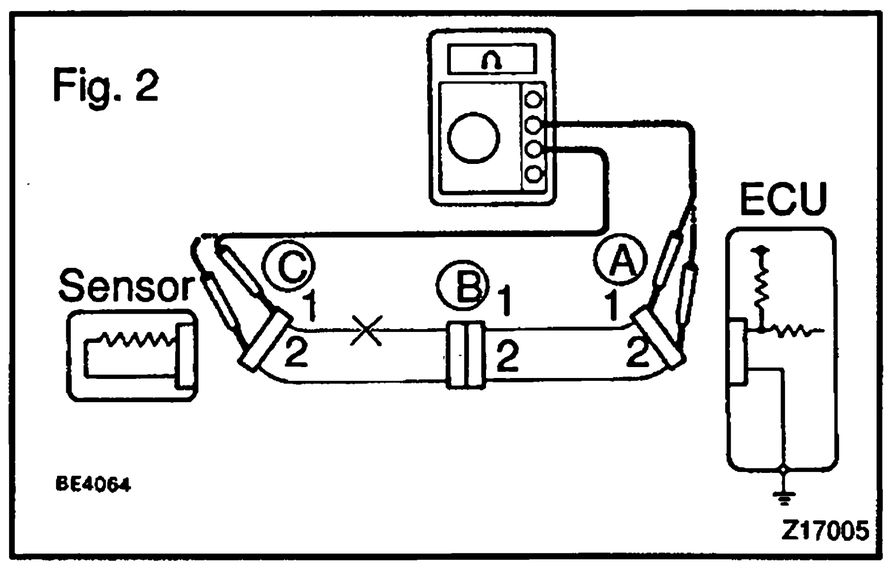
5. CONNECTOR HANDLING

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



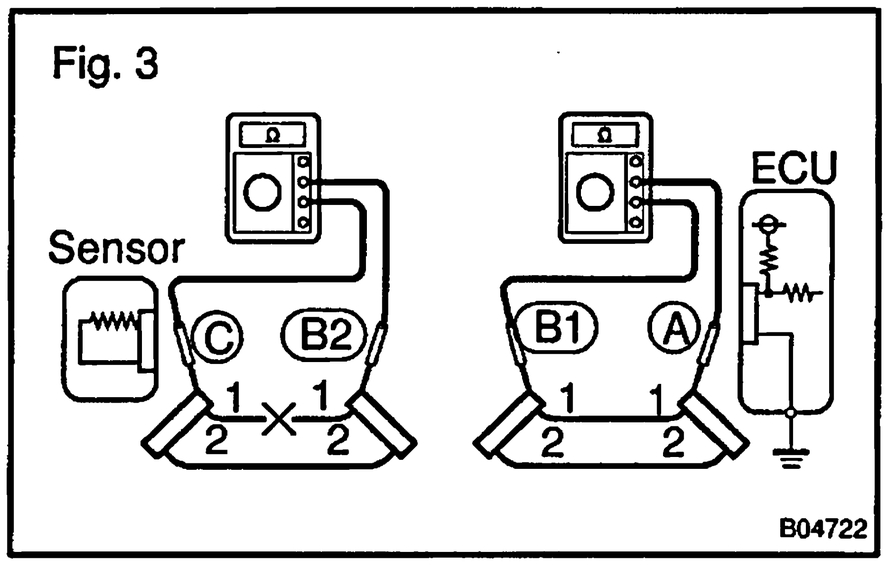
6. CHECK OPEN CIRCUIT

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



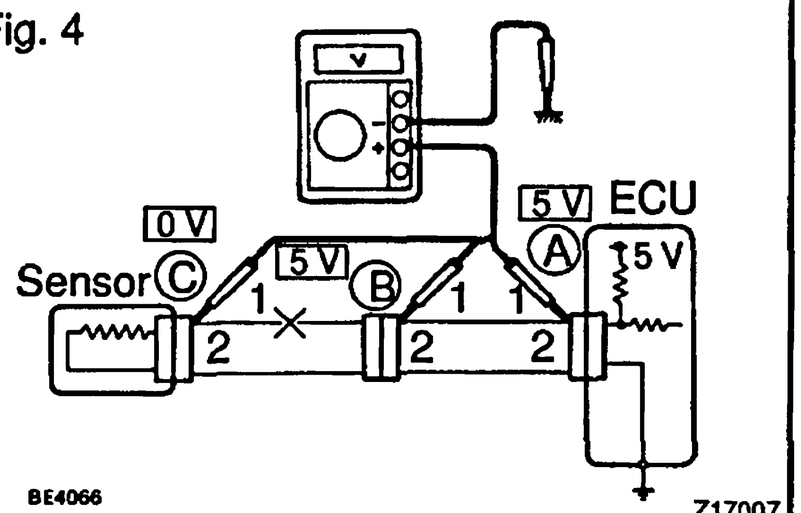
(a) Check the continuity.

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



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

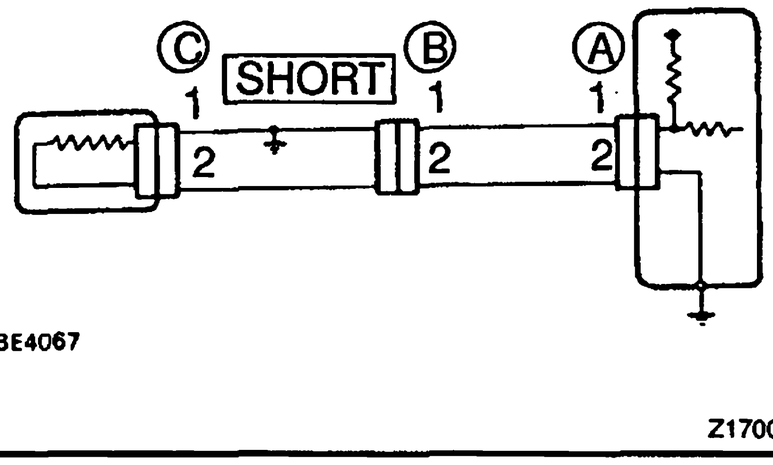
Fig. 4



(b) Check the voltage.
In a circuit in which voltage is applied (to the ECU connector terminal), an open circuit can be checked for by conducting a voltage check.
As shown in Fig. 4, with each connector still connected, measure the voltage between body ground and terminal 1 of connector "A" at the ECU 5 V output terminal, terminal 1 of connector "B", and terminal 1 of connector "C", in that order.

If the results are:
5 V: Between Terminal 1 of connector "A" and Body Ground
5 V: Between Terminal 1 of connector "B" and Body Ground
0 V: Between Terminal 1 of connector "C" and Body Ground
Then it is found out that there is an open circuit in the wire harness between terminal 1 of "B" and terminal 1 of "C".

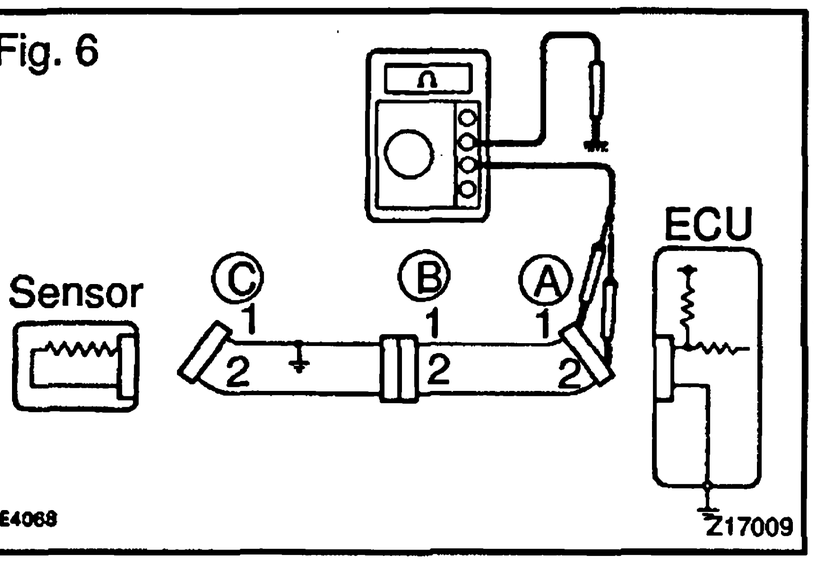
Fig. 5



7. CHECK SHORT CIRCUIT

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

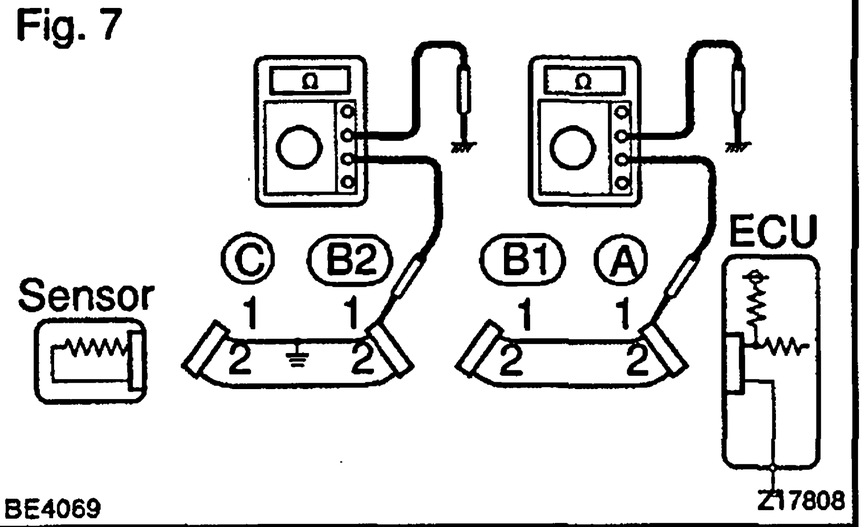
Fig. 6



Check the continuity with ground.

(1) Disconnect connectors "A" and "C" and measure the resistance between terminal 1 and 2 of connector "A" and body ground.
In the case of Fig. 6
Between terminal 1 of connector "A" and body ground → Continuity (short)
Between terminal 2 of connector "A" and body ground → No continuity
Therefore, it is found out that there is a short circuit between terminal 1 of connector "A" and terminal 1 of connector "C".

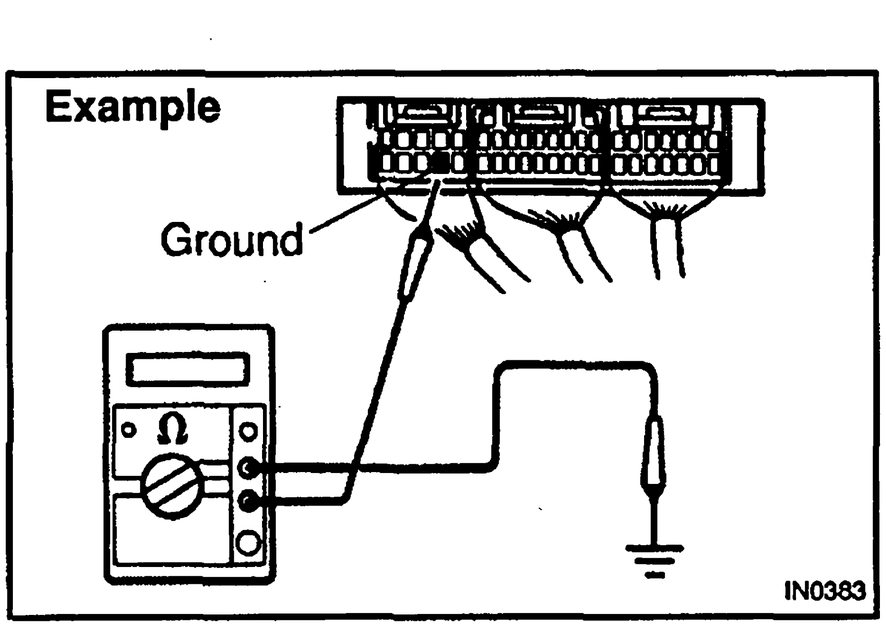
Fig. 7



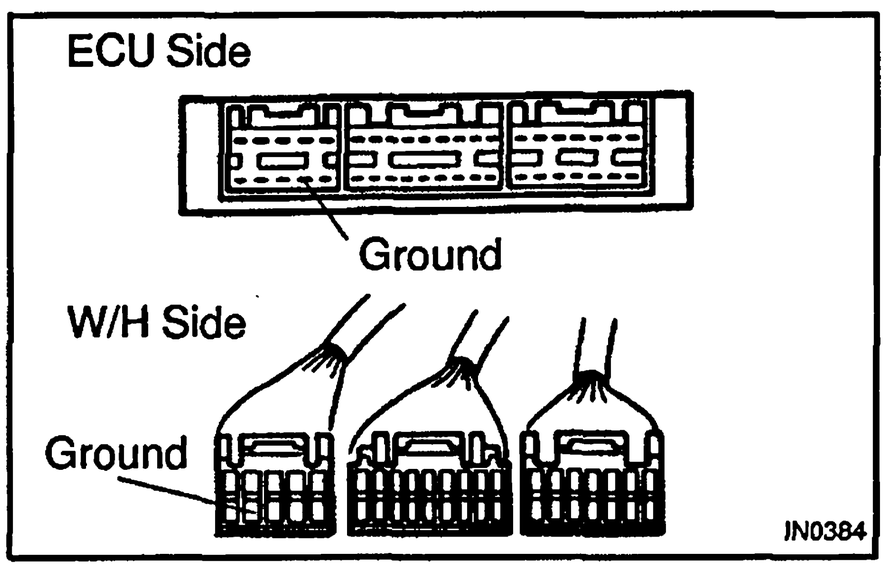
(2) Disconnect connector "B" and measure the resistance between terminal 1 of connector "A" and body ground, and terminal 1 of connector "B2" and body ground.
In the case of Fig. 7
Between terminal 1 of connector "A" and body ground → No continuity
Between terminal 1 of connector "B2" and body ground → 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

IN00S–14

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	Befor 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

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
T/M	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	Four Wheel Drive Vehicle (4x4)

PREPARATION

PP

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
5VZ–FE Engine Repair Manual	RM519E
5VZ–FE Engine Repair Manual Supplement (Jun., 1999)	RM703E
5VZ–FE Engine Emission Control Repair Manual	ERM120E

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

EMISSION CONTROL

EQUIPMENT

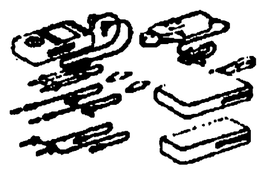
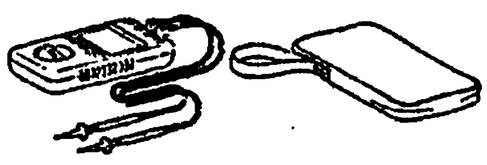
PP3TB-01

Torque wrench	
Vacuum gauge	

ELECTRONIC FUEL INJECTION

RECOMMENDED TOOLS

PP2AI–02

	09082–00050 TOYOTA Electrical Tester Set.	
	(09082–00040) TOYOTA Electrical Tester.	

PP2AJ-02

EQUIPMENT

Hand–held tester	
Torque wrench	

COOLING

EQUIPMENT

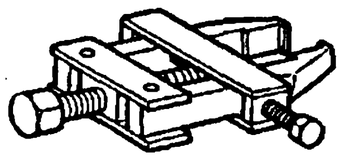
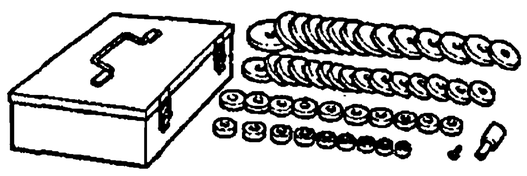
PP3TC-01

Radiator cap tester	

CHARGING

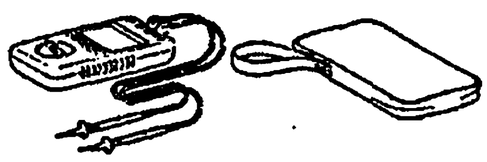
SST (Special Service Tools)

PP3TG–02

	09285–76010	Injection Pump Camshaft Bearing Cone Replacer	Rotor rear bearing cover
	09820–00021	Alternator Rear Bearing Puller	
	09820–00031	Alternator Rear Bearing Replacer	
	09950–60010	Replacer Set	Rotor front bearing

PP3TE–01

RECOMMENDED TOOLS

	09082–00040 TOYOTA Electrical Tester.	

PP3TF-01

EQUIPMENT

Battery specific gravity gauge	Battery
Belt tension gauge	
Torque wrench	
Vernier calipers	Rotor (Slip ring)

SERVICE SPECIFICATIONS

SS

REFER TO FOLLOWING REPAIR MANUALS:

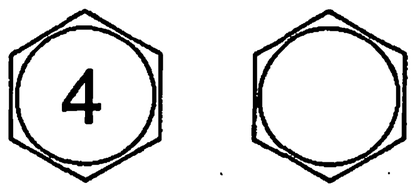
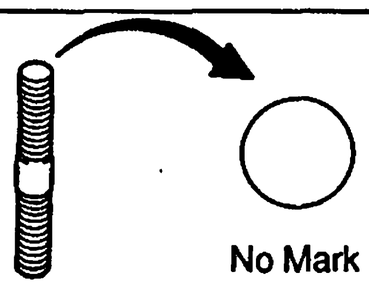
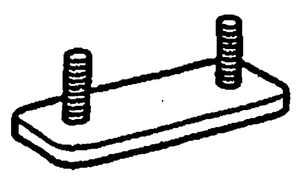
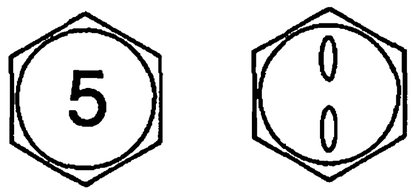
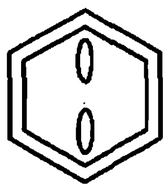
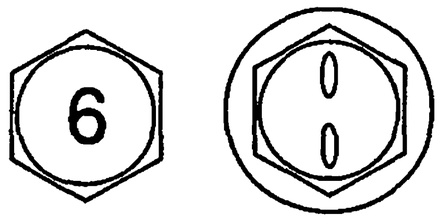
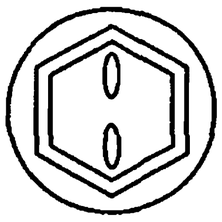
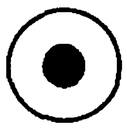
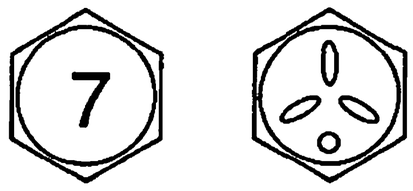
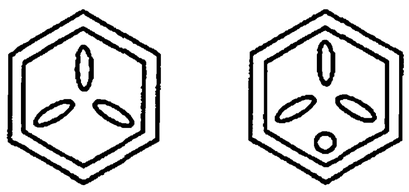
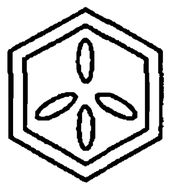
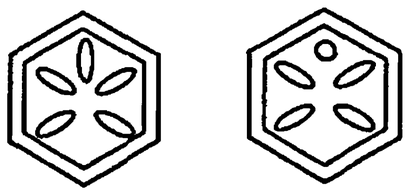
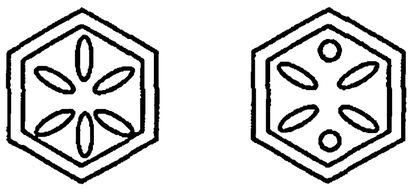
Manual Name	Pub. No.
5VZ–FE Engine Repair Manual	RM519E
5VZ–FE Engine Repair Manual Supplement (Jun., 1999)	RM703E
5VZ–FE Engine Emission Control Repair Manual	ERM120E

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

SS

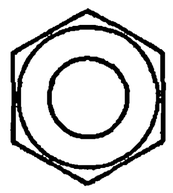
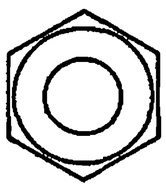
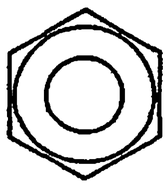
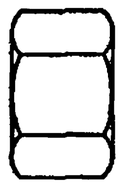
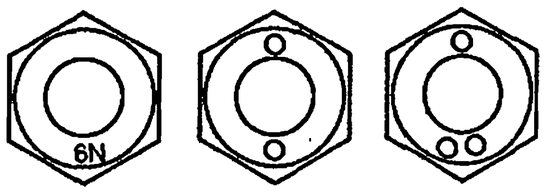
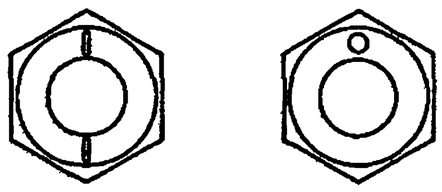
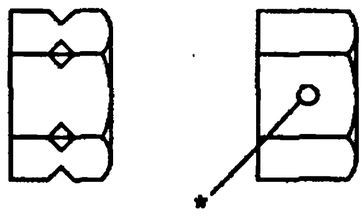
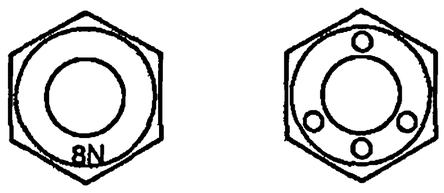
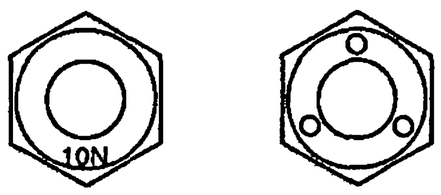
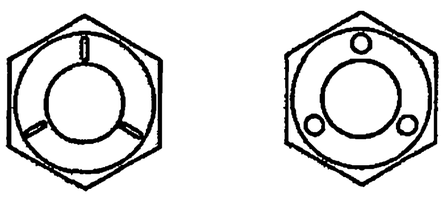
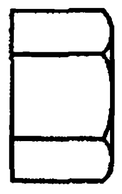
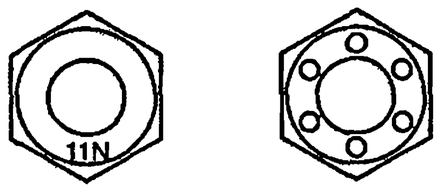
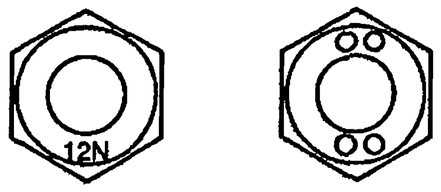
SS0ZT–01

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
		 *	7N (5T)
			8N
		 No Mark	10N (7T)
			11N
			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

EMISSION CONTROL

TORQUE SPECIFICATION

SS1KH–01

Part tightened	N·m	kgf·cm	ft·lbf
No. 1 front exhaust pipe x Exhaust crossover pipe	62	632	46
No. 1 front exhaust pipe x No. 2 front exhaust pipe	48	489	35
No. 2 Front exhaust pipe x Center exhaust pipe	48	489	35
A/F sensor (bank 1 sensor 1) x No. 1 front exhaust pipe	20	200	14
Oxygen sensor (bank 1 sensor 2) x No. 2 front exhaust pipe	44	450	32

ELECTRONIC FUEL INJECTION

SERVICE DATA

SS15C-02

Throttle control motor	Motor resistance Clutch resistance	at 20°C (68°F) at 20°C (68°F)	0.3 – 100 Ω 4.2 – 5.2 Ω
Throttle position sensor	Resistance	at 20°C (68°F)	1.2 – 3.2 kΩ
Accelerator pedal position sensor	Resistance Standard throttle valve opening percentage Sensor lever full–open position	at 20°C (68°F)	1.2 – 3.2 kΩ 60 % or more
A/F sensor (bank 1 sensor 1)	Heater Resistance	at 20°C (68°F) at 800°C (1,472°F)	0.8 – 1.4 Ω 1.8 – 3.2 Ω
Oxygen sensor (bank 1 sensor 2)	Heater resistance	at 20°C (68°F) at 800°C (1,472°F)	11 – 16 Ω 23 – 32 Ω

SS15D–02

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
Throttle body x Air intake chamber	18	180	13
A/F sensor (bank 1 sensor 1) x No. 1 front exhaust pipe	20	200	14
Oxygen sensor (bank 1 sensor 2) x No. 2 front exhaust pipe	44	450	32

COOLING

SERVICE DATA

SS1KI-01

Radiator cap	Relief valve opening pressure	STD	74 – 103 kPa (0.75 – 1.05 kgf/cm^2, 10.7 – 14.9 psi)
		Minimum	59 kPa (0.6 kgf/cm^2, 8.8 psi)

CHARGING

SERVICE DATA

SS1KJ-01

Battery	Voltage	at 20°C (68°F)	12.7 – 12.9 V
Drive belt	Tension	New belt	160 ± 20 lbf
		Used belt	100 ± 20 lbf
Alternator	Rated output ampere		12 V 60 A
	Rotor coil resistance	at 20°C (68°F)	2.1 – 2.5 Ω
	Slip ring diameter	STD	14.2 – 14.4 mm (0.559 – 0.567 in.)
		Minimum	12.8 mm (0.504 in.)
	Brush exposed length	STD	10.5 mm (0.413 in.)
		Minimum	1.5 mm (0.059 in.)
Aletrnator regulator	Regulating voltage	at 25°C (77°F)	13.7 – 14.7 V
		at 115°C (239°F)	13.2 – 14.0 V

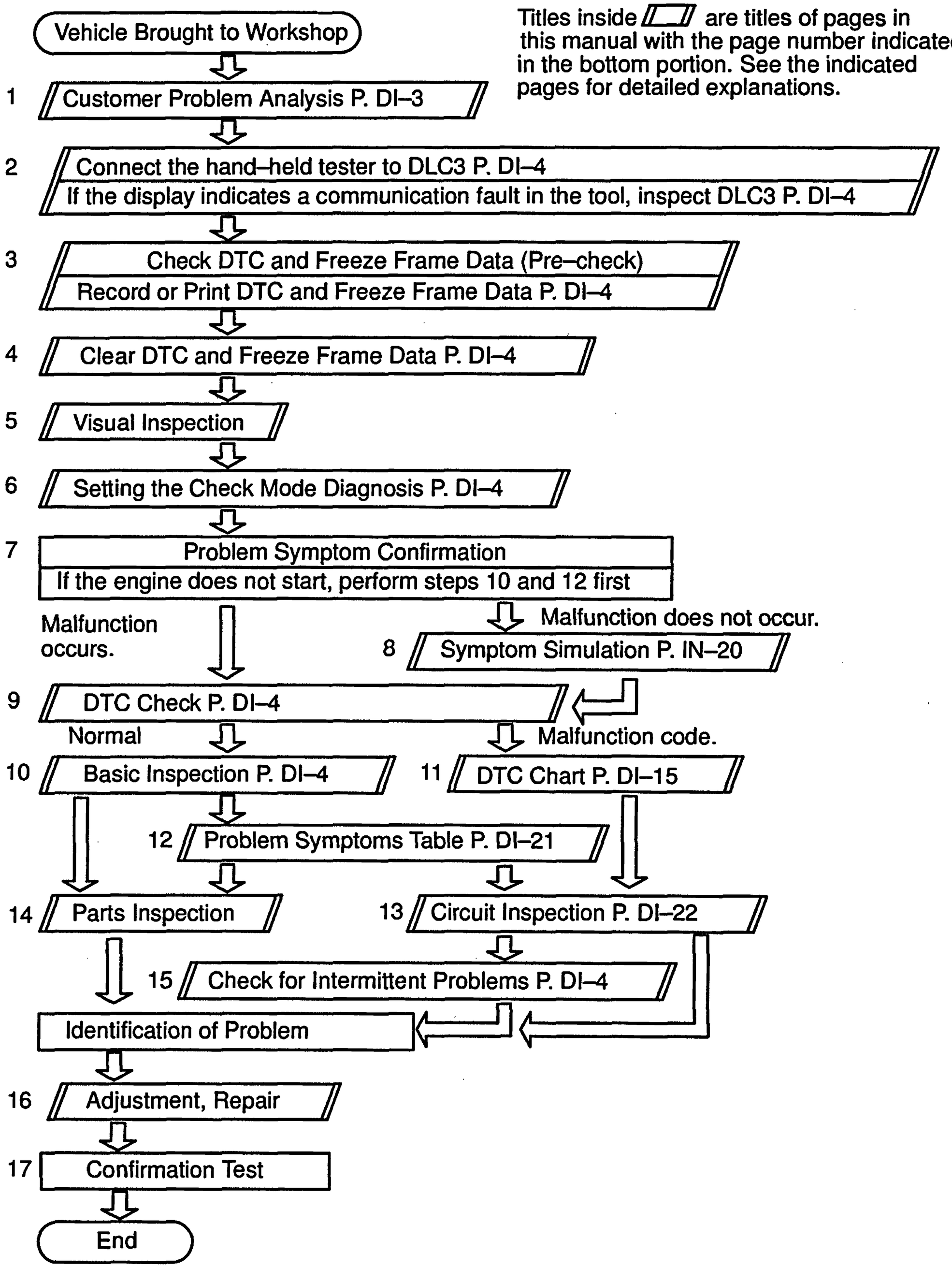
DIAGNOSTICS

ENGINE

HOW TO PROCEED WITH TROUBLESHOOTING

DI6AI–01

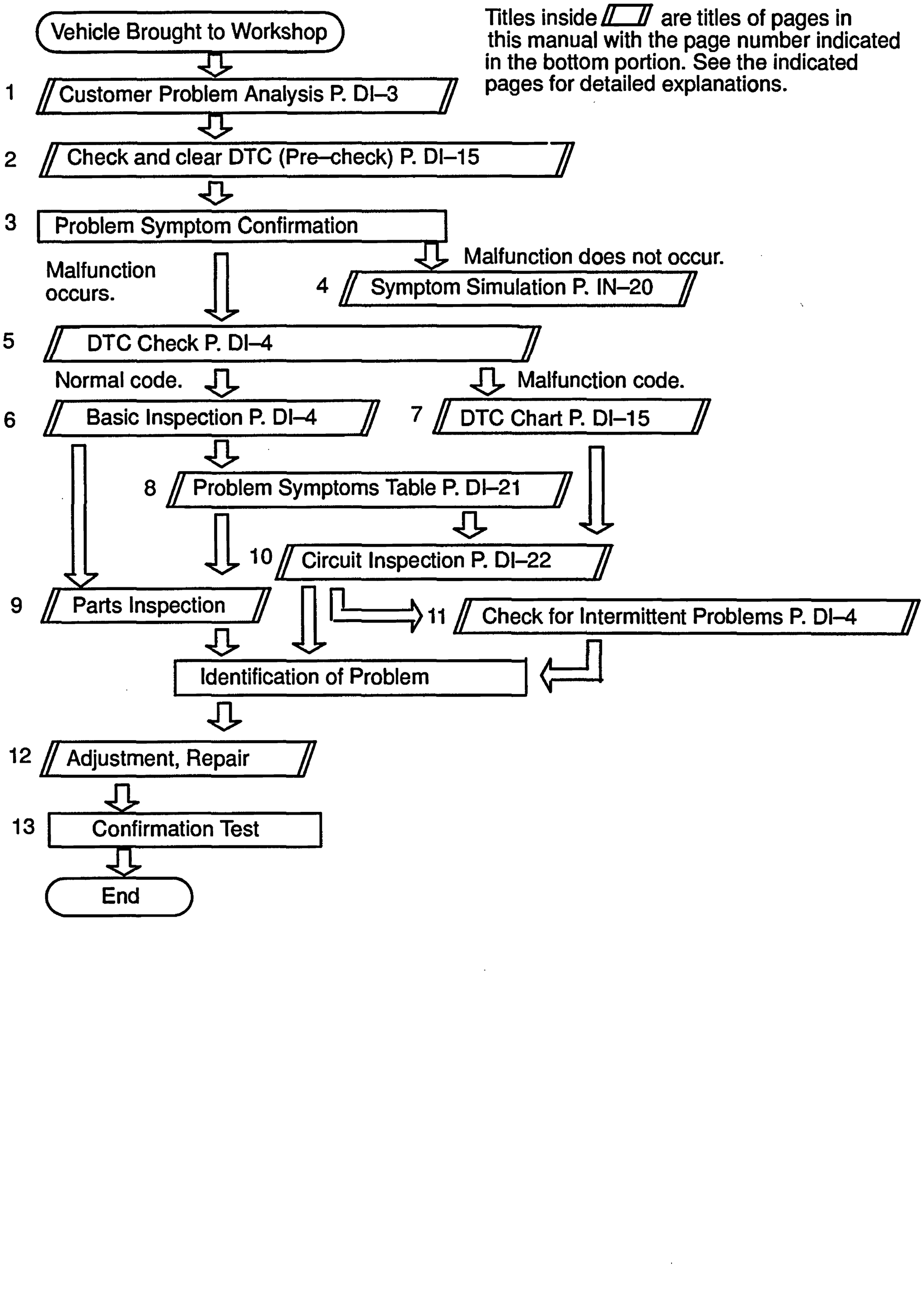
When using hand–held tester, troubleshoot in accordance with the procedure on the following page.



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.

DI

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



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.

DI

DI6AJ–01

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

Inspector's Name

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

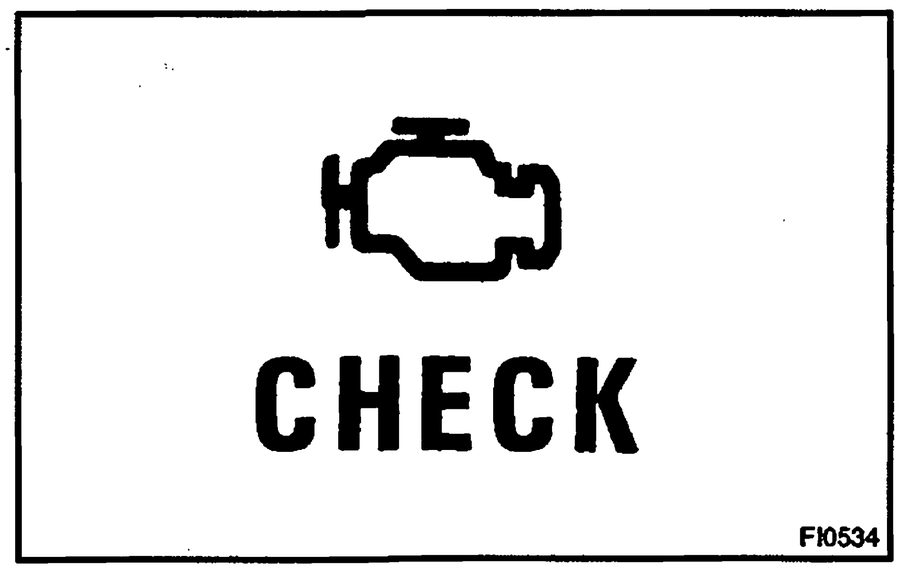
Problem Symptoms

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

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 _____

DTC Inspection	Normal Mode (Pre–check)	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )
	Check (test) Mode	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )

DI



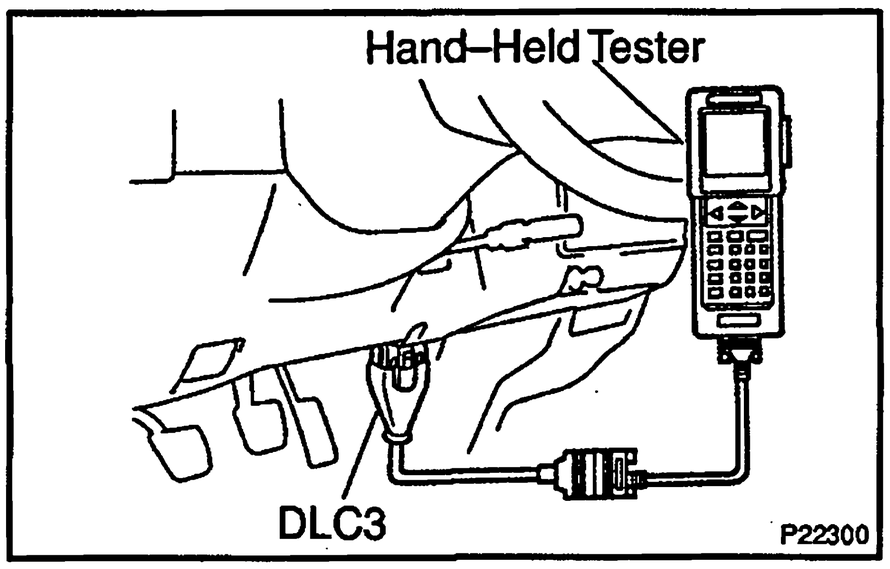
DI9PE–01

PRE–CHECK

1. DIAGNOSIS SYSTEM

(a) Description for EURO–OBD (European specification).

- When troubleshooting Euro–OBD vehicles, the only difference from the usual troubleshooting procedure is that you connect the vehicle to the OBD scan tool complying with ISO 15031–4 or hand–held tester, and read off various data output from the vehicle's engine ECU.
  Euro–OBD regulations require that 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 emission control system/components or in the power train control components which affect vehicle emissions, or a malfunction in the computer. In addition to the check engine warning light (CHK ENG) lighting up when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTCs) prescribed by ISO15031–6 are recorded in the engine ECU memory (See page DI–15). If the malfunction does not reoccur in 3 consecutive trips, the CHK ENG goes off automatically but the DTCs remain recorded in the engine ECU memory.

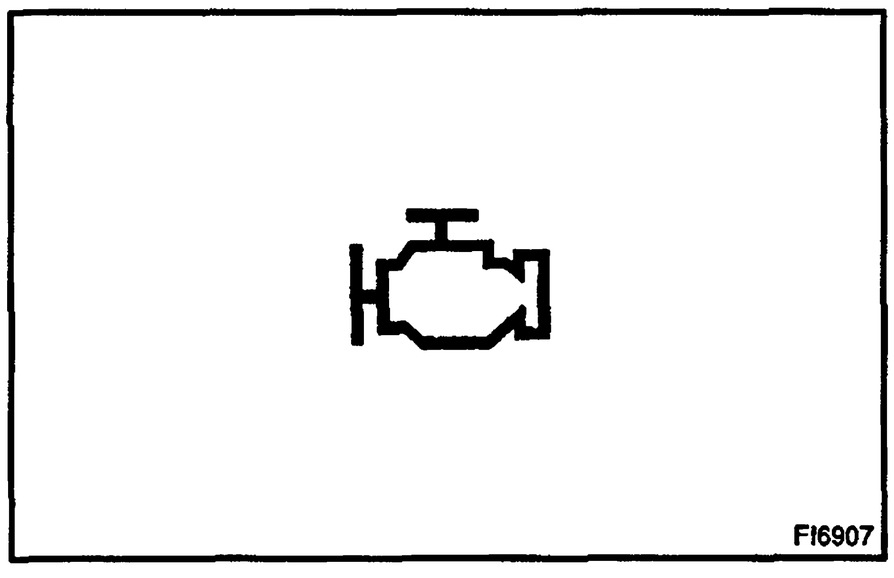


- To check the DTCs, connect the OBD scan tool or hand–held tester to the Data Link Connector 3 (DLC3) on the vehicle. The OBD scan tool or hand–held tester also enables you to erase the DTCs and check freeze frame data and various forms of engine data. (For operating instructions, see the OBD scan tool's instruction book.)
  The DTCs include ISO controlled codes and manufacturer controlled codes. ISO controlled codes must be set as prescribed by the ISO, while manufacturer controlled codes can be set freely by the manufacturer within the prescribed limits (See DTC chart on page DI–15).

- The diagnosis system operates in the normal mode during normal vehicle use. It also has the check mode for technicians to simulate malfunction symptoms and make a troubleshooting. Most DTCs use 2 trip detection logic* to prevent erroneous detection and ensure thorough malfunction detection. By switching the engine ECU to the check mode 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 step 2)
- *2 trip detection logic:
  When a malfunction is first detected, the malfunction is temporarily stored in the engine ECU memory. (1st trip) If the same malfunction is detected again during the second drive test, this second detection causes the CHK ENG to light up. (2nd trip) (However, the ignition switch must be turned OFF between the 1st trip and the 2nd trip.)
- Freeze frame data:
  Freeze frame data records the engine condition when a misfire (DTCs P0300 – P0306) or fuel trim malfunction (DTCs P0171 and P0172) or other malfunction (first malfunction only), is detected.
  Because freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when the malfunction is detected. When troubleshooting, it is useful to determine whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

Priorities for troubleshooting:
If troubleshooting priorities for multiple DTCs are given in the applicable DTC chart, follow them.
If no instructions are given, troubleshoot the DTCs according to the following priorities.

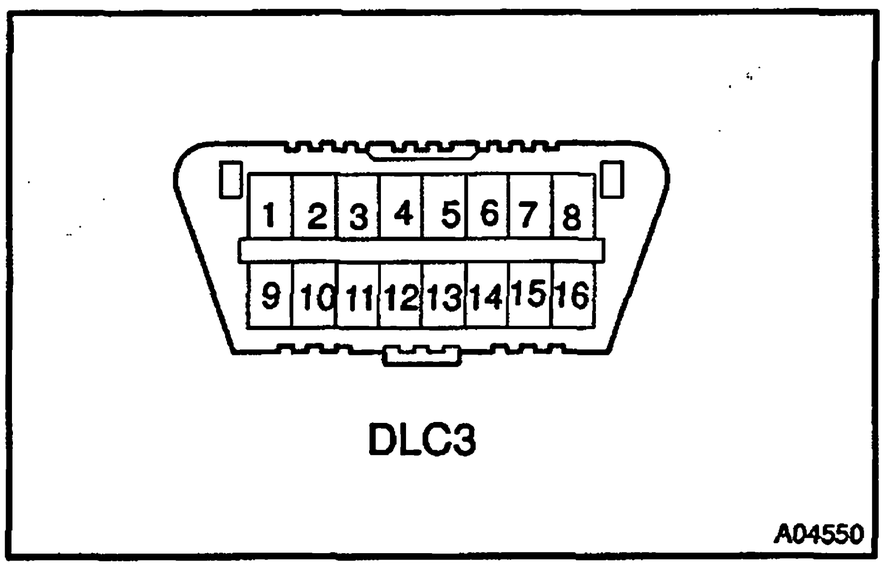
(1) DTCs other than fuel trim malfunction (DTCs P0171 and P0172) and misfire (DTCs P0300 – P0306).
(2) Fuel trim malfunction (DTCs P0171 and P0172).
(3) Misfire (DTCs P0300 – P0306).


F16907

(b) Description for M–OBD (Except European specification)

- When troubleshooting Multiplex OBD (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you 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 indicates the CHK ENG on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition to an indication of the CHK ENG when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTCs) are recorded in the engine ECU memory (See page DI–15). When the malfunction does not reoccur, the CHK ENG is indicated until the ignition switch is turned OFF, but the CHK ENG is not indicated when the ignition switch is turned ON. However, the DTCs remain recorded in the engine ECU memory.
- To check the DTCs, connect the hand–held tester to DLC3 on the vehicle or read the DTC which is indicated on the multi–information display when TC and CG terminals on the DLC3 are connected. The hand–held tester also enables you to erase the DTCs and check freeze frame data and various forms of engine data (For operating instructions, see the instruction book.).
- The diagnosis system operates in the normal mode during normal vehicle use. It also has the check (test) mode for technicians to simulate malfunction symptoms and make a troubleshooting. Most DTCs use 2 trip detection logic* to prevent erroneous detection, and ensure thorough malfunction detection. By switching the engine ECU to the check (test) mode, using the hand–held tester, when troubleshooting, the technician can cause the CHK ENG to light up for a malfunction that is only detected once or momentarily. (Hand–held tester only) (See step 2)
- * 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 CHK ENG to light up.
  in the 2 trip detection logic, the same mode is repeated twice (However, the ignition switch must be turned OFF between the 1st trip and 2nd trip).

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



DLC3

(c) Check the DLC3.
The vehicle's engine ECU uses the ISO 9141–2 (Euro–OBD)/ISO 14230 (M–OBD) communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031–3 and matches the ISO 9141–2/ISO 14230 format.

DI

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

- If the communication is normal when the tool is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If the communication is still not possible 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.

2. INSPECT DIAGNOSIS (Normal Mode)

(a) Check the DTC on the hand–held tester.

NOTICE:
Hand–held tester only:
When the diagnosis system is switched from the normal mode to the check mode, all the DTCs and freeze frame data recorded in the normal mode will be erased. So before switching modes, always check the DTCs and 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 push the hand–held tester main switch ON.
(4) Use the hand–held tester to check the DTCs and freeze frame data, and note them down. (For operating instructions, see the hand–held tester instruction book.)
(5) See page DI–15 to confirm the details of the DTCs.

(b) Clear the DTC.
The DTCs and freeze frame data will be erased by either actions.
(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 of EFI and ECTS fuses.

NOTICE:
If the hand–held tester switches the engine ECU from the normal mode to the check mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during the check mode, the DTCs and freeze frame data will be erased.

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) Initial conditions.
- Battery voltage 11 V or more
- Throttle valve fully closed
- Transmission in P or N position
- A/C switched OFF

(b) Turn the ignition switch OFF.
(c) Prepare the hand–held tester.
(d) Connect the hand–held tester to the DLC3.
(e) Turn the ignition switch ON and push the hand–held tester main switch ON.
(f) Switch the hand–held tester from the normal mode to the check (test) mode.

NOTICE:
If the hand–held tester switches the engine ECU from the normal mode to the check mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during the check mode, the DTCs and freeze frame data will be erased.

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

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

(i) After simulating the malfunction conditions, use the hand–held tester diagnosis selector to check the DTCs and freeze frame data, etc.

HINT:
Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from the check (test) mode to the normal mode. So all the DTCs, etc. are erased.

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

4. FAIL–SAFE CHART

If any of the following codes is recorded, the engine ECU enters into the fail–safe mode.

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
P0100/31	Ignition timing fixed at 5° BTDC	Returned to normal condition
P0110/24	Intake air temperature fixed at 20°C (68°F)	Returned to normal condition
P0115/22	Water temperature fixed at 80°C (176°F)	Returned to normal condition
P0120/41	VTA fixed at 0°	The following condition must be repeated at least twice consecutively when closed throttle position switch is OFF: VTA ≧ 0.1 V and ≦ 0.95 V
P0141/21	The heater circuit in which an abnormality is detected is turned off	Ignition switch OFF
P0325/52 P0330/53 P0340/12	Max. timing retardation	Ignition switch OFF
P1300/14	Fuel cut	Returned to normal condition

5. CHECK FOR INTERMITTENT PROBLEMS

HINT:
Hand–held tester only:
By putting the vehicle's engine ECU in the 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 DTCs (See step 2).
(b) Set the check (Test) mode (See step 3).
(c) Perform a simulation test (See page IN–10).
(d) Check the connector and terminal (See page IN–20).
(e) Handle the connector (See page IN–20).

6. BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshoot all the possible circuits considered as a cause 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 the engine troubleshooting.

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

NO → **Charge or replace battery.**

YES

2	**Is engine cranked?**

NO → **Proceed to problems table on page DI–21.**

YES

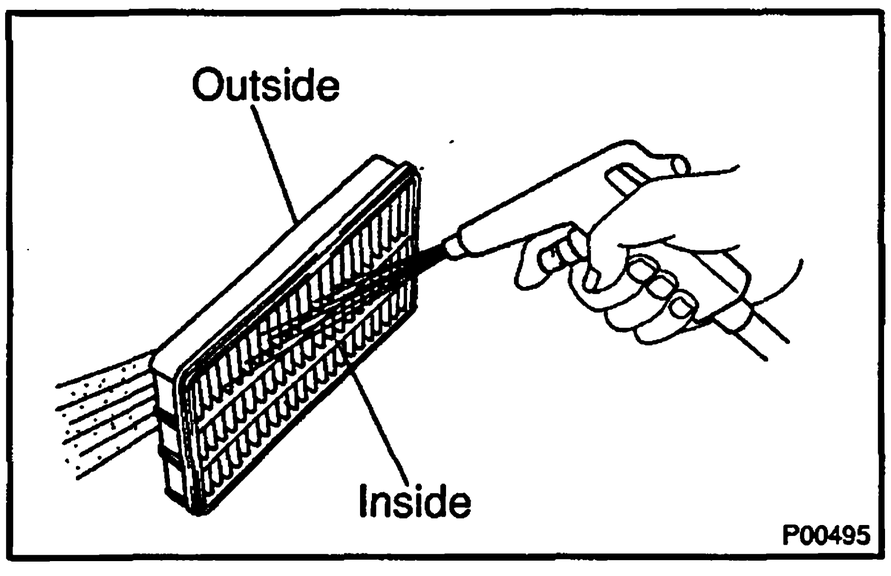
DI

3	**Does engine start?**

NO → **Go to step 7.**

YES

4	**Check air filter.**



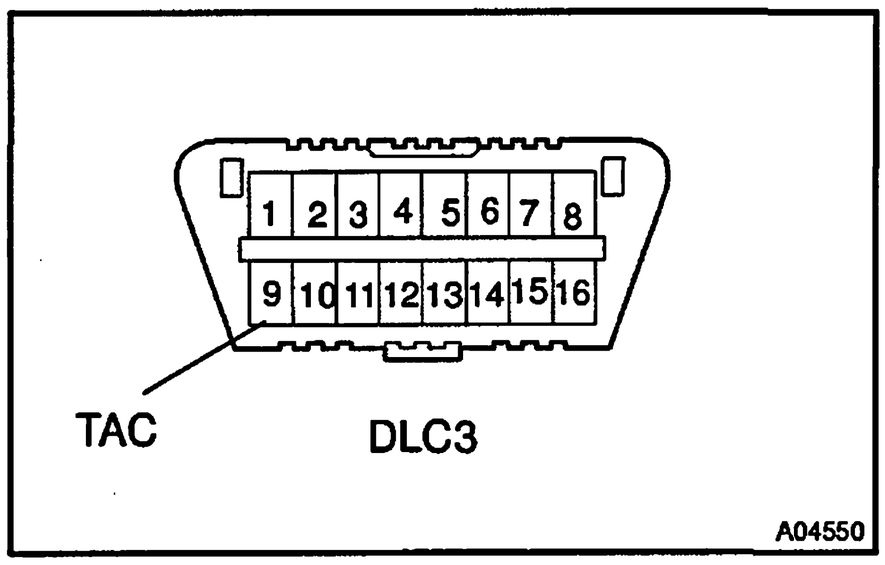
PREPARATION:
Remove the air filter.
CHECK:
Visually check that the air filter is not dirty or excessive oily.
HINT:
If necessary, clean the air filter with compressed air. First blow from the inside thoroughly, and then blow from the outside of the air filter.

NG → **Repair or replace**

OK

5	**Check idle speed.**

PREPARATION:
(a) Warm up the engine to the normal operating temperature.
(b) Switch off all the accessories.
(c) Switch off the A/C.
(d) Shift the transmission into the N position.
(e) Connect the hand–held tester to the DLC3 on the vehicle.



(f) If you have no hand–held tester, connect tachometer test probe to terminal 9 (TAC) of the DLC3.
SST 09843–18030

NOTICE:
As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility with your unit before use.

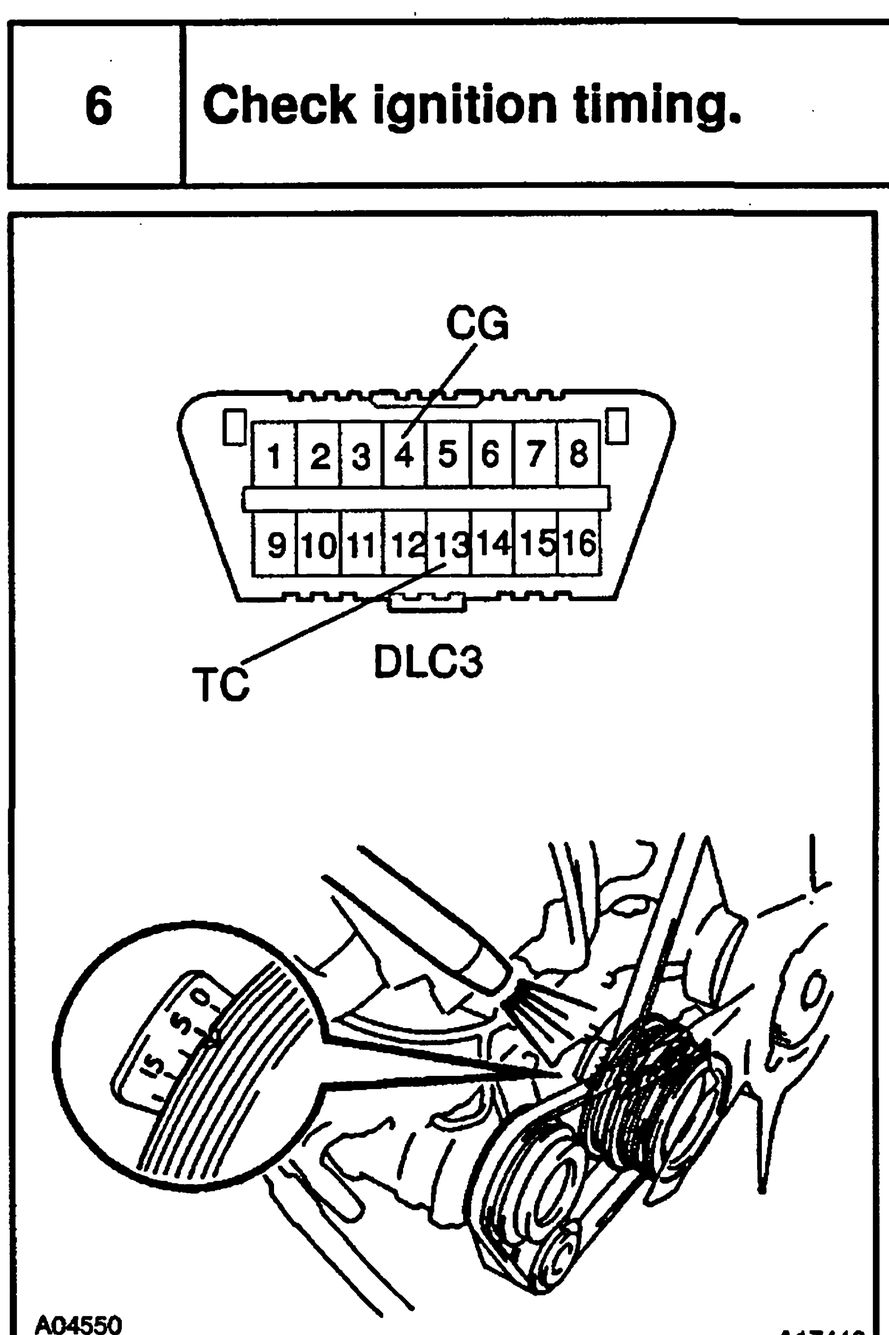
CHECK:
Check the idle speed.

OK:
Idle speed: 650 – 750 rpm

NG → **Proceed to problem symptoms table on page DI–21.**

OK

6	**Check ignition timing.**



PREPARATION:
(a) Warm up the engine to the normal operating temperature.
(b) Shift the transmission into the N position.
(c) Keep the engine speed at idle.
(d) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843–18040
(e) Using a timing light, connect the tester to the ignition coil connector wire.

CHECK:
Check the ignition timing.

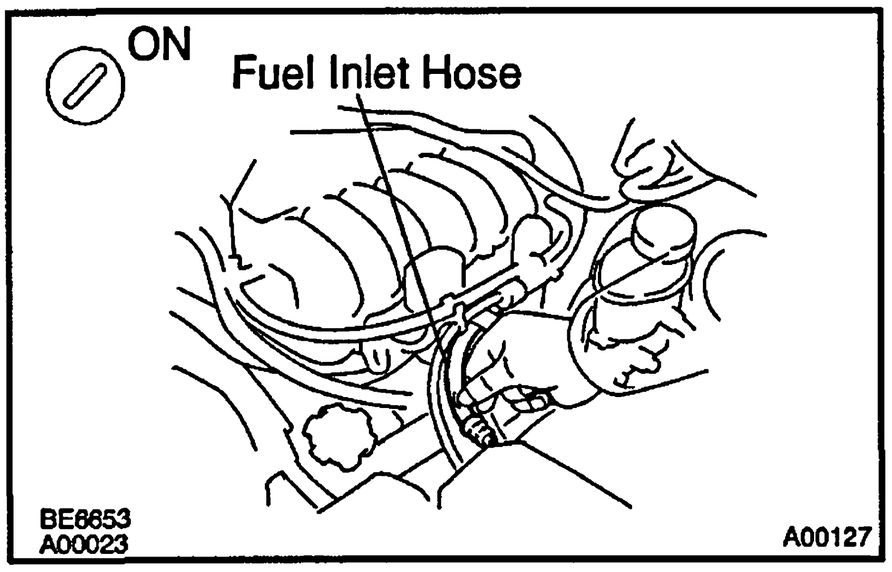
OK:
Ignition timing: 3–7° BTDC at idle

NG → **Proceed to Pub. No. RM519E on page IG–3 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–21.

7	Check fuel pressure.



PREPARATION:

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

(b) Use the ACTIVE TEST mode to operate the fuel pump.

CHECK:

Check the fuel pressure in the fuel inlet hose when it is pinched-by hand.

OK:

There is pressure in the fuel inlet hose.

NG → **Proceed to Pub. No. RM519E on page IG–3 and continue to troubleshoot.**

OK

8	Check for spark (See Pub No. RM519E on page IG–3).

NG → **Proceed to Pub. No. RM519E on page IG–3 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–21.

7. ENGINE OPERATING CONDITION

NOTICE:

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

Hand–held tester display	Measurement Item	Normal Condition*
FUEL SYS #1	Fuel System Bank 1 OPEN: Air–fuel ratio feedback stopped CLOSED: Air–fuel ratio feedback operating	Idling after warming up: CLOSED
FUEL SYS #2	Fuel System Bank 2 OPEN: Air–fuel ratio feedback stopped CLOSED: Air–fuel ratio feedback operating	Idling after warming up: CLOSED
CALC LOAD	Calculator Load: Current intake air volume as a proportion of max. intake air volume	Idling: 25.7 – 46.4 % Racing without load (2,500rpm): 19.7 – 40.5 %
COOLANT TEMP	Water Temp. Sensor Value	After warming up: 80 – 95°C (176 – 203°F)
SHORT FT #1	Short–term Fuel Trim Bank 1	0 ± 20 %

Hand–held tester display	Measurement Item	Normal Condition*
LONG FT #1	Long–term Fuel Trim Bank 1	0 ± 20 %
SHORT FT #2	Short–term Fuel Trim Bank 2	0 ± 20 %
LONG FT #2	Long–term Fuel Trim Bank 2	0 ± 20 %
ENGINE SPD	Engine Speed	Idling: 700 – 800 rpm
VEHICLE SPD	Vehicle Speed	Vehicle stopped: 0 km/h (0 mph)
IGN ADVANCE	Ignition Advance: Ignition Timing of Cylinder No.1	Idling: BTDC 5 – 15°
INTAKE AIR	Intake Air Temp. Sensor Value	Equivalent to ambient temp.
MAP	Absolute Pressure Inside Intake Manifold	Idling: 26 – 47 kPa. Racing without load (2,500 rpm): 20 – 41 kPa
THROTTLE POS	Voltage Output of Throttle Position Sensor Calculated as a percentage: 0 V → 0 %, 5 V → 100 %	Throttle fully closed: 8 – 20 % Throttle fully open: 64 – 96 %
O2S B1 S1	Voltage Output of Oxygen Sensor Bank 1 Sensor 1	Idling: 0.1 – 0.9 V
O2S B1 S2	Voltage Output of Oxygen Sensor Bank 1 Sensor 2	Driving (50 km/h, 31 mph): 0.1 – 0.9 V
O2S B2 S1	Voltage Output of Oxygen Sensor Bank 2 Sensor 1	Idling: 0.1 – 0.9 V
O2FT B1 S1	Oxygen Sensor Fuel Trim Bank 1, Sensor 1 (Same as SHORT FT #1)	0 ± 20 %
O2FT B2 S1	Oxygen Sensor Fuel Trim Bank 2, Sensor 1 (Same as SHORT FT #2)	0 ± 20 %
MIL ON RUN DIST	Distance since activation of check engine warning light	When there is no DTC: 0 km/h (0 mph)
INJECTOR	Fuel injection time for cylinder No.1	Idling: 1.92 – 3.37 ms
MISFIRE RPM	Engine RPM for first misfire range	Misfire 0: 0 rpm
MISFIRE LOAD	Engine load for first misfire range	Misfire 0: 0 g/r
STARTER SIG	Starter Signal	Cranking: ON
A/C SIG	A/C Switch Signal	A/C ON: ON
PNP SW	Park/Neutral Position Switch Signal	P or N position: ON
ELCTRCAL LOAD SIG	Electrical Load Signal	Defogger switch ON: ON
CTP	Closed Throttle Position	Throttle fully closed: ON
STOP LIGHT SW	Stop Light Switch Signal	Stop light switch ON: ON
PS OIL PRESS SW	Power Steering Oil Pressure Switch Signal	Turn steering wheel: ON
FC IDL	Fuel Cut Idle: Fuel cut when throttle valve fully closed, during deceleration	Fuel cut operating: ON
FC TAU	Fuel Cut TAU: Fuel cut during very light load	Fuel cut operating: ON
CYL#1 – CYL#6	Abnormal revolution variation for each cylinder	0 %
IGNITION	Total number of ignition for every 1,000 revolutions	0 – 300
INTAKE CTRL VSV	Intake Air Control Valve VSV Signal	VSV operating: ON
A/C CUT SIG	A/C Cut Signal	A/C S/W OFF: ON
FUEL PUMP	Fuel Pump Signal	Idling: ON
EVAP (PURGE) VSV	EVAP VSV Signal	VSV operating: ON
THROTTLE POS #2	Throttle position sensor No.2 output voltage	Throttle fully closed: 2.0 – 2.9 V Throttle fully open: 4.6 – 5.0 V

Hand–held tester display	Measurement Item	Normal Condition*
ACCEL POS	Accelerator pedal position sensor No.1 output voltage	Accelerator pedal released: 0.25 – 0.9 V Accelerator pedal depressed: 3.2 – 4.8 V
ACCEL POS #2	Accelerator pedal position sensor No.2 output voltage	Accelerator pedal released: 1.8 – 2.7 V Accelerator pedal depressed: 4.7 – 5.0 V
THROTTLE TARGET POS	Target position of throttle valve	Idling: 0.4 – 1.1 V
THROTTLE OPEN DUTY	Throttle motor opening duty ratio	Throttle fully closed: 0 % When accelerator pedal is depressed, duty ratio is increased
THROTTLE CLOSE DUTY	Throttle motor closed duty ratio	Throttle fully closed: 0 %–40 % When accelerator pedal is quick released, duty ratio is increased
THROTTLE MOTOR CTL	Whether or not throttle motor control is permitted	Idling: ON
THROTTLE CLUTCH CTL	Whether or not magnetic clutch control is permitted	Idling: ON
+BM	Whether or not electric throttle control system power is inputted	Idling: ON
ACCEL IDL	Whether or not accelerator pedal position sensor is detecting idle	Idling: ON
THROTTLE IDL	Whether or not throttle position sensor is detecting idle	Idling: ON
FAIL #1	Whether or not fail safe function is executed	ETCS is failed: ON
FAIL #2	Whether or not fail safe function is executed	ETCS is failed: ON
THROTTLE LEAN VALUE	Throttle fully closed learning value	0.4 – 0.8 V
ACCEL LEAN VALUE	Accelerator fully closed learning value	0.4 – 0.8 V
THROTTLE MOTOR	Throttle motor control current	Idling: 0 – 3.0 A
ETCS MAG CLUTCH	Magnetic clutch control current	0.8 – 1.0 A
TOTAL FT B1	Total Fuel Trim Bank 1: Average value for fuel trim system of bank 1	Idling: 0.5 – 1.4
TOTAL FT B2	Total Fuel Trim Bank 2: Average value for fuel trim system of bank 2	Idling: 0.5 – 1.4
O2 LR B1 S1	Oxygen Sensor Lean Rich Bank 1 Sensor 1: Response time for oxygen sensor output to switch from lean to rich	Idling after warming up: 0 – 1,000 msec.
O2 LR B2 S1	Oxygen Sensor Lean Rich Bank 2 Sensor 1: Response time for oxygen sensor output to switch from lean to rich	Idling after warming up: 0 – 1,000 msec.
O2 RL B1 S1	Oxygen Sensor Rich Lean Bank 1 Sensor 1: Response time for oxygen sensor output to switch from rich to lean	Idling after warming up: 0 – 1,000 msec.
O2 RL B2 S1	Oxygen Sensor Rich Lean Bank 1 Sensor 1: Response time for oxygen sensor output to switch from rich to lean	Idling after warming up: 0 – 1,000 msec.

*: If no conditions are specifically stated for "Idling", it means the shift lever is at N or P position, the A/C switch is OFF and all accessory switches are OFF.

DI6AL-02

DIAGNOSTIC TROUBLE CODE CHART

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 the check mode, check the circuit for that code listed in the table below. For details of each code, refer to the "See Page" under the respective "DTC No." in the DTC chart.

DTC No. (See Page)	Detection Item	Trouble Area	CHK ENG *1	Memory
P0100/31 (DI–22)	Air Flow Circuit Malfunction	• Open or short in air flow meter circuit • Air flow meter • Engine ECU	○	○
P0110/24 (DI–28)	Intake Air Temp. Circuit Malfunction	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor (inside air flow meter) • Engine ECU	–	○
P0115/22 (DI–32)	Water Temp. Circuit Malfunction	• Open or short in water temp. sensor circuit • Water temp. sensor • Engine ECU	○	○
P0116/22 (DI–37)	Engine Coolant Temp. Circuit Range/Performance Problem	• Cooling system • Engine coolant temp. sensor	○	○
P0120/41 (DI–38)	Throttle Position Sensor Circuit Malfunction	• Open or short in throttle position sensor circuit • Throttle position sensor • Engine ECU	–	○
P0121/41 (DI–43)	Throttle/Pedal Position Sensor/ Switch "A"Circuit Range/Performance Problem	• Throttle position sensor	○	○
P0125/91 (DI–44)	Insufficient Coolant Temp. for Closed Loop Fuel Control	• Open or short in A/F sensor circuit • A/F sensor • Air induction system • Fuel pressure • Injector • Gas leakage on exhaust system • ECU	○	○
P0136/27 (DI–50)	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor	○	○
P0141/27 (DI–52)	Oxygen Sensor Heated Circuit Malfunction (Bank 1 Sensor 2)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • ECU	○	○
P0171/25 (DI–54)	System too Lean (Fuel Trim)	• Air intake (hose loose) • Fuel line pressure • Injector blockage • Oxygen sensor malfunction • Air flow meter • Water temp. sensor	–	○
P0172/26 (DI–54)	System too Rich (Fuel Trim)	• Injector leak, blockage • Air flow meter • Engine coolant temp. sensor • Ignition system • Fuel pressure • Gas leakage on exhaust system • Open or short in A/F sensor (bank 1, sensor 1) circuit • A/F sensor • ECU	○	○

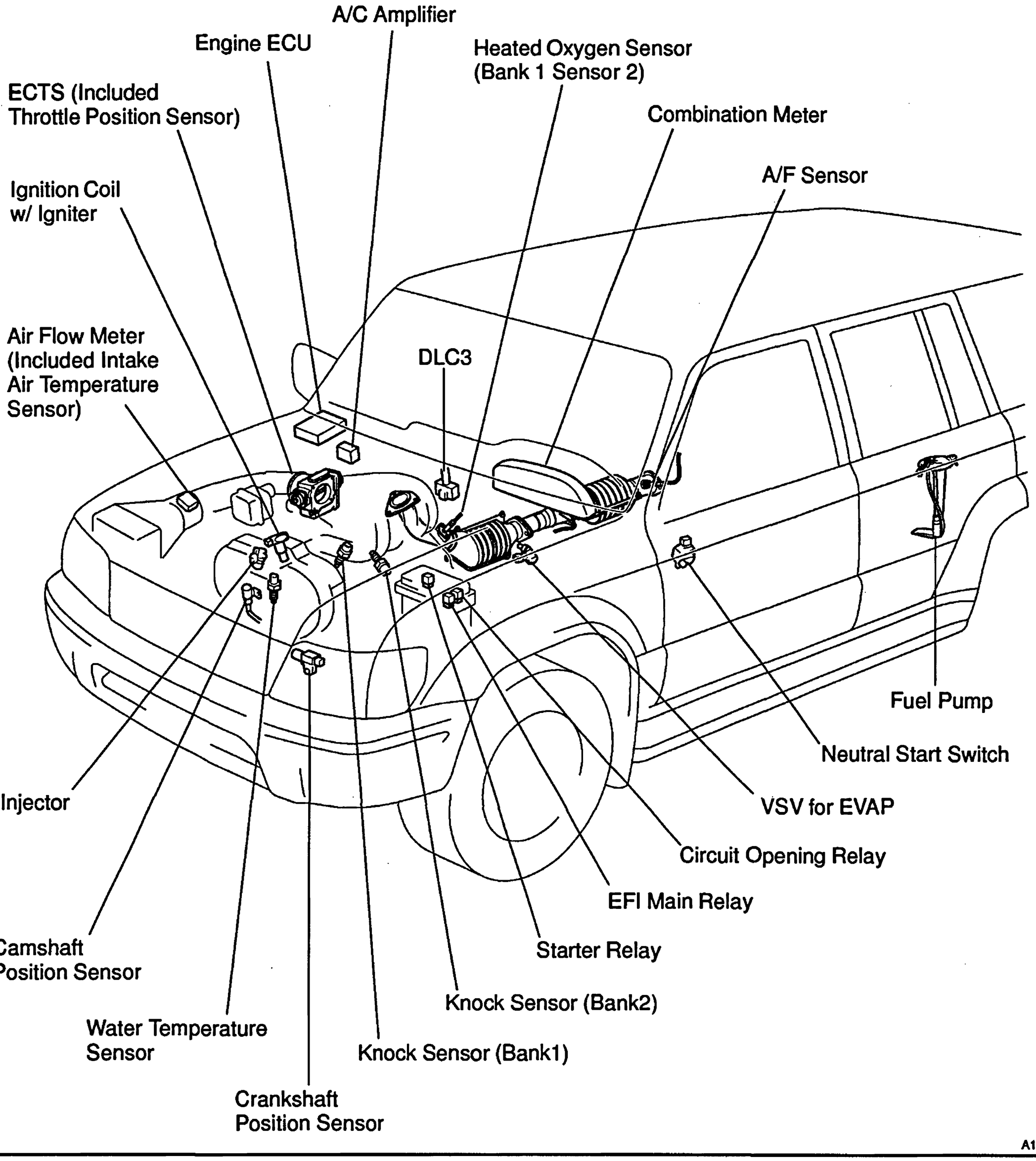
DTC No. (See Page)	Detection Item	Trouble Area	CHK ENG *1	Memory
P0300/93 (DI–59)	Random/Multiple Cylinder Misfire Detected	• Open or short in engine wire • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Air flow meter • Engine coolant temp. sensor • Compression pressure • Valve clearance • Valve timing • ECU	○	○
P0301/93 (DI–59)	Cylinder 1 Misfire Detected			
P0302/93 (DI–59)	Cylinder 2 Misfire Detected			
P0303/93 (DI–59)	Cylinder 3 Misfire Detected			
P0304/93 (DI–59)	Cylinder 4 Misfire Detected			
P0305/93 (DI–59)	Cylinder 5 Misfire Detected			
P0306/93 (DI–59)	Cylinder 6 Misfire Detected			
P0325/52 (DI–64)	Knock Sensor 1 Circuit Malfunction (Bank 1)	• Open or short in knock sensor 1 circuit • Knock sensor 1 (looseness) • Engine ECU	○	○
P0330/55 (DI–64)	Knock Sensor 2 Circuit Malfunction (Bank 2)	• Open or short in knock sensor 2 circuit • Knock sensor 2 (looseness) • Engine ECU	○	○
P0335/12, 13 (DI–69)	Crankshaft Position Sensor Circuit Malfunction	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Starter • Engine ECU	○	○
P0340/12 (DI–72)	Camshaft Position Sensor Circuit Malfunction	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Starter • Engine ECU	○	○
P0420/94 (DI–74)	Catalyst System Efficiency Below Threshold (bank 1)	• Gas leakage on exhaust system • Oxygen sensor • Three–way catalytic converter	○	○
P0443/94 (DI–76)	Evaporative Emission Control System Purge Control Vent Control Malfunction	• Open or short in VSV circuit for EVAP • VSV for EVAP • Engine ECU	○	○
P0500/42 (DI–79)	Vehicle Speed Sensor Circuit Malfunction	• Open or short in No.1 vehicle speed sensor circuit • No.1 vehicle speed sensor • Combination meter • Engine ECU	○	○
P0505/33 (DI–81)	Idle Control System Malfunction	• Open or short in ISC valve circuit • ISC valve • Engine ECU	○	○
P1120/19 (DI–82)	Accelerator Pedal Position Sensor Circuit Malfunction	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • Engine ECU	○	○
P1121/19 (DI–87)	Accelerator Pedal Position Sensor Range/Performance Problem	• Accelerator pedal position sensor • Engine ECU	○	○
P1125/89 (DI–88)	Throttle Control Motor Circuit Malfunction	• Open or short in throttle control motor circuit • Throttle control motor • Engine ECU	○	○

DTC No. (See Page)	Detection Item	Trouble Area	CHK ENG *1	Memory
P1126/89 (DI–91)	Magnetic Clutch Circuit Malfunction	• Open or short in magnetic clutch circuit • Magnetic clutch • Engine ECU	○	○
P1127/89 (DI–93)	ECTS Actuator Power Source Circuit Malfunction	• Open in ECTS power source circuit • Engine ECU	○	○
P1128/89 (DI–95)	Throttle Control Motor Lock Malfunction	• Throttle control motor • Throttle body • Engine ECU	○	○
P1129/89 (DI–96)	Electric Throttle Control System Malfunction	• Electric throttle control system • Engine ECU	○	○
P1130/21 (DI–97)	A/F Sensor Circuit Range/Performance Malfunction (Bank 1 Sensor 1)	• Open or short in A/F sensor circuit • A/F sensor • Air induction system • Fuel pressure • Injector • ECU	○	○
P1133/21 (DI–100)	A/F Sensor Circuit Response Malfunction (Bank 1 Sensor 1)	• Open or short in A/F sensor circuit • A/F Sensor • Air induction system • Fuel pressure • Injector • ECU	○	○
P1135/21 (DI–103)	A/F Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	• Open or short in heater circuit of A/F sensor • A/F sensor heater • ECU	○	○
P1300/14 (DI–105)	Igniter Circuit Malfunction No. 1	• Open or short in IGF or IGT circuit from igniter to engine ECU • Ignition coil No. 1 (w/ Igniter) • Engine ECU	○	○
P1335/13 (DI–110)	Crankshaft Position Sensor Circuit Malfunction (During idling)	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Starter • Engine ECU	–	○
P1520/52 (DI–111)	Stop Light Switch Signal Malfunction	• Short in stop light switch signal circuit • Stop light switch • ECU	○	○
P1600/96 (DI–114)	ECU BATT Malfunction	• Open in back up power source circuit • ECU	○	○
P1633/89 (DI–116)	ECU Malfunction (ETCS Circuit)	• Engine ECU	○	○
B2795/99	Unmatched Key Code	• Immobilizer system	○	○
B2796/99	No Communication in Immobilizer System	• Immobilizer system	–	○
B2797/99	Communication Malfunction No.1	• Immobilizer system	–	○
B2798/99	Communication Malfunction No.2	• Immobilizer system	–	○

*1: ○ ... Check engine warning light (CHK ENG) light up

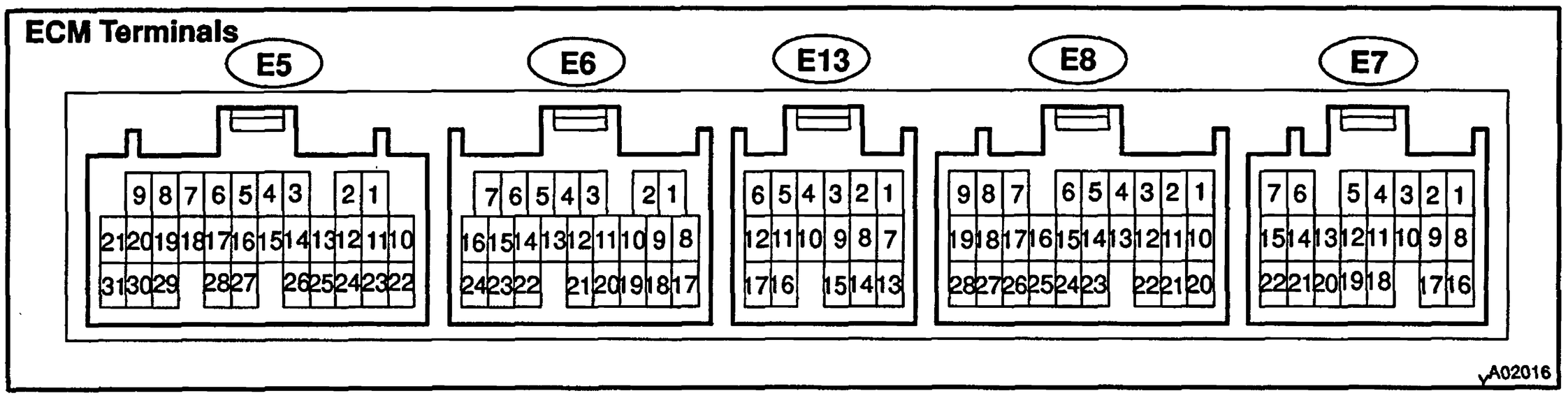
DI6AM-02

PARTS LOCATION



DI8AN–02

TERMINALS OF ECU



Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
BATT (E7–16) – E1 (E6–17)	B–Y ↔ BR	Always	9 – 14
+B (E7–1) – E1 (E6–17)	B ↔ BR	IG switch ON	9 – 14
VC (E5–25) – E2 (E5–11)	G–B ↔ BR	IG switch ON	4.5 – 5.5
VTA (E5–15) – E2 (E5–11)	Y–R ↔ BR	IG switch ON, Throttle valve fully closed	0.3 – 1.0
		IG switch ON, Throttle valve fully open	2.7 – 5.2
VG (E5–12) – E2 (E5–11)	Y ↔ BR	Idling, A/C switch OFF	1.1 – 1.5
THA (E5–13) – E2 (E5–11)	Y–G ↔ BR	Idling, Intake air temp. 20°C (68°F)	0.5 – 3.4
THW (E5–18) – E2 (E5–11)	G ↔ BR	Idling, Engine coolant temp. 80°C (176°F)	0.2 – 1.0
STA (E7–7) – E1 (E6–17)	R ↔ BR	Cranking	6.0 or more
#10 (E6–6) – E01 (E5–4)	L ↔ BR	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–129)
#20 (E6–5) – E01 (E5–4)	W ↔ BR	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–129)
#30 (E6–4) – E01 (E5–4)	G ↔ BR	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–129)
#40 (E6–3) – E01 (E5–4)	Y ↔ BR	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–129)
#50 (E6–1) – E01 (E5–4)	R–B ↔ BR	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–129)
#60 (E6–8) – E01 (E5–4)	R ↔ BR	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–129)
IGT1 (E6–11) – E1 (E6–17)	B ↔ BR	Idling	Pulse generation (See page DI–105)
IGT2 (E6–10) – E1 (E6–17)	G–B ↔ BR	Idling	Pulse generation (See page DI–105)
IGT3 (E6–9) – E1 (E6–17)	B–W ↔ BR	Idling	Pulse generation (See page DI–105)
IGF (E6–2) – E1 (E6–17)	B–R ↔ BR	IG switch ON	4.5 – 5.5
		Idling	Pulse generation (See page DI–105)

Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
G2 (E6–13) – NE– (E6–21)	W ↔ B	Idling	Pulse generation (See page DI–69)
NE+ (E6–12) – NE– (E6–21)	W ↔ B	Idling	Pulse generation (See page DI–69)
FC (E7–22) – E01 (E5–4)	R–W ↔ BR	IG switch ON	9 ± 14
		Idling	0 – 3.0
OX2B (E5–27) – E1 (E6–17)	W ↔ BR	Engine speed at 2,500 rpm for 3 min. after warming up	Pulse generation ()
HT2B (E5–29) – E03 (E5–7)	G–Y ↔ W–B	Idling	Below 3.0
		IG switch ON	9 – 14
KNK1 (E5–23) – E1 (E6–17)	GR ↔ BR	Idling	Pulse generation (See page DI–64)
KNK2 (E5–22) – E1 (E6–17)	B ↔ BR	Idling	Pulse generation (See page DI–64)
NSW (E8–3) – E1 (E6–17)	B–W ↔ BR	IG switch ON, Other shift position than P and N	9 – 14
		IG switch ON, Shift position in P or N	0 – 3.0
SP1 (E7–6) – E1 (E6–17)	V–W ↔ BR	IG switch ON, driving wheel rotating slowly	Pulse generation (See page DI–79)
W (E7–2) – E01 (E5–4)	Y–R ↔ BR	Idling	9 – 14
		IG switch ON	Below 3.0
ACT (E7–3) – E1 (E6–17)	L–B ↔ BR	A/C switch OFF	Below 2.0
		A/C switch ON at idling	5.0 or more
AC1 (E7–9) – E1 (E6–17)	L–Y ↔ BR	A/C switch ON at idling	Below 2.0
		A/C switch OFF	9 – 14
SIL (E7–14) – E1 (E6–17)	V–W ↔ BR	During transmission	Pulse generation
STP (E7–20) – E1 (E6–17)	G–W ↔ BR	IG switch ON, Brake pedal is depressed	7.5 – 14
		IG switch ON, Brake pedal is released	Below 1.5
VTA2 (E13–4) – E2 (E5–11)	B ↔ BR	IG switch ON, Throttle valve fully closed	1.5 – 2.7
		IG switch ON, Throttle valve fully open	4.5 – 5.5
TXCT (E7–19) – E1 (E6–17)	R–Y ↔ BR	At time of inserting key	Pulse generation
IMLD (E7–12) – E1 (E6–17)	R–L ↔ BR	In condition without key inserted	Pulse generation
MREL (E7–4) – E1 (E6–17)	L–B ↔ BR	IG switch ON	9 – 14
AF1+ (E5–14) – E1 (E6–17)	R ↔ BR	IG switch ON	3.0 – 3.6
AF1– (E5–26) – E1 (E6–17)	G ↔ BR	IG switch ON	2.7 – 3.3
HAF1 (E5–21) – E04 (E5–8)	G–Y ↔ W–B	Idling	Below 1.5
		IG switch ON	9 – 14
KSW (E7–11) – E1 (E6–17)	Y ↔ BR	At time of inserting key	Below 1.5
		In condition without key inserted	4 – 5
CODE (E7–5) – E1 (E6–17)	L–B ↔ BR	At time of inserting key	Pulse generation
EVP (E6–14) – E01 (E5–4)	P–G ↔ BR	IG switch ON	9 – 14

DI6AO-02

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	See page
Engine does not crank (Engine does not start)	1. Starter 2. Starter relay	*1
No initial combustion (Engine does not start)	1. Engine ECU power source circuit 2. Fuel pump control circuit 3. Engine ECU	DI–124 DI–132 IN–20
No complete combustion (Engine does not start)	1. Fuel pump control circuit	DI–132
Engine cranks normally (Difficult to start)	1. Starter signal circuit 2. Fuel pump control circuit 3. Compression	DI–121 DI–132 ★
Cold engine (Difficult to start)	1. Starter signal circuit 2. Fuel pump control circuit	DI–121 DI–132
Hot engine (Difficult to start)	1. Starter signal circuit 2. Fuel pump control circuit	DI–121 DI–132
High engine idle speed (Poor idling)	1. A/C signal circuit (Compressor circuit) 2. Engine ECU power source circuit	IN–20 DI–124
Low engine idle speed (Poor idling)	1. A/C signal circuit (Compressor circuit) 2. Fuel pump control circuit	IN–20 DI–132
Rough idling (Poor idling)	1. Compression 2. Fuel pump control circuit	★ DI–132
Hunting (Poor idling)	1. Engine ECU power source circuit 2. Fuel pump control circuit	DI–124 DI–132
Hesitation/Poor acceleration (Poor driveability)	1. Fuel pump control circuit 2. A/T faulty *2	DI–132 –
Surging (Poor driveability)	1. Fuel pump control circuit	DI–132
Soon after starting (Engine stall)	1. Fuel pump control circuit	DI–132
During A/C operation (Engine stall)	1. A/C signal circuit (Compressor circuit) 2. Engine ECU	IN–20 IN–20

*1: See Pub. No. RM519E

*2: Only for A/T

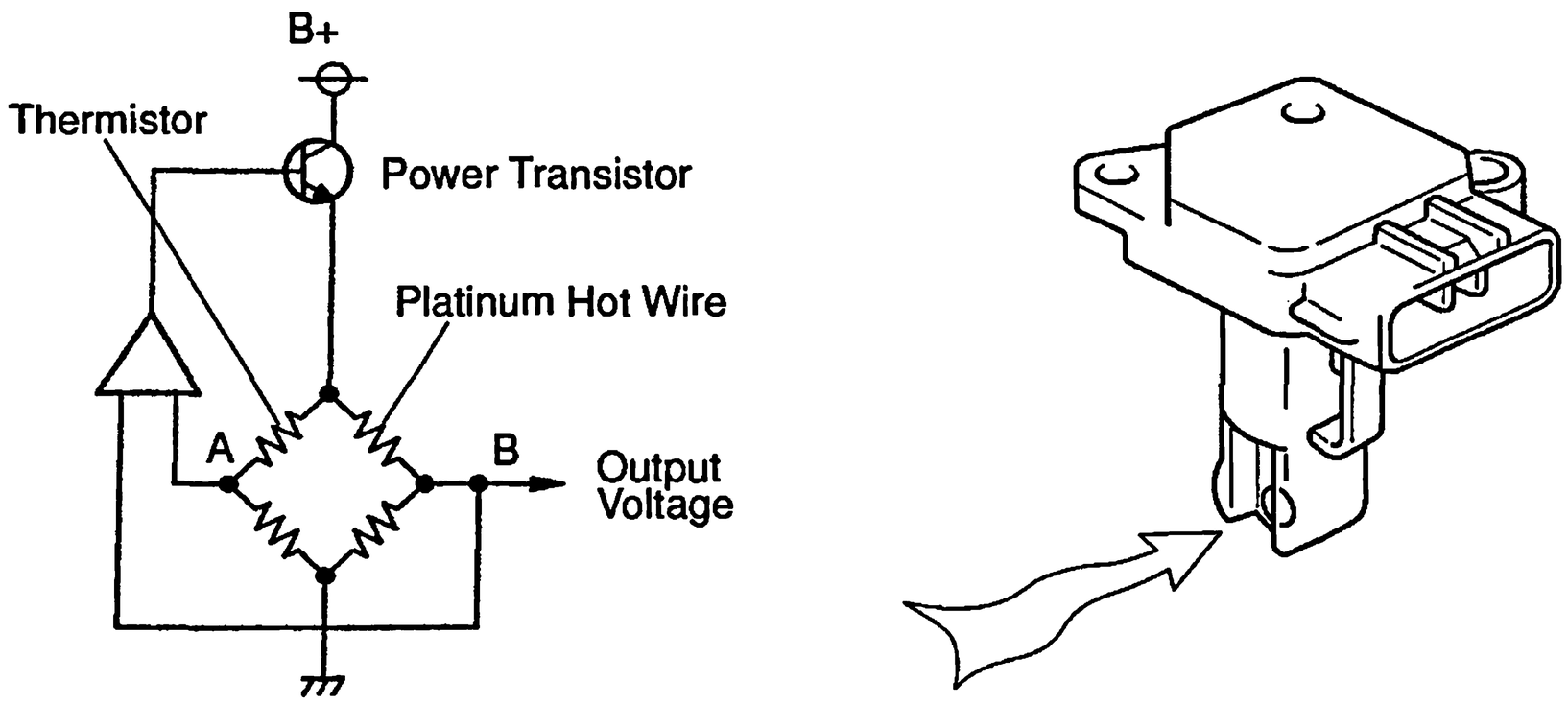
DI8AP–02

CIRCUIT INSPECTION

DTC	P0100/31	Air Flow Circuit Malfunction

CIRCUIT DESCRIPTION

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



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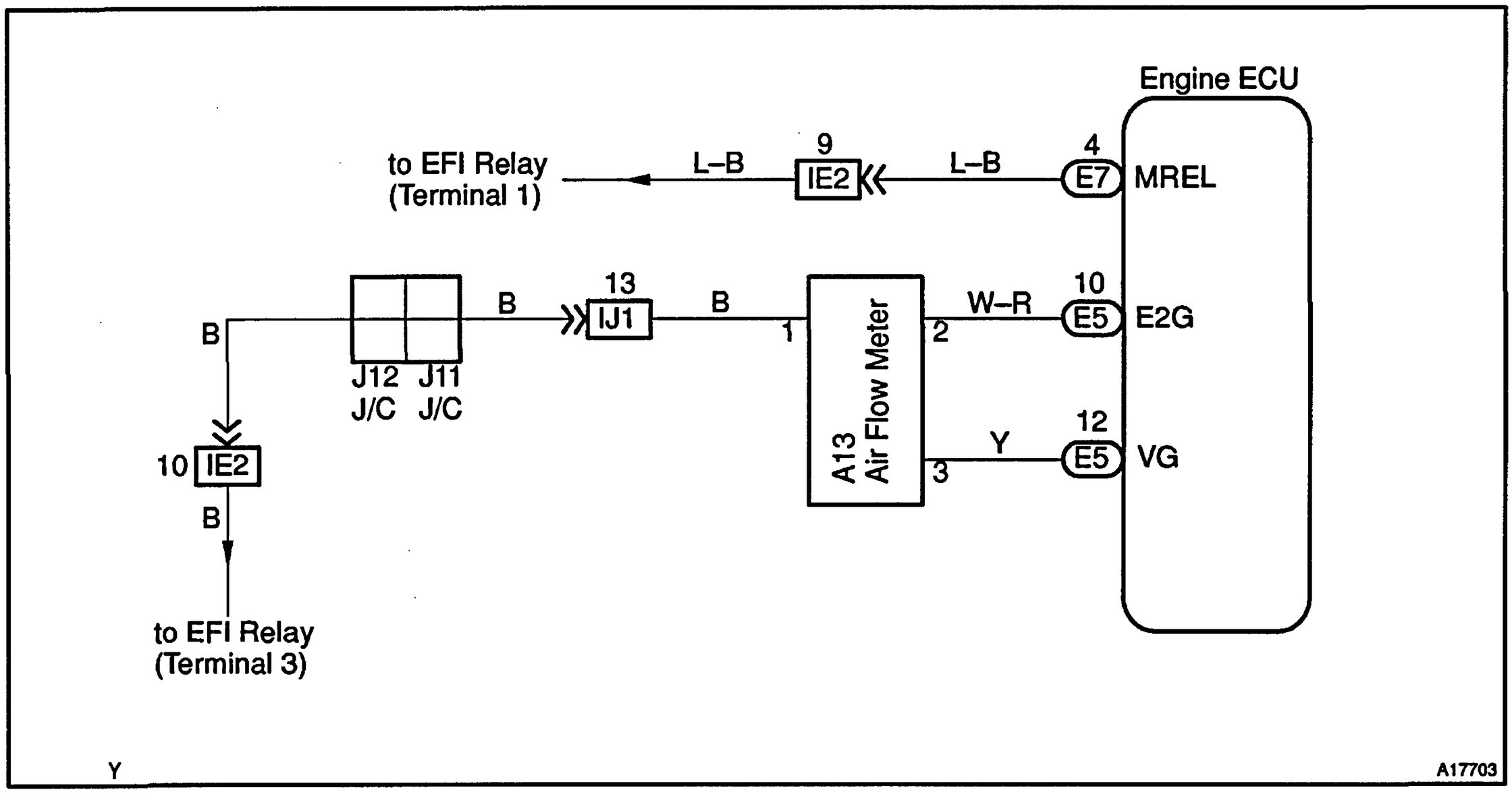
DTC No.	DTC Detecting Condition	Trouble Area
P0100/31	Open or short in air flow meter circuit with engine speed 2,000 rpm or less for 3 seconds or more	• Open or short in air flow meter circuit • Air flow meter • Engine ECU
	Open or short in air flow meter circuit with engine speed 3,000 rpm or more for 3 seconds or more (2 trip detection logic)	

HINT:
After confirming DTC P0100/31, use the hand–held tester to confirm the air flow ratio from the CURRENT DATA.

Air Flow Value (gm/sec.)	Malfunction
Approx. 0	• Air flow meter power source circuit open • VG circuit open or short
11.0 ~ 25.1 (idling after warmed up)	• E3 circuit open

WIRING DIAGRAM



INSPECTION PROCEDURE

When using hand–held tester

HINT:

Read freeze frame data on the hand–held tester. Because freeze frame data 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 warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

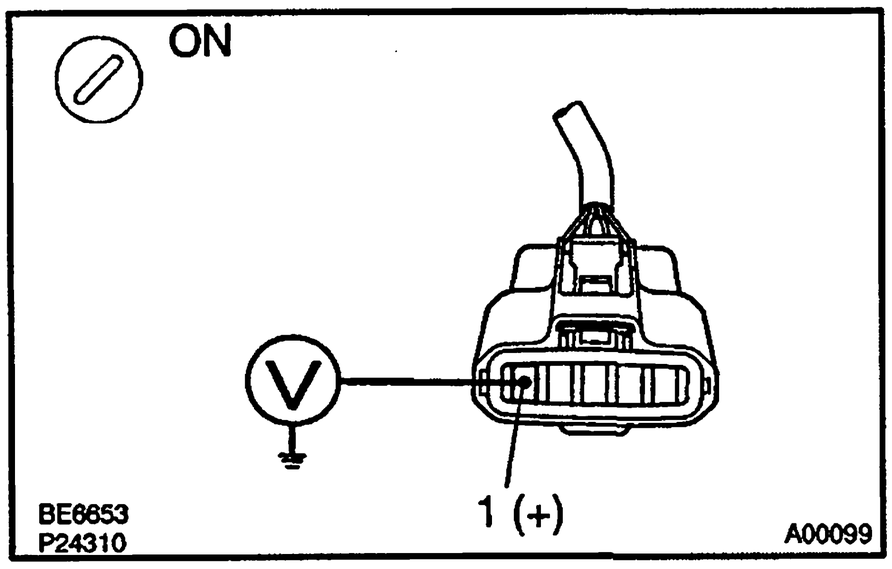
1	**Read value of air flow rate on hand–held tester.**

RESULT:

	A	B
Air flow rate (gm/sec.)	Approx. 0	11.0 – 25.1 (idling after warmed up)

A	**Go to step 2.**
B	**Go to step 5.**

2	Check voltage of air flow meter power source.



PREPARATION:

(a) Disconnect the air flow meter connector.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminal 1 of the air flow meter connector and the body ground.

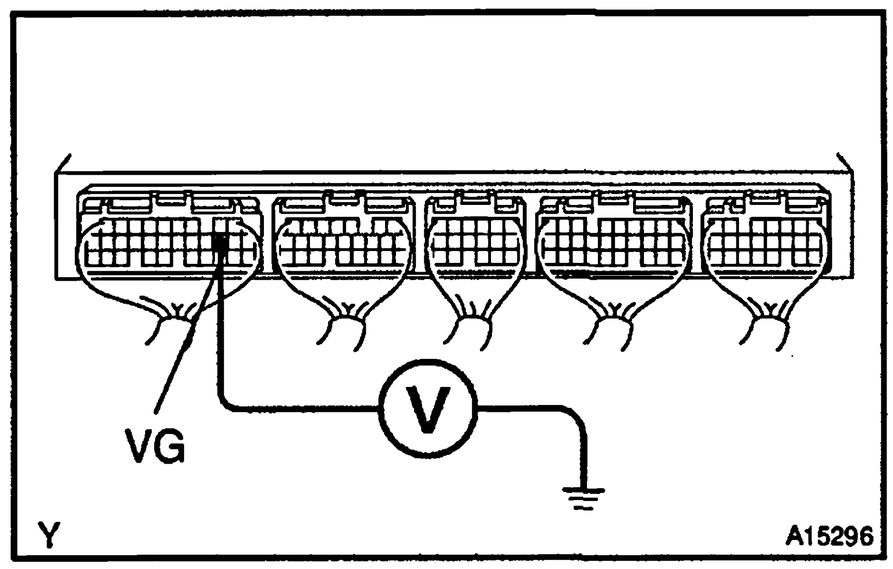
OK:

Voltage: 9 – 14 V

NG → **Check for open in harness and connector between EFI main relay (Marking: EFI) and air flow meter (See page IN–20).**

OK

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



PREPARATION:

(a) Remove the glove compartment door.

(b) Start the engine.

CHECK:

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

OK:

Voltage:

1.1 – 1.5 V (P or N range and A/C switch OFF)

OK → **Check and replace engine ECU (See page IN–20).**

NG

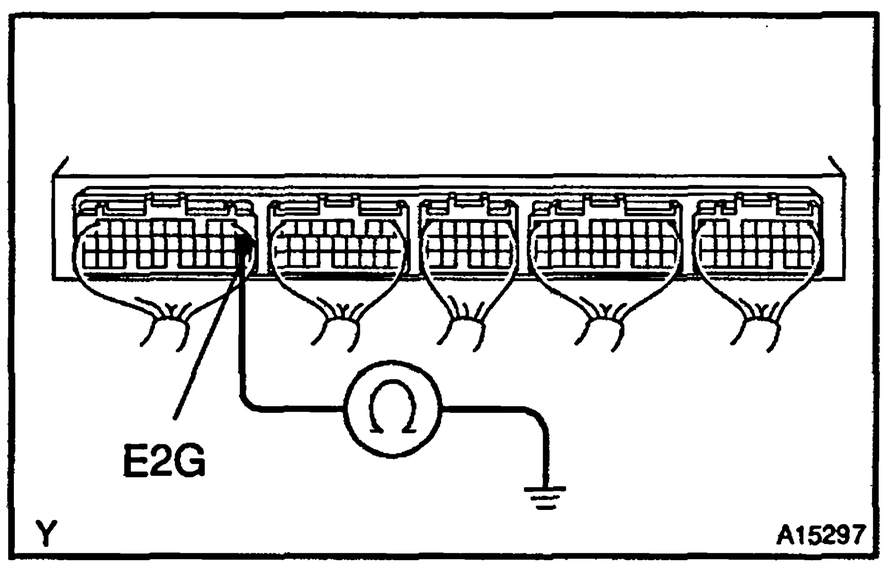
4	**Check for open and short in harness and connector between air flow meter and engine ECU (See page IN–20).**

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

OK

Replace air flow meter.

5	**Check continuity between terminal E2G of engine ECU connector and body ground.**



PREPARATION:
Remove the glove compartment door.
CHECK:
Check the continuity between terminal E2G of the engine ECU connector and body ground.
OK:
Continuity

NG → **Check and replace engine ECU (See page IN–20).**

OK

6	**Check for open in harness and connector between air flow meter and engine ECU (See page IN–20).**

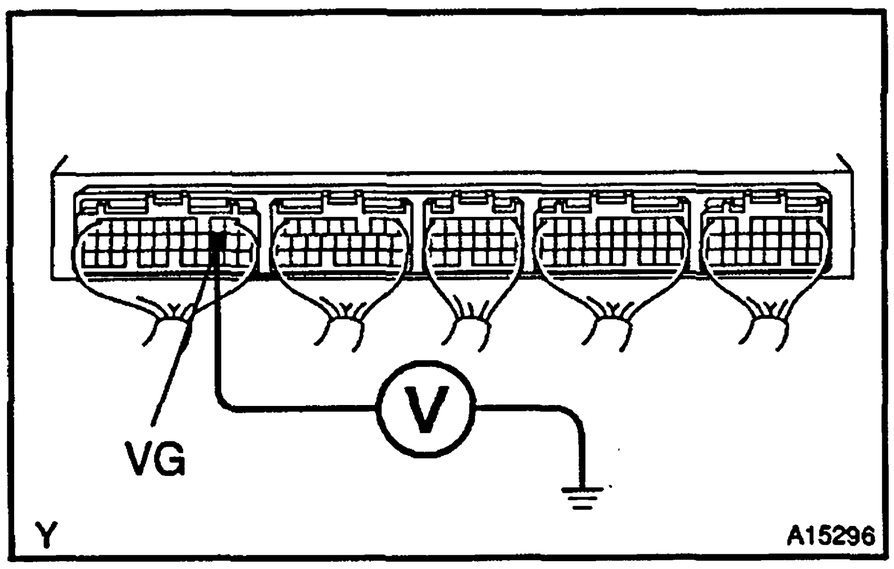
NG → **Repair or replace harness or connector.**

OK

Replace air flow meter.

When not using hand–held tester

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



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

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

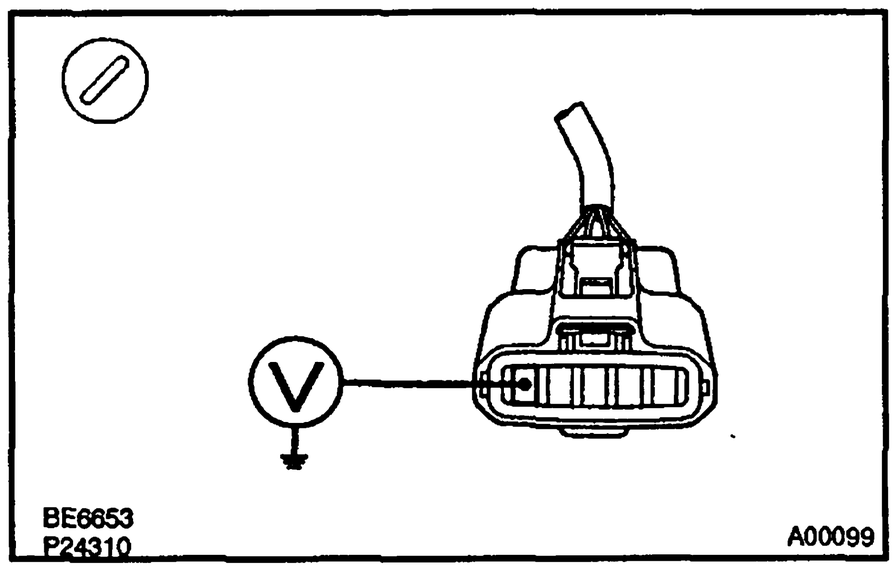
OK:

voltage:
1.1 – 1.5 V (P or N range and A/C switch OFF)

OK	**Check and replace engine ECU (See page IN–20).**

NG

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



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

CHECK:
Measure the voltage between terminal 1 of the air flow meter connector and body ground.

OK:

Voltage: 9 – 14 V

NG	**Check for open in harness and connector between EFI main relay (Marking: EFI) and air flow meter (See page IN–20).**

OK

3	**Check for open in harness and connector between air flow meter and engine ECU (See page IN–20).**

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

OK

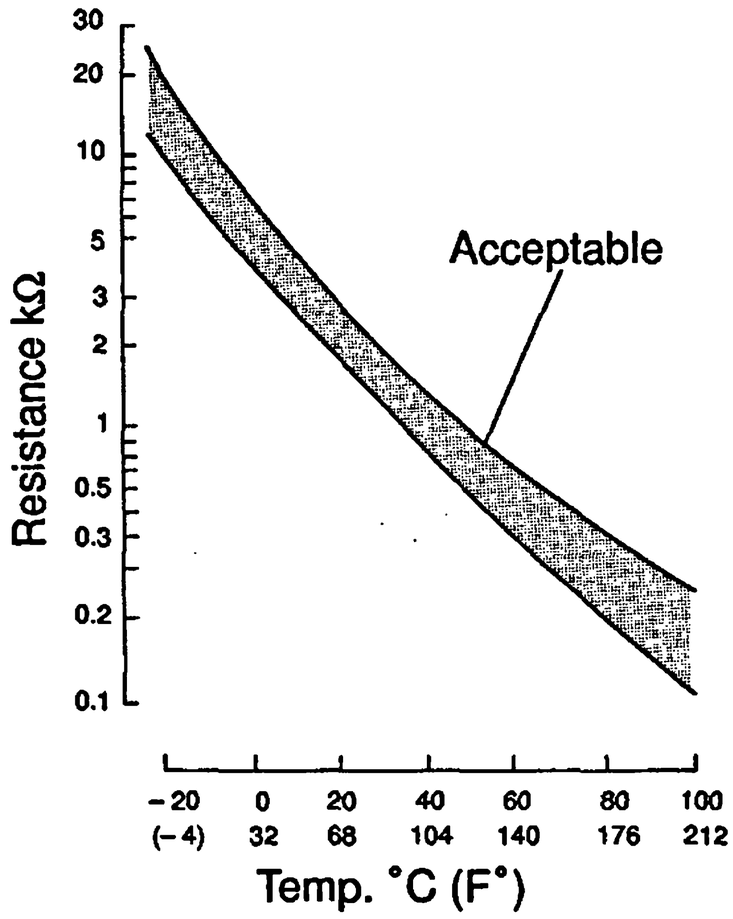
Replace air flow meter.

DI9PF–01

DTC	P0110/24	Intake Air Temp. Circuit Malfunction

CIRCUIT DESCRIPTION

(fig. 1)



The intake air temperature sensor senses the intake air temperature. A thermistor built in this sensor changes the resistance value according to the intake air temperature as shown in the illustration. This resistance value of air intake temperature sensor is one of the factors to decide the fuel injection volume.

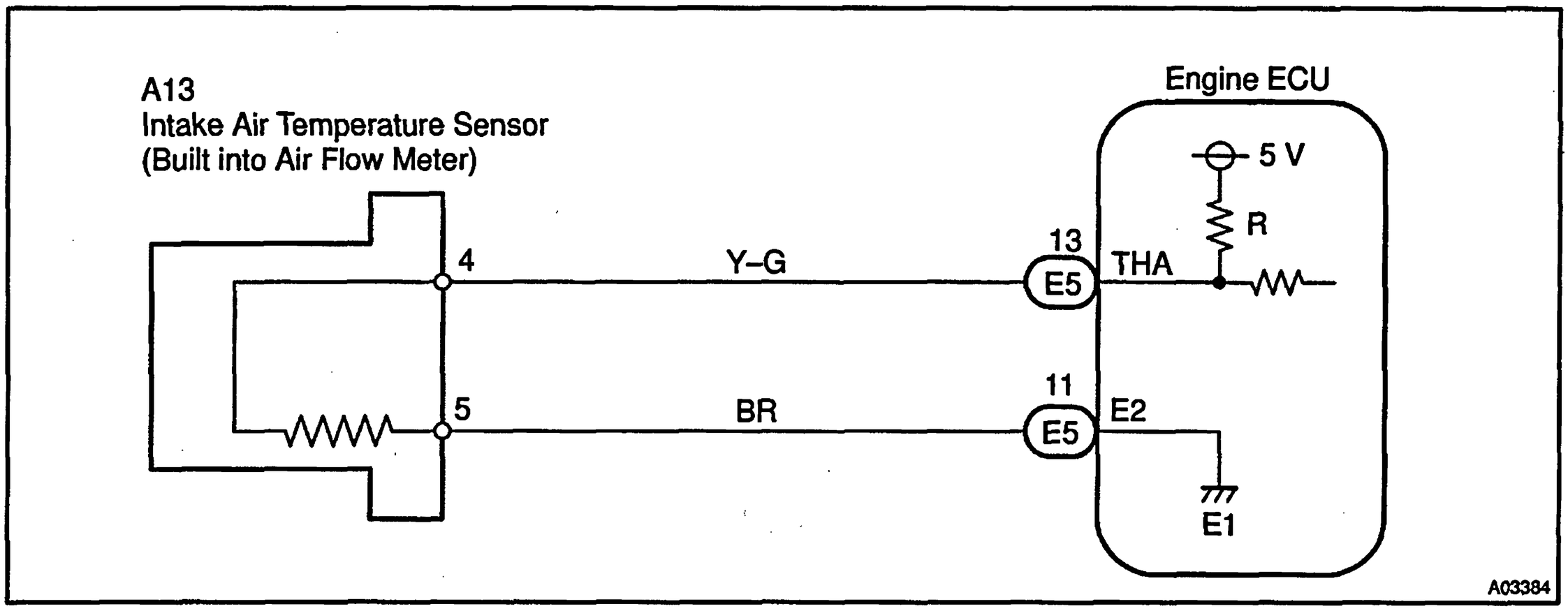
DTC No.	DTC Detecting Condition	Trouble Area
P0110/24	Open or short in intake air temperature sensor circuit	• Intake air temperature sensor circuit • Air flow meter (Intake air temperature sensor) • Engine ECU

HINT:

After confirming DTC P0110/24, use the hand–held tester to confirm the intake air temperature from the 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 DTCs P0110/24, P0115/22 and P0120/41 are output simultaneously, E2 (Sensor Ground) may be open.
- Read freeze frame data on the hand–held tester. Because freeze frame data 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 warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester

1	**Read value of intake air temp. on hand–held tester**

HINT:

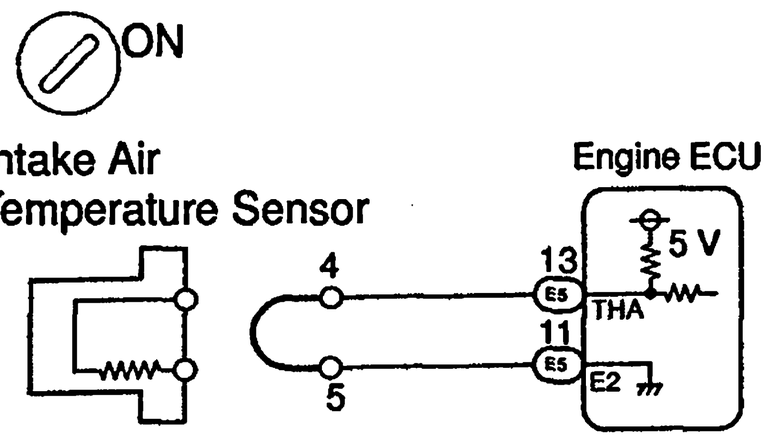
- If there is an open circuit, the hand–held tester indicates –40°C (–40°F).
- If there is a short circuit, the hand–held tester indicates 140°C (284°F) or more.

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–4).

2	Check for open in harness or engine ECU.



PREPARATION:

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

CHECK:

Read the intake air temperature on a hand–held tester.

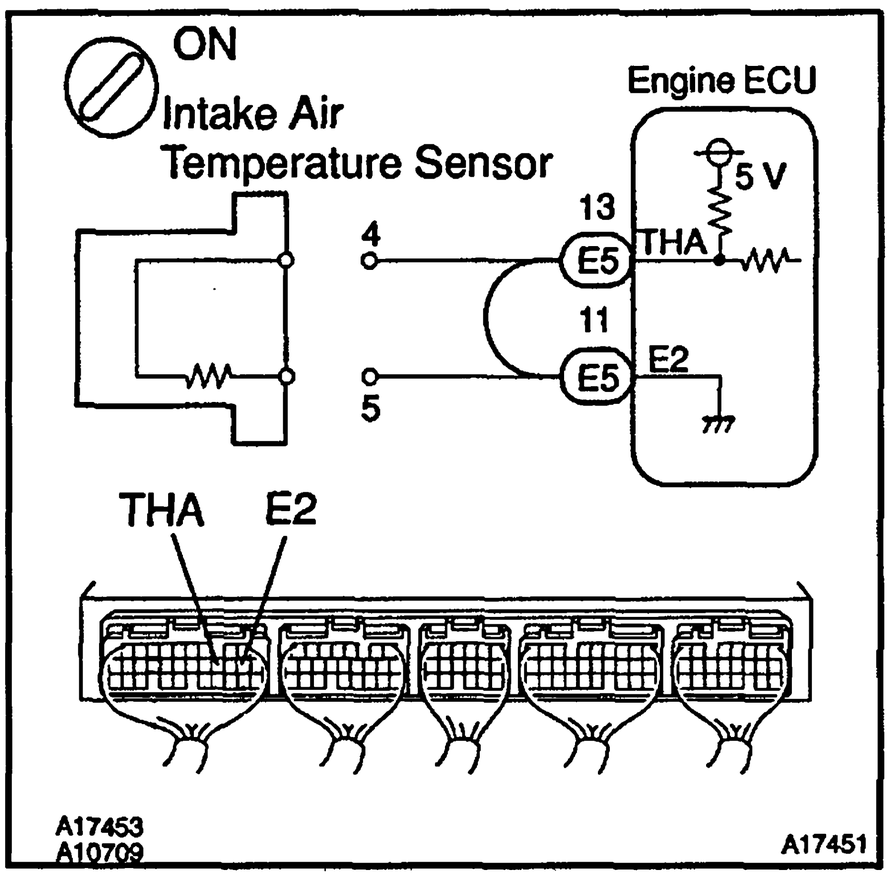
OK:

140°C (284°F) or more

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

NG

3	Check for open in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.
(b) Connect terminals THA and E2 of the engine ECU connector.
(c) Disconnect the air flow meter connector.
(d) Do a visual and contact pressure check for the engine ECU connector (See page IN–20).

CHECK:

Read the intake air temperature on the hand–held tester.

OK:

140°C (284°F) or more

OK	Open in harness between terminals E2 and THA, repair or replace harness.

NG

**Confirm good connection at engine ECU.
If OK, check and replace engine ECU
(See page IN–20).**

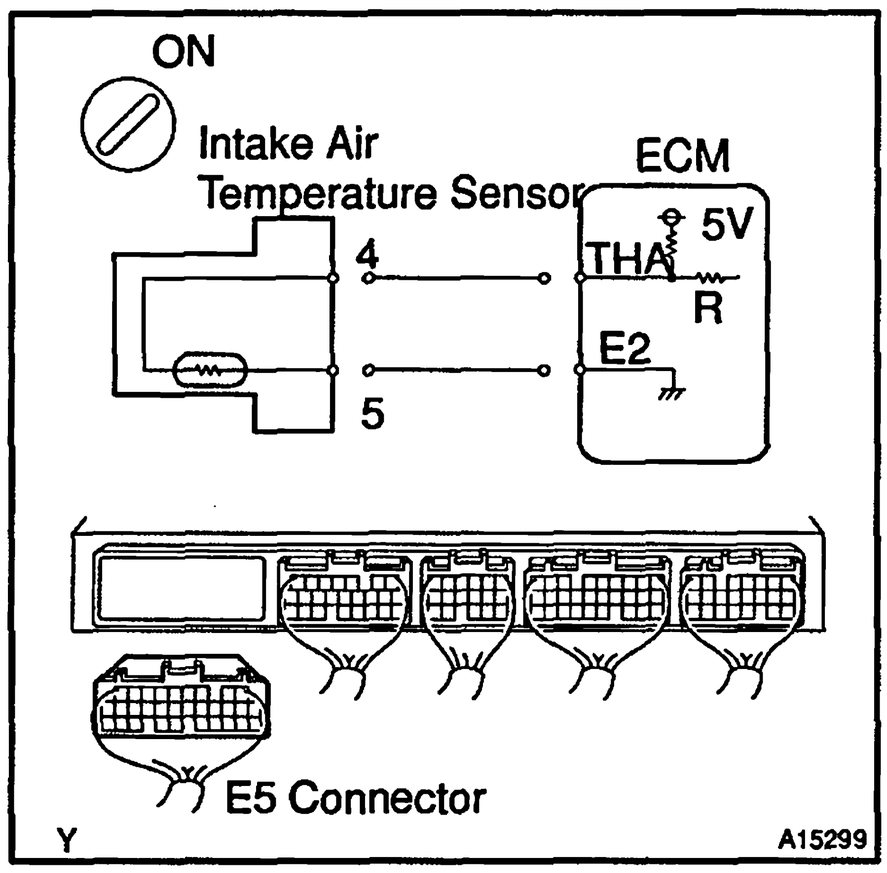
4	Check for short in harness and ECM.

PREPARATION:
(a) Disconnect the air flow meter connector.
(b) Turn the ignition switch ON.
CHECK:
Read the intake air temperature on the hand–held tester.
OK:
–40°C (–40°F)

OK → **Replace air flow meter.**

NG

5	Check for short in harness or ECM.



PREPARATION:
(a) Remove the glove compartment door.
(b) Disconnect the E5 engine ECU connector.
(c) Disconnect the air flow meter connector.
(d) Turn the ignition switch ON.
CHECK:
Read the intake air temperature on the hand–held tester.
OK:
–40°C (–40°F)

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

NG

Check and replace ECM (See page IN–20).

DI8AR–02

DTC	P0115/22	Engine Coolant Temp. Circuit Malfunction

CIRCUIT DESCRIPTION

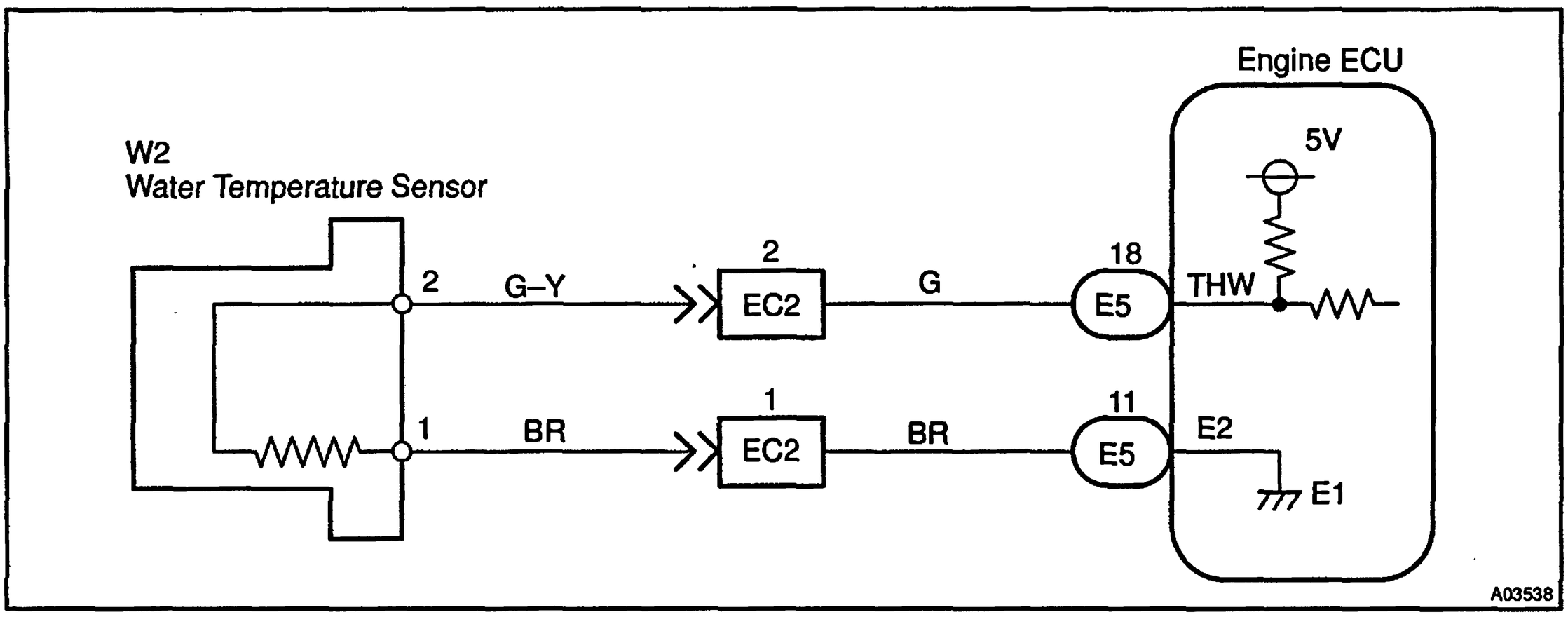
A thermistor built in the water temperature sensor changes the resistance value according to the water temperature. The structure of the sensor and connection to the engine ECU is the same as that in the DTC P0110/24 (See page DI–28).

DTC No.	DTC Detecting Condition	Trouble Area
P0115/22	Open or short in water temperature sensor circuit	• Water temperature sensor circuit • Water temperature sensor • Engine ECU

HINT:
After confirming DTC P0115/22, use the hand–held tester to confirm the engine coolant temperature from the CURRENT DATA.

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

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs P0110/24, P0115/22 and P0120/41 are output simultaneously, E2 (sensor ground) may be open.
- Read freeze frame data on the hand–held tester. Because freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester

1	**Read value of engine coolant temp. on hand–held tester.**

HINT:

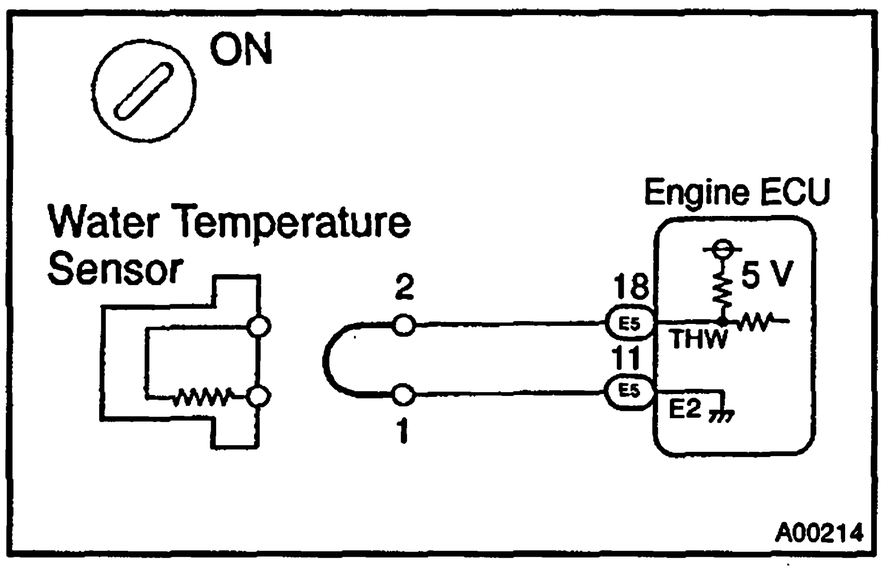
- If there is an open circuit, the hand–held tester indicates –40°C (–40°F).
- If there is a short circuit, the hand–held tester indicates 140°C (284°F) or more.

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–4).

2	**Check for open in harness or engine ECU.**



PREPARATION:

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

CHECK:

Read the engine coolant temperature on the hand–held tester.

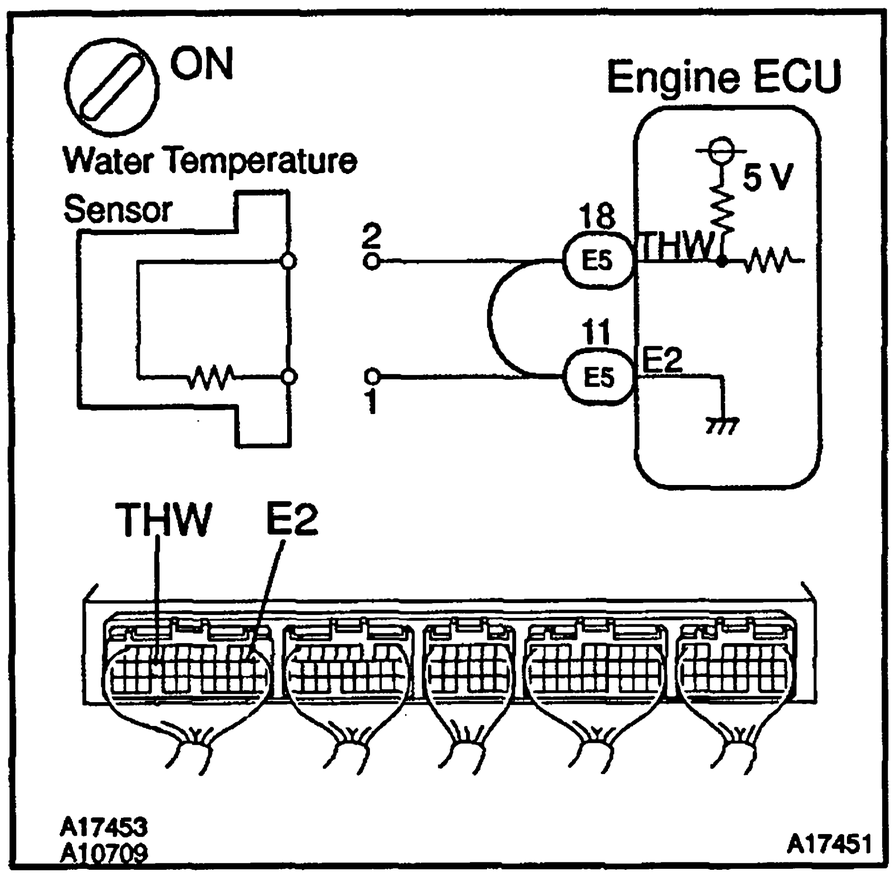
OK:

140°C (284°F) or more

OK → **Confirm good connection at sensor.**
If OK, replace water temperature sensor.

NG

3	Check for open in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.
(b) Connect between terminals THW and E2 of the engine ECU connector.
(c) Disconnect the water temperature sensor connector.
(d) Do a visual and contact pressure check for the engine ECU connector (See page IN–20).
(e) Turn the ignition switch ON.

CHECK:

Read the engine coolant temperature on the hand–held tester.

OK:

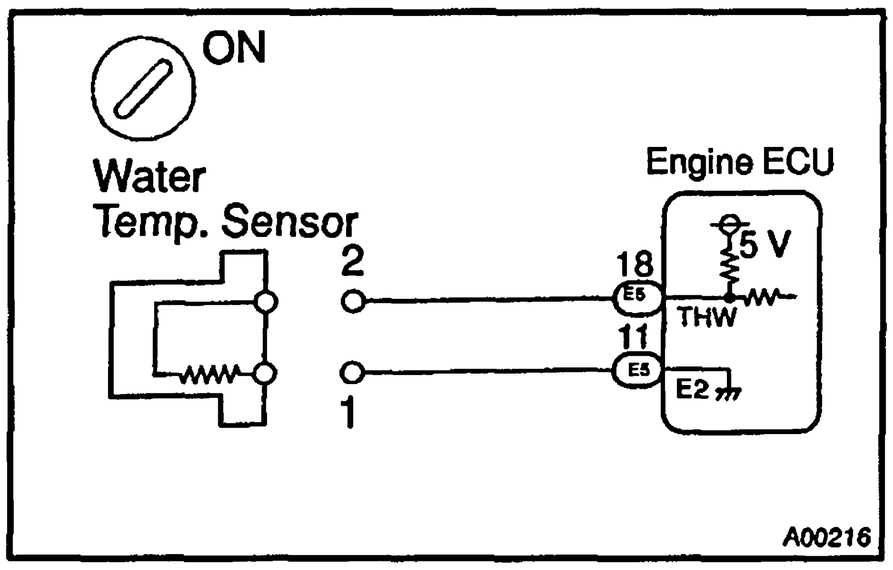
140°C (284°F) or more

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

NG

**Confirm good connection at engine ECU.
If OK, check and replace engine ECU.
(See page IN–20).**

4	Check for short in harness and engine ECU.



PREPARATION:

(a) Disconnect the water temperature sensor connector.
(b) Turn the ignition switch ON.

CHECK:

Read the engine coolant temperature on the hand–held tester.

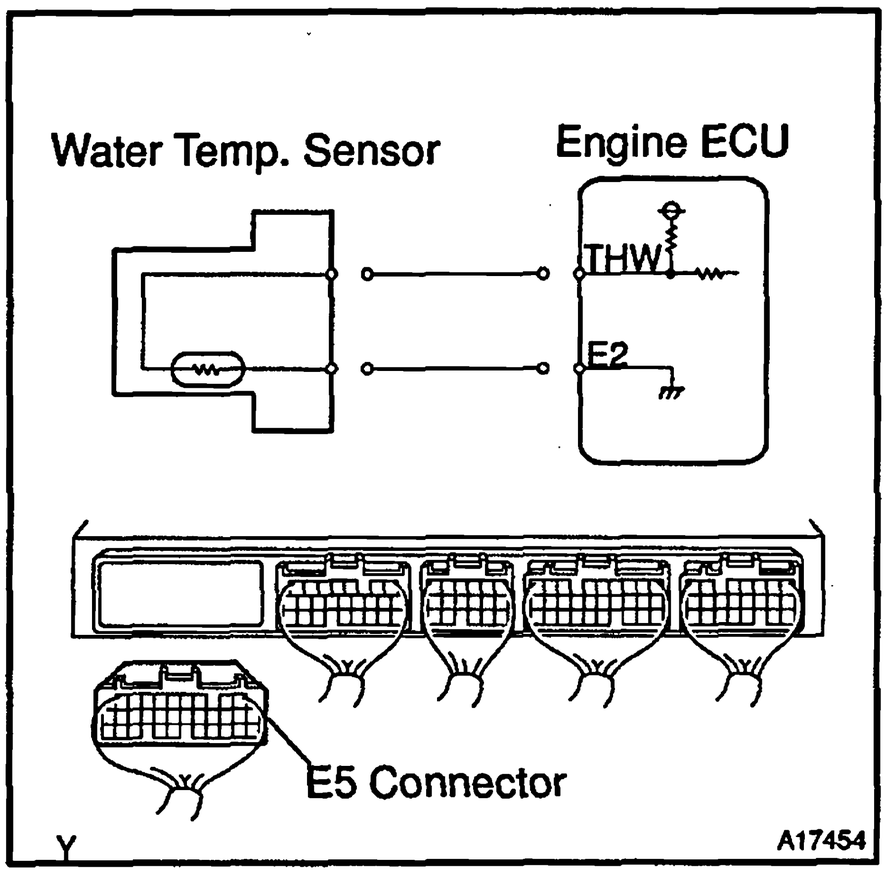
OK:

–40°C (–40°F)

OK	Replace water temperature sensor.

NG

5	Check for short in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment door.
(b) Disconnect the E5 connector from the engine ECU.
(c) Disconnect the water temperature sensor connector.
(d) Turn the ignition switch ON.

CHECK:

Read the water temperature on the hand–held tester.

OK:

–40°C (–40°F)

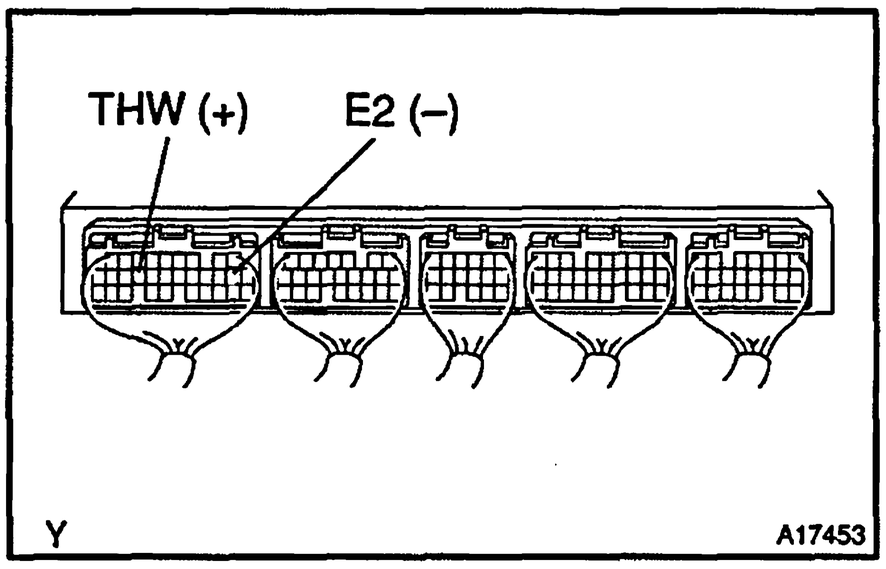
OK → **Repair or replace harness or connector.**

NG

Check and replace engine ECU (See page IN–20).

When not using hand–held tester

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



PREPARATION:

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

CHECK:

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

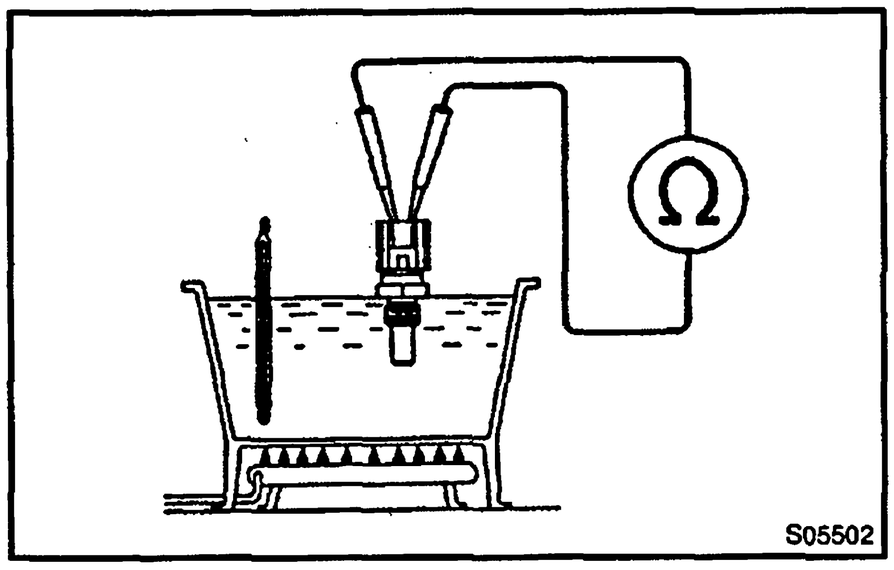
OK:

Water temperature	Voltage
20°C (68°F)	0.5 – 3.4 V
60°C (140°F)	0.2 – 1.0 V

OK → **Check for intermittent problems (See page IN–20).**

NG

2	Check water temperature sensor.



PREPARATION:
Remove the water temperature sensor.
CHECK:
Measure the resistance between terminals as shown in the illustration.
OK:

Water temperature	Resistance
20°C (68°F)	2 – 3 kΩ
60°C (140°F)	0.2 – 0.4 kΩ

NG → Replace water temperature sensor.

OK ↓

3	Check for open and short in harness and connector between engine ECU and water temperature sensor (See page IN–20).

NG → Repair or replace harness or connector.

OK ↓

Check and replace engine ECU.

DTC	P0116/22	Engine Coolant Temp. Circuit Range/ Performance Problem

CIRCUIT DESCRIPTION

Refer to DTC P0115/22 on page DI–32.

DTC No.	DTC Detection Condition	Trouble Area
P0116/22	When engine starts, water temperature is –7°C (20°F) or less. And, in 20 min. or more after engine starts, water temperature sensor value is 20°C (68°F) or less (2 trip detection logic)	• Cooling system • Water temperature sensor
	When engine starts, water temperature is between –7°C (20°F) and 10°C (50°F). And, in 5 min. or more after engine starts, water temperature sensor value is 20°C (68°F) or less (2 trip detection logic)	

INSPECTION PROCEDURE

HINT:

- If DTCs P0115/22 and P0116/22 are output simultaneously, water temperature sensor circuit may be open. Perform a troubleshooting of DTC P0115/22 first.
- Read freeze frame data on the hand–held tester. Because freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

1	**Are there any other codes (besides DTC P0116/22) being output?**

YES → **Go to relevant DTC chart (See page DI–15).**

NO

2	**Check thermostat (See Pub No. RM519E on page EG–171).**

NG → **Replace thermostat.**

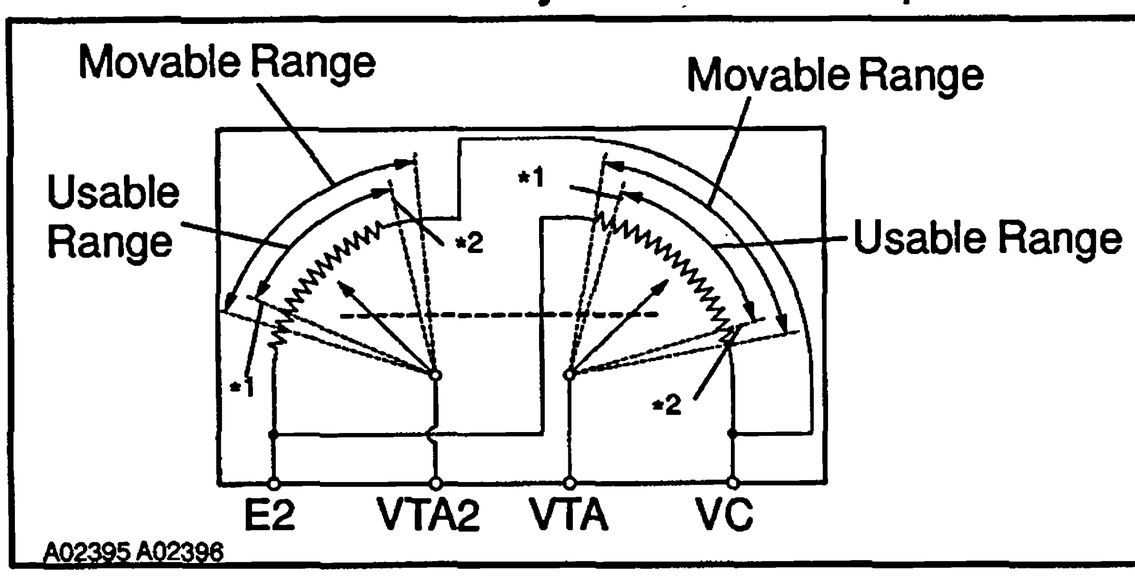
OK

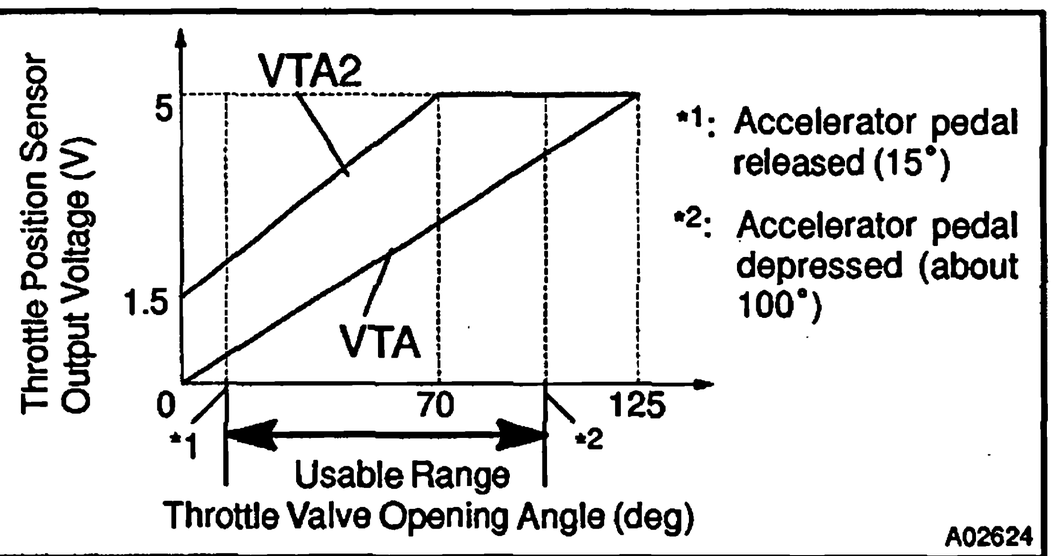
Replace water temperature sensor.

DTC	P0120/41	Throttle/Pedal Position Sensor/Switch "A" Circuit Malfunction

CIRCUIT DESCRIPTION

The throttle position sensor is mounted on the throttle body and it has the 2 sensors to detect the throttle opening angle and the malfunction of the throttle position sensor's own.
The voltage applied to terminals VTA and VTA2 of the engine ECU changes between 0 V and 5 V in proportion to the opening angle of the throttle valve.
The engine ECU judges the current opening angle of the throttle valve from these signals input from terminals VTA and VTA2, and the engine ECU controls the throttle motor to make the throttle valve angle properly in response to the driving condition.
If this DTC is stored, the engine ECU shuts down the power for the throttle motor and the electromagnetic clutch, and the throttle valve is fully closed by the return spring. However, the opening angle of the throttle valve can be controlled by the accelerator pedal through the throttle cable.



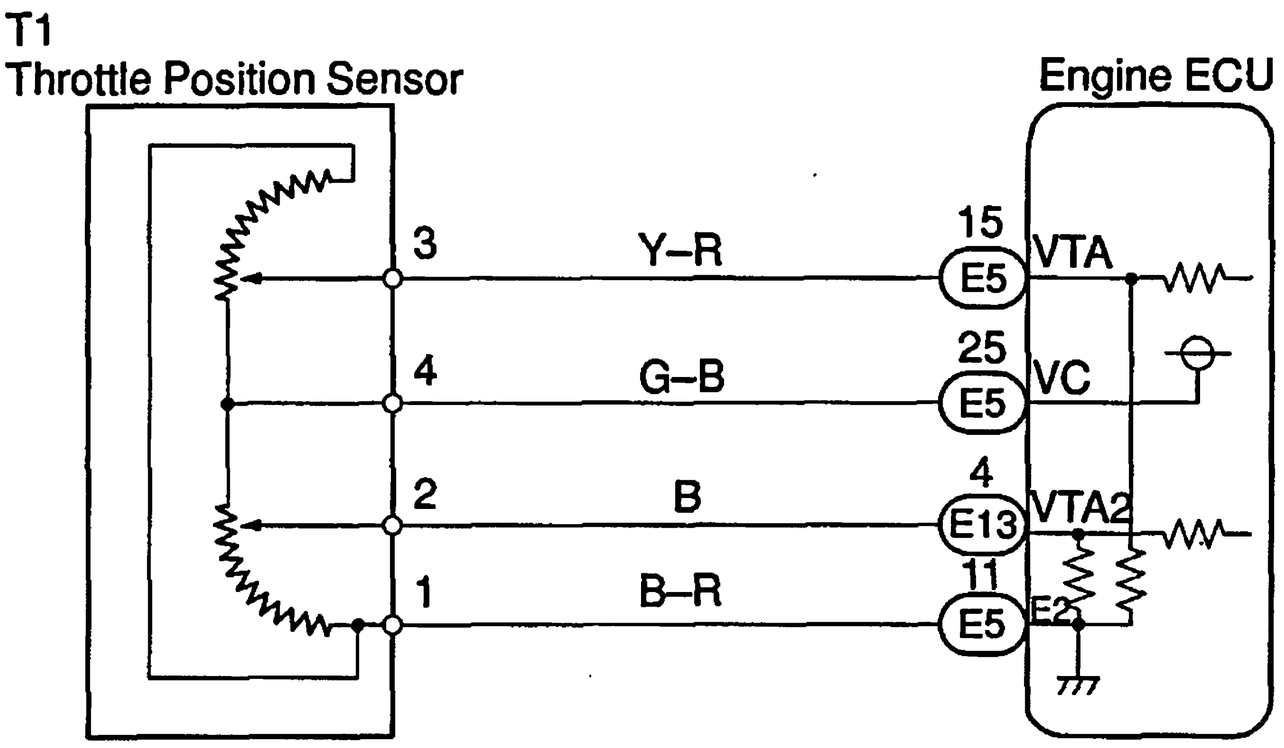


DTC No.	DTC Detecting Condition	Trouble Area
P0120	Condition (a), (b), (c), (d) or (e) continues for 2.0 seconds: (a) VTA ≦ 0.2 V (b) VTA2 ≦ 0.5 V (c) VTA ≧ 4.8 V (d) When VTA ≧ 0.2 V and ≦ 2.0 V, and VTA2 ≧ 4.97 V (e) VTA–VTA2 ≦ 0.02 V, or VTA2–VTA ≧ 0.02V	• Open or short in throttle position sensor circuit • Throttle position sensor • Engine ECU
	Condition (a) continues for 0.4 seconds: (a) VTA ≦ 0.2 V and VTA2 ≦ 0.5 V	

HINT:
After confirming DTC P0120/41, use the hand–held tester to confirm the throttle valve opening percentage and closed throttle position switch condition.

Throttle valve opening position expressed as percentage and voltage				Trouble area
Accelerator pedal released		Accelerator pedal depressed		
THROTTLE POS	THROTTLE POS #2	THROTTLE POS	THROTTLE POS #2	
0 %	0 V	0 %	0 V	VC circuit open
0 %	2.0–2.9 V	0 %	4.7–5.1 V	VTA circuit open or ground short
8–20 %	0 V	64–96 %	0 V	VTA2 circuit open or ground short
100 %	5 V	100 %	5 V	E2 circuit open

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs P0110/24, P0115/22, P0120/41 and P1120/19 are output simultaneously, E2 (sensor ground) may be open.
- Read freeze frame data using the hand–held tester. Because freeze frame data 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.

When using hand–held tester:

1	**Read throttle valve opening percentage on hand–held tester.**

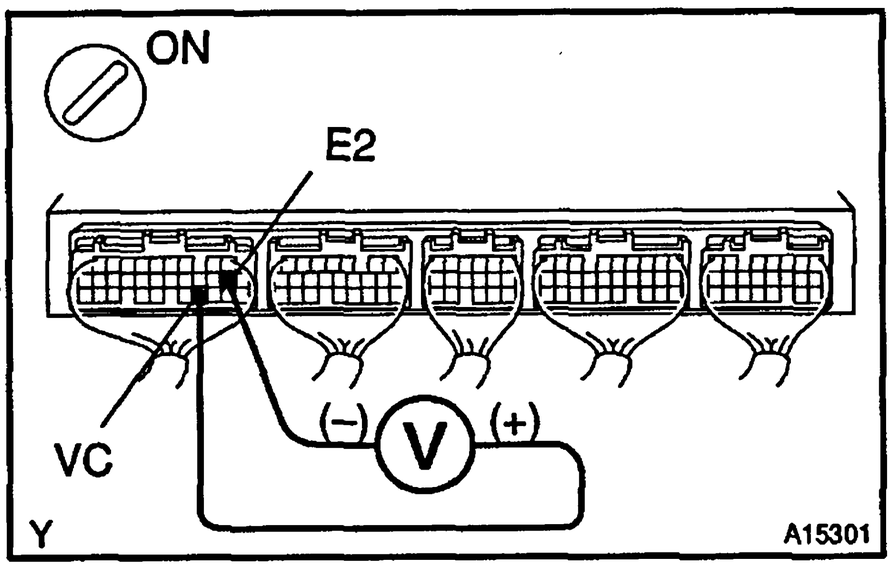
OK:

Accelerator pedal	Throttle valve opening position expressed as percentage (VTA)	VTA2 Voltage
Released	8 – 20 %	2.0 – 2.9 V
Depressed	64 – 96 %	4.7 – 5.1 V

OK → **Check and replace engine ECU (See page IN–20).**

NG

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



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

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

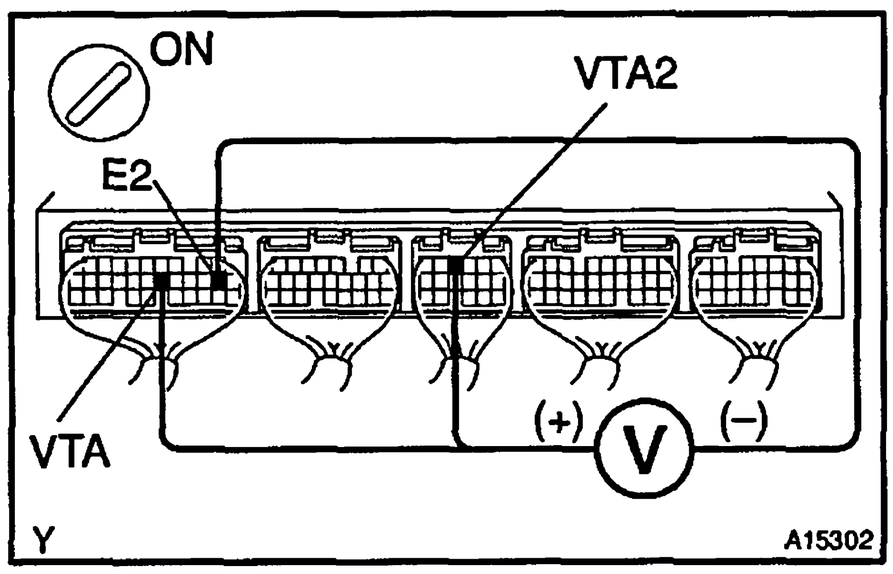
OK:

4.5 – 5.5 V

NG → **Check and replace engine ECU (See page IN–20).**

OK

3	Check voltage between terminals VTA and E2, and VTA2 and E2 of engine ECU connector.



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals VTA and E2, and VTA2 and E2 of the engine ECU connector.

OK:

Accelerator pedal	Voltage	
	VTA – E2	VTA2 – E2
Released	0.4 – 1.0 V	2.0 – 2.9 V
Depressed	3.2 – 4.8 V	4.7 – 5.1 V

OK → **Check and replace engine ECU (See page IN–20).**

NG

4	Check throttle position sensor (See page FI–1).

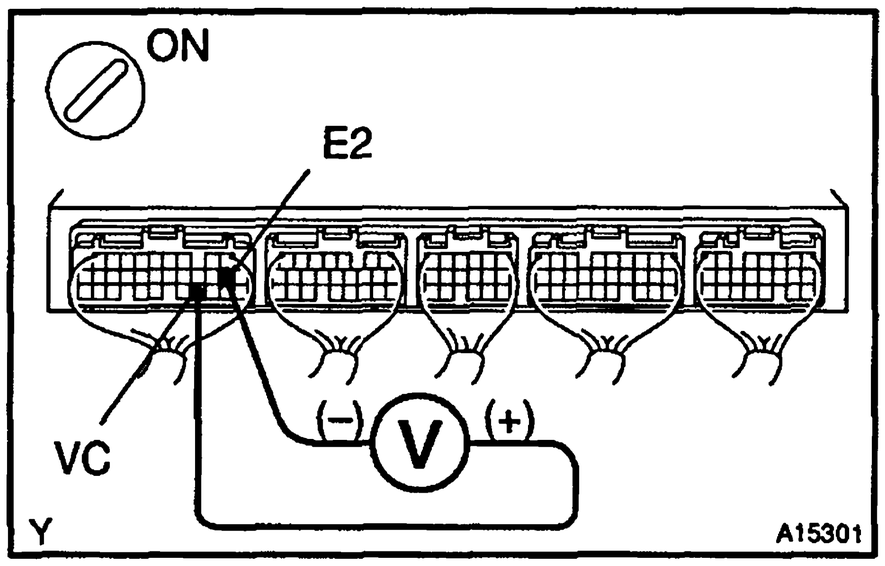
NG → Replace throttle position sensor (See page FI–4).

OK

Check for open and short in harness and connector in VC, VTA, VTA2 and E2 circuits between engine ECU and throttle position sensor (See page IN–20).

When not using hand–held tester:

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



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

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

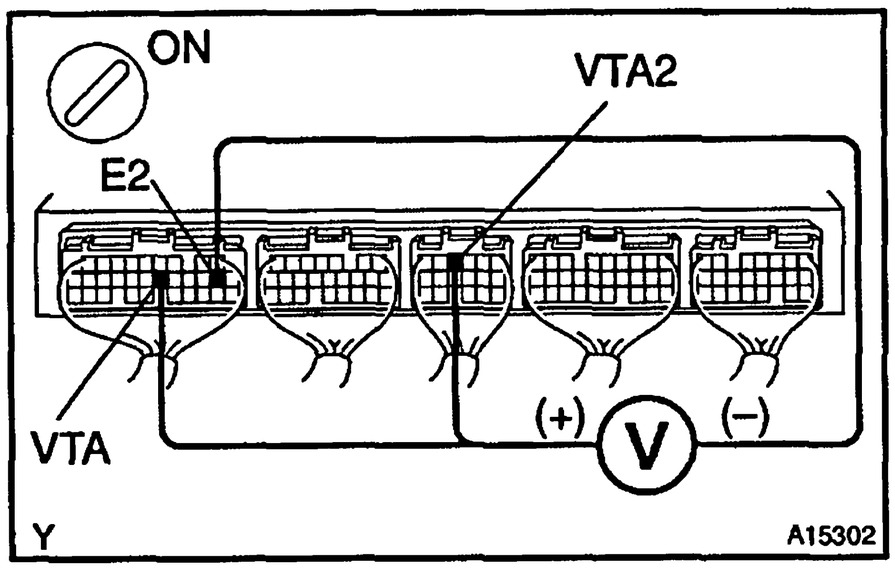
OK:

4.5 – 5.5 V

NG → Check and replace engine ECU (See page IN–20).

OK

2	Check voltage between terminals VTA and E2, and VTA2 and E2 of engine ECU connector.



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals VTA and E2, and VTA2 and E2 of the engine ECU connector.

OK:

Accelerator pedal	Voltage	
	VTA – E2	VTA2 – E2
Released	0.4 – 1.0 V	2.0 – 2.9 V
Depressed	3.2 – 4.8 V	4.7 – 5.1 V

OK → **Check and replace engine ECU (See page IN–20).**

NG

3	Check throttle position sensor (See page FI–1).

NG → **Replace throttle position sensor (See page FI–4).**

OK

Check for open and short in harness and connector in VC, VTA, VTA2 and E2 circuits between engine ECU and throttle position sensor (See page IN–20).

DTC	P0121/41	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance Problem

CIRCUIT DESCRIPTION

Refer to DTC P0120/41 on page DI–38.

DTC No.	DTC Detection Condition	Trouble Area
P0121/41	After vehicle speed has been exceeded 30 km/h (19 mph) even once, output value of throttle position sensor is out of applicable range for vehicle speed is more than 0 km/h (0 mph). (2 trip detection logic)	• Throttle position sensor

INSPECTION PROCEDURE

HINT:

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

1	**Are there any other codes (besides DTC P0121/41) being output?**

YES → **Replace engine ECU (See page IN–20).**

NO

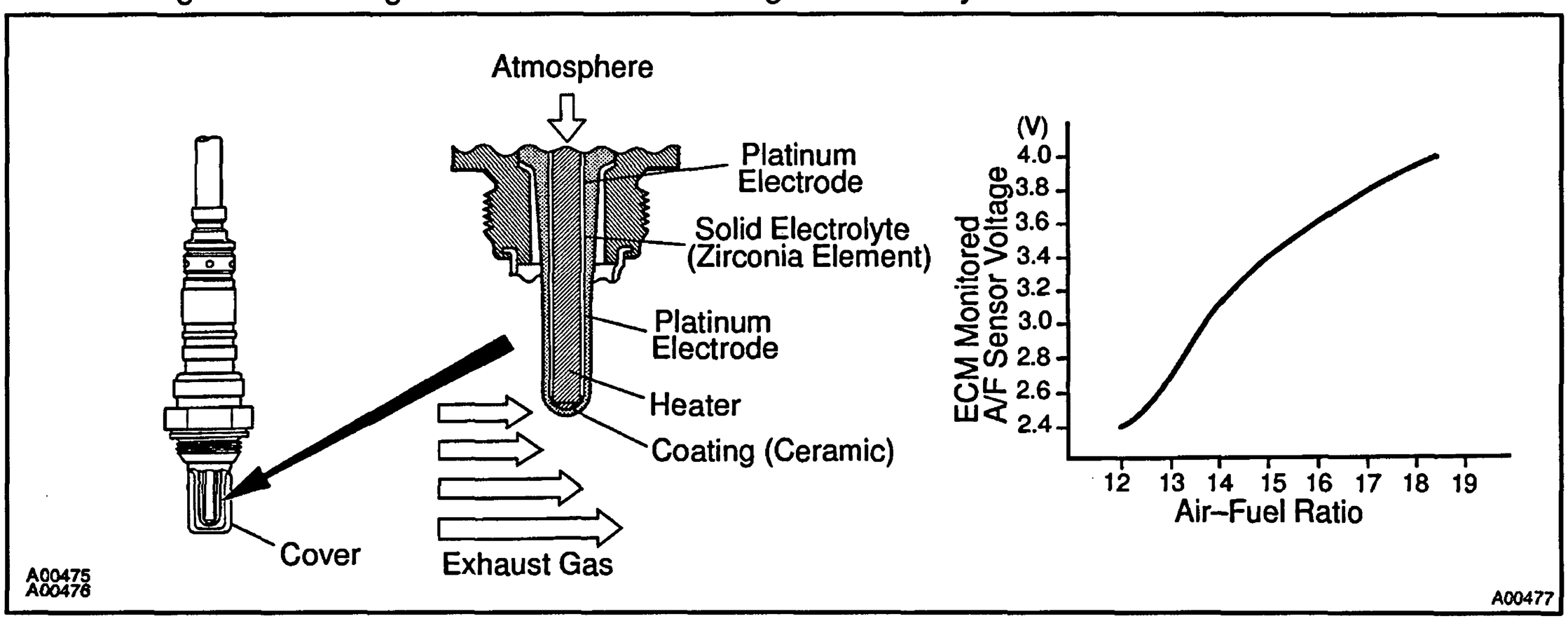
Replace throttle position sensor (See page FI–4).

DI9PJ–01

DTC	P0125/91	Insufficient Coolant Temp. for Closed Loop Fuel Control

CIRCUIT DESCRIPTION

To obtain a high purification rate for the CO, HC and NOx components of the exhaust gas, a three–way catalytic converter is used. However, for the most efficient use of the three–way catalytic converter, the air–fuel ratio must be precisely controlled so that it can be always close to the stoichiometric air–fuel ratio.
The A/F sensor has a characteristic to provide output voltage* approximately proportional to the existing air–fuel ratio. The A/F sensor output voltage* is used to provide feedback for the engine ECU to control the air–fuel ratio.
By the A/F sensor output, the engine ECU can determine the deviation amount from the stoichiometric air–fuel ratio and control the proper injection time immediately. If the A/F sensor malfunctions, the engine ECU is unable to perform accurate air–fuel ratio control.
The A/F sensor is equipped with a heater which heats the zirconia element. The heater is controlled by the engine ECU. When the intake air volume is low (the temperature of the exhaust gas is low), current flows to the heater to heat the sensor for a detection of the accurate oxygen concentration detection.
*: The voltage value changes at the inside of the engine ECU only.

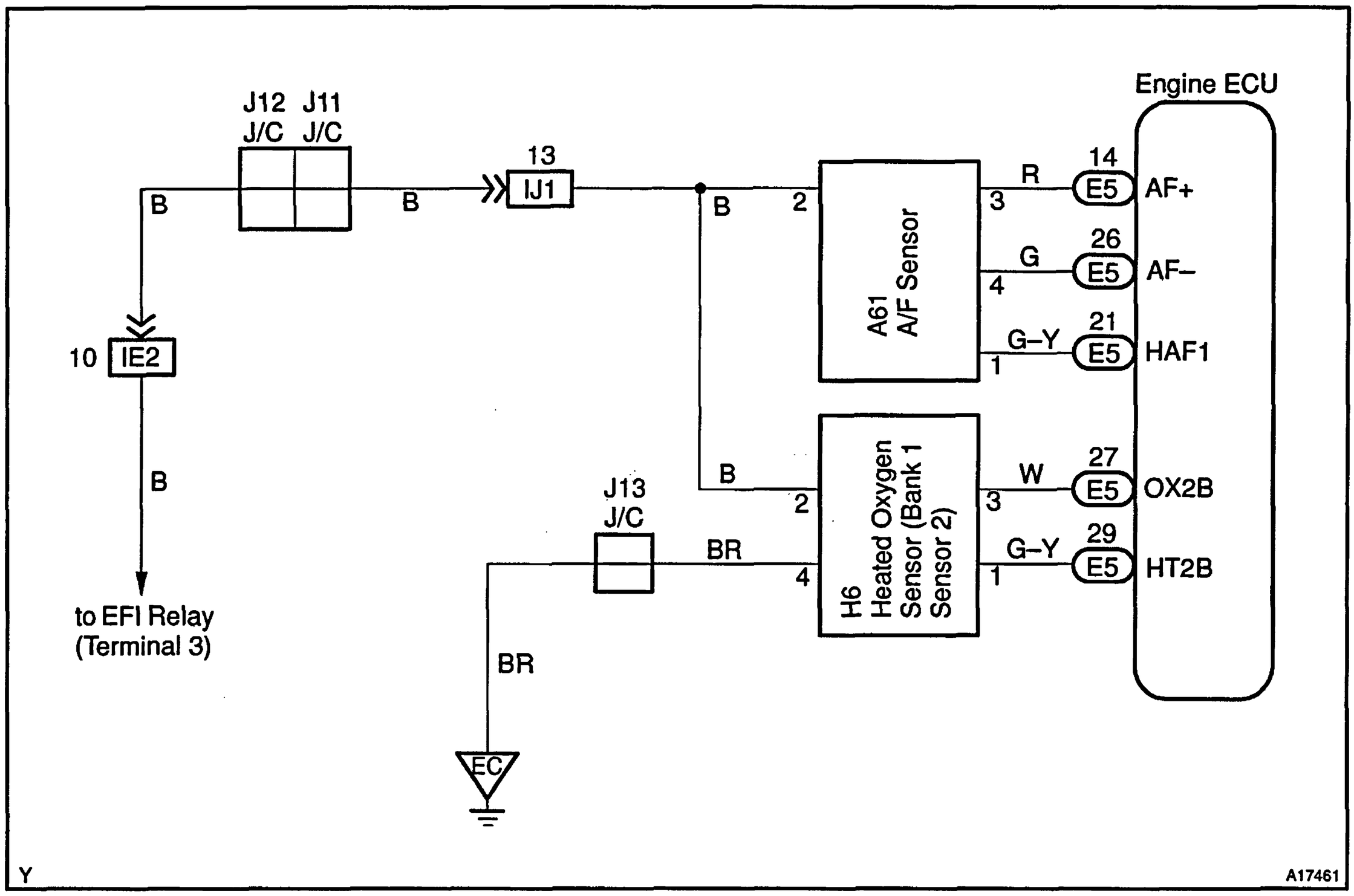


DTC No.	DTC Detecting Condition	Trouble Area
P0125	After engine is warmed up, A/F sensor output* does not change when conditions (a), (b) and (c) continue for at least 1.5 min.: *: Output value changes at inside of engine ECU only (a) Engine speed: 1,500 rpm or more (b) Vehicle speed: 40 – 100 km/h (25 – 62 mph) (c) Throttle valve does not fully closed (d) After starting engine ≧ 140 sec.	• Open or short in A/F sensor (bank 1 sensor 1) circuit • A/F sensor (bank 1 sensor 1) • Air induction system • Fuel pressure • Injector • Exhaust gas leak in exhaust system • Engine ECU

HINT:

- After confirming DTC P0125/91, use the hand–held tester to confirm the output voltage of the heated oxygen sensor (bank 1 sensor 1) from the CURRENT DATA.
- The engine ECU controls the voltage of the AF1+ and AF1– terminals in the engine ECU to the fixed voltage. Therefore, it is impossible to confirm the A/F sensor output voltage without a hand–held tester.
- If the output voltage of the heated oxygen sensor is less than 0.1 V, the heated oxygen sensor circuit may be open or short.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

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

1	**Are there any other codes (besides DTC P0125/91) being output?**

YES → **Go to relevant DTC chart.**

NO

2	**Read value for voltage output of A/F sensor on hand–held tester.**

PREPARATION:

Race the engine at 2,500 rpm for 90 seconds to warm up the A/F sensor.

CHECK:

Read the voltage value of the A/F sensor on the hand–held tester.

HINT:

The voltage of AF1+ terminal of the engine ECU is fixed at 3.3V and the AF1– terminal is fixed at 3.0V. Therefore, it is impossible to check the A/F sensor output voltage at the terminals (AF1+/AF1–) of the engine ECU.

OK:

Condition	A/F Sensor Voltage value
Engine idling	• Not remains at 3.3. V • Not remains at 3.8 V or more • Not remains at 2.8 V or less
Engine racing	
Driving at engine speed 1,500 rpm or more and vehicle speed 40 km/h (25 mph) or move, and operating throttle valve open and close	

HINT:

- When the fuel is abudant, there is a case that the output voltage of the A/F sensor is below 2.8V. This is considered normal.
- When the fuel is cut, there is a case that the output voltage of the A/F sensor is above 3.8 V, it is normal.
- If the output voltage of the A/F sensor remains at 3.30 V even after performing all the above conditions, the A/F sensor circuit may be open.
- If the output voltage of the A/F sensor remains at 3.8 V or more, or 2.8 V or less even after performing all the above conditions, the A/F sensor circuit may be short.

OK → **Go to step 9.**

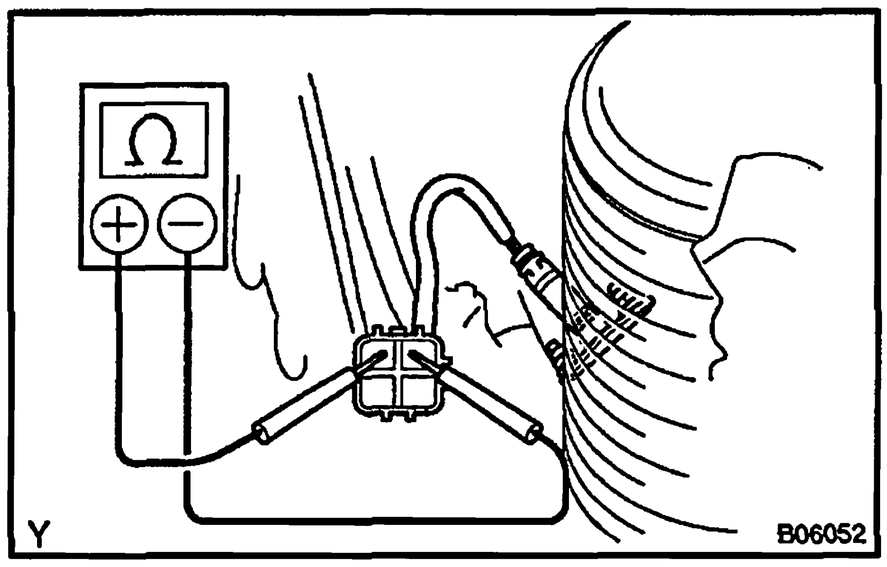
NG

3	**Check for open and short in harness and connector between engine ECU and A/F sensor (See page IN–20).**

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

OK

4	**Check resistance of A/F sensor heater.**



PREPARATION:
Disconnect the A/F sensor connector.
CHECK:
Measure the resistance between terminals +B and HT
OK:

At 20 °C (68°F)	0.8 – 1.4 Ω
At 800 °C (1,472°F)	1.8 – 3.2 Ω

NG → **Replace A/F sensor.**

OK

5	**Check air induction system.**

NG → **Repair or replace.**

OK

6	**Check fuel pressure (See page DI–4).**

NG → **Check and repair fuel pump, pressure regulator, fuel pipe line and filter.**

OK

7	**Check injector injection (See Pub. No. RM519E on page EG–140).**

NG → **Replace injector.**

OK

8	**Check exhaust gas leak on exhaust system.**

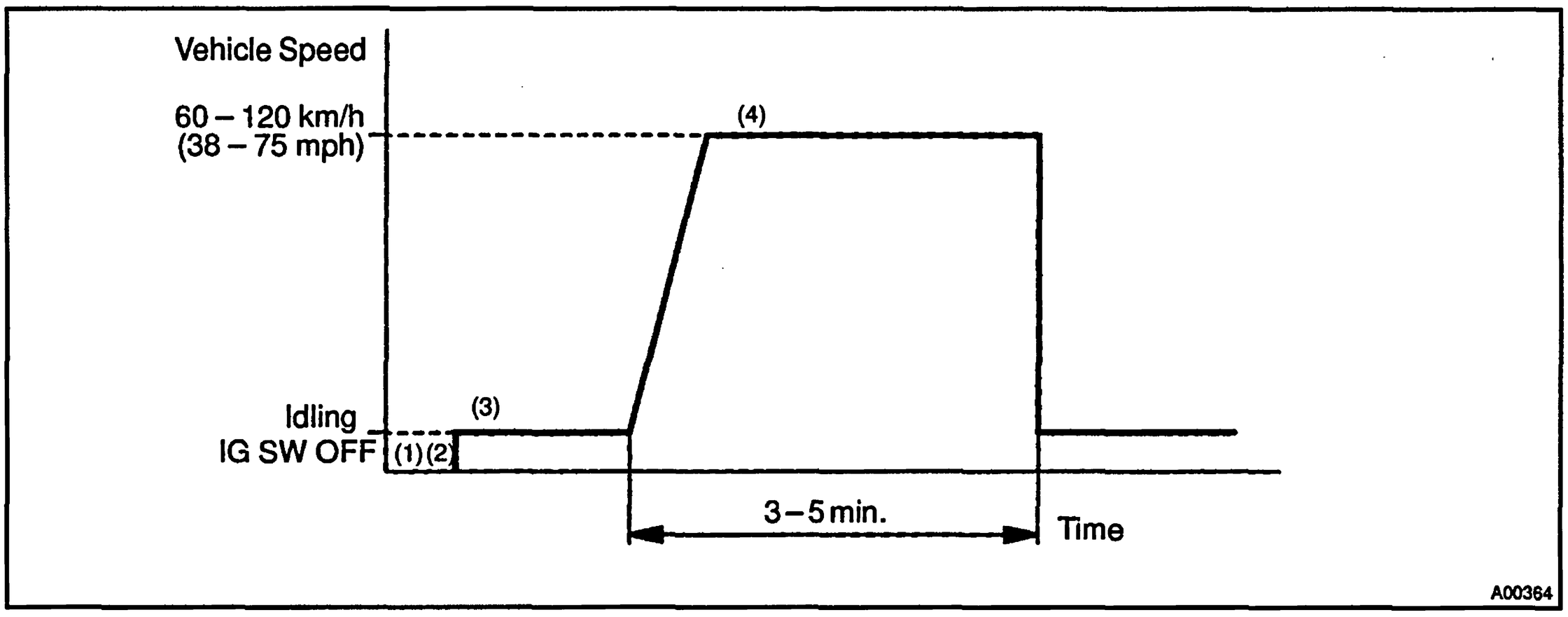
NG → **Repair or replace.**

OK

Replace A/F sensor.

9	**Perform confirmation driving pattern.**

CONFIRMATION DRIVING PATTERN:



(1) Connect the hand–held tester to the DLC3.
(2) Switch the hand–held tester from the normal mode to the check mode.
(3) Start the engine and warm it up with all the accessory switches OFF.
(4) Drive the vehicle at 60 – 120 km/h (38 – 75 mph) and the engine speed at 1,600 – 3,200 rpm for 3 – 5 minutes.

HINT:
If a malfunction exists, the MIL will light up during step (4).

NOTICE:

- **If the conditions in this test are not strictly followed, a malfunction detection can not be performed.**
- **If you do not have a hand–held tester, turn the ignition switch OFF after performing steps (3) and (4), and then perform steps (3) and (4) again.**

Go

1	Is there DTC P0125/91 being output again?

YES → Check and replace engine ECU (See page IN–20).

NO

2	Did vehicle runs out of fuel in past?

NO → Check for intermittent problems (See page DI–4).

YES

DTC P0125/91 is caused by shortage of fuel.

DTC	P0136/27	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 on page DI–44.

DTC No.	DTC Detection Condition	Trouble Area
P0136/27	Voltage output of heated oxygen sensor remains at 0.40 V or more, or 0.5 V or less when vehicle is driven at 40 km/h (25 mph) or more after engine is warmed up (2 trip detection logic)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor

HINT:

- Bank 1 refers to the bank that includes the cylinder No. 1
- Sensor 2 refers to the sensor farther away from the engine body.

WIRING DIAGRAM

Refer to DTC P0125/91 on page DI–44.

INSPECTION PROCEDURE

HINT:

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

1	**Are there any other codes (besides DTC P0136/27) being output?**

YES → **Go to relevant DTC chart (See page DI–15).**

NO

2	**Check for open and short in harness and connector between ECU and heated oxygen sensor (See page IN–20).**

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

OK

3	**Check output voltage of heated oxygen sensor on hand–held tester.**

PREPARATION:

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

(b) Warm up the engine.

CHECK:

Read the output voltage of the heated oxygen sensor when the engine is suddenly raced.

HINT:

Perform a quick racing to 4,000 rpm for 3 times.

OK:

Alternating from 0.40 V or less to 0.5 V or more.

OK → **Check that each connector is properly connected.**

NG

Replace heated oxygen sensor.

DI9PL–01

DTC	P0141/21	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 on page DI–44.

DTC No.	DTC Detection Condition	Trouble Area
P0141/27	When heater operates, heater current exceeds 2.35 A (2 trip detection logic)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • Engine ECU
	Heater current of 0.2 A or less when heater operates (2 trip detection logic)	

HINT:

- Bank 1 refers to the bank that includes cylinder No. 1.
- Sensor 2 refers to the closer sensor to the engine body.

WIRING DIAGRAM

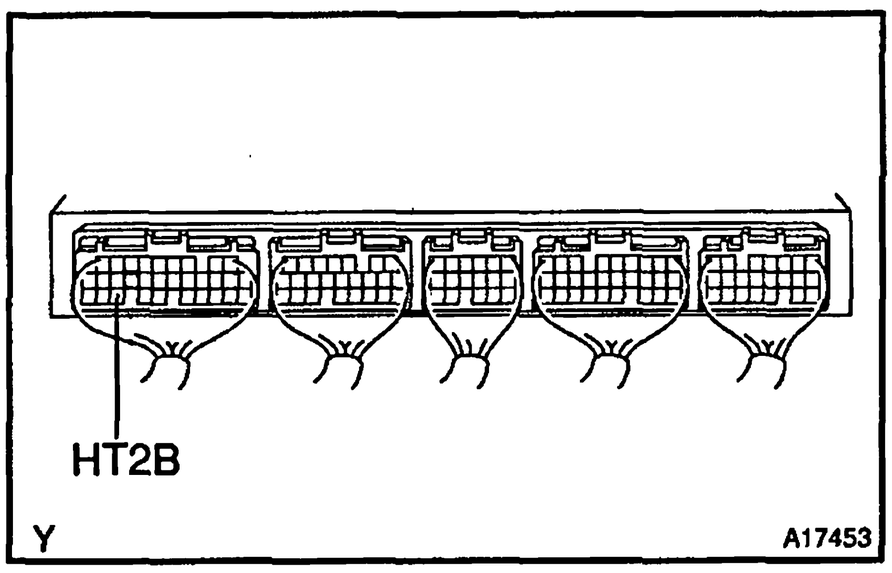
Refer to DTC P0125/91 on page DI–44.

INSPECTION PROCEDURE

HINT:

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

1	Check voltage between terminals HT2B, of ECU connector and body ground.



PREPARATION:

Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals HT2B, of the engine ECU connector and body ground.

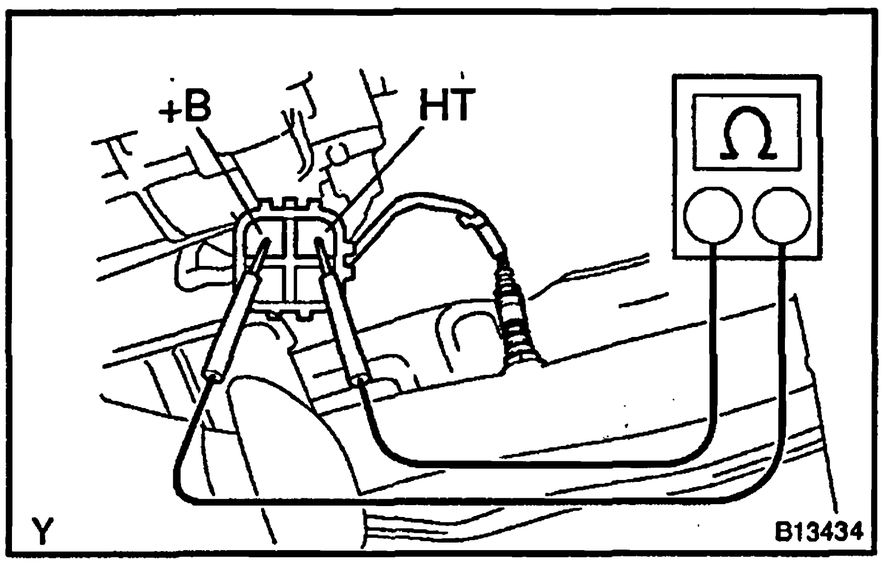
OK:

9 – 14 V

OK → Check and replace ECU (See page IN–20).

NG

2	Check resistance of heated oxygen sensor heater.



PREPARATION:
Disconnect the oxygen sensor connector.
CHECK:
Using an ohmmeter, measure the resistance between terminals +B and HT.
OK:

At 20°C (68°F)	11 – 16 Ω
At 800°C (1,472°F)	23 – 32 Ω

NG → **Replace heated oxygen sensor.**

OK →

Repair or replace harness or connector between EFI main relay (Marking: EFI MAIN) and heated oxygen sensor and engine ECU (See page IN–20).

DI9PM–01

DTC	P0171/25	System too Lean (Fuel Trim)

DTC	P0172/26	System too Rich (Fuel Trim)

CIRCUIT DESCRIPTION

Fuel trim refers to the feedback compensation value compared to the basic injection time. Fuel trim includes short–term fuel trim and long–term fuel trim. Short–term fuel trim is the short–term fuel compensation used to maintain the air–fuel ratio at its ideal theoretical value. The signal from the A/F sensor is approximately proportional to the existing air–fuel ratio, and the engine ECU compares it with the ideal theoretical value. The engine ECU reduces the fuel volume immediately if the air–fuel ratio is rich but increases fuel volume if it is lean. Long–term fuel trim compensates for the deviation from the central value of the short–term fuel trim stored up by each engine tolerance, and also the deviation from the central value due to the passage of time and changes of environment, as well. If both the short–term fuel trim and long–term fuel trim exceed a certain value, it is detected as a malfunction and the MIL lights up.

DTC No.	DTC Detecting Condition	Trouble Area
P0171/25	When air fuel ratio feedback is stable after engine warming up, fuel trim is considerably in error on LEAN side (2 trip detection logic)	• Air induction system • Injector blockage • Air flow meter • Engine coolant temperature sensor • Fuel pressure • Exhaust gas leak on exhaust system • Open or short in A/F sensor circuit • A/F sensor • Engine ECU
P0172/26	When air fuel ratio feedback is stable after engine warming up, fuel trim is considerably in error on RICH side (2 trip detection logic)	• Injector leak or blockage • Air flow meter • Engine coolant temperature sensor • Ignition system • Fuel pressure • Exhaust gas leak on exhaust system • Open or short in A/F sensor circuit • A/F sensor • Engine ECU

HINT:

- When DTC P0171/25 is recorded, the actual air–fuel ratio is on the LEAN side. When DTC P0172/26 is recorded, the actual air–fuel ratio is on the RICH side.
- If the vehicle runs out of fuel, the air–fuel ratio is lean and DTC P0171/25 is recorded. The MIL then comes on.
- If the total of the short–term fuel trim value and long–term fuel trim value is within ±35 % (80°C (176°F) or more), the system functions normally.
- The A/F sensor (bank 1 sensor 1) output voltage and the short–term fuel trim value can be read using a hand–held tester.
- The engine ECU controls the voltage of the AF1+ terminal of the engine ECU to the fixed voltage. Therefore, it is impossible to confirm the A/F sensor output voltage without a hand–held tester.
- The hand–held tester displays the one fifth of the A/F sensor output voltage which is displayed on the hand–held tester.

WIRING DIAGRAM

Refer to DTC P0125/91 on page DI–44.

INSPECTION PROCEDURE

HINT:

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

1	**Check air induction system.**

NG → **Repair or replace.**

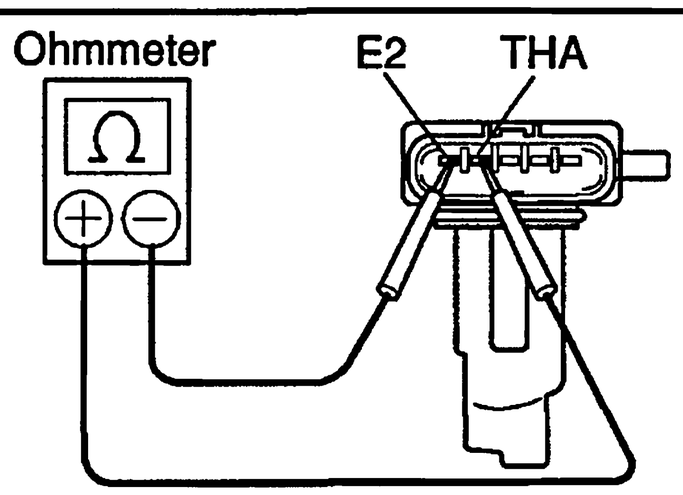
OK

2	**Check injector injection (See Pub. No. RM519E on page EG–140).**

NG → **Replace injector.**

OK

3	**Check air flow meter.**

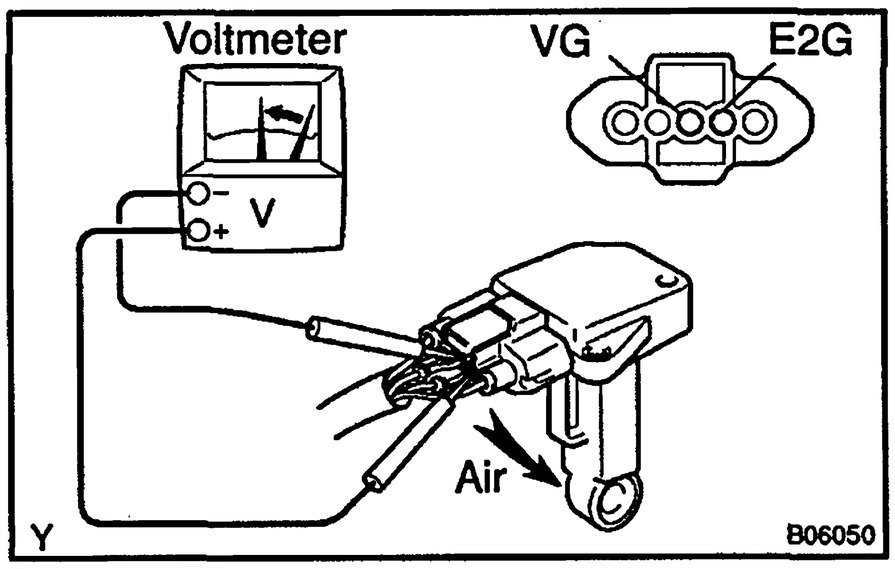


CHECK:

Measure the resistance between terminals THA and E2.

OK:

Resistance	Temperature
13.6 – 18.4 kΩ	–20°C (–4°F)
2.2 – 2.7 kΩ	20°C (68°F)
0.5 – 0.7 kΩ	60°C (140°F)



CHECK:

(a) Turn the ignition switch ON.

(b) Using a voltmeter, connect the positive tester probe to terminal VG, and negative tester probe to terminal E2G.

(c) Check that the voltage fluctuates when blowing air into the air flow meter.

NG → **Repair or replace.**

OK

4 Check water temperature sensor (See page DI–32).

NG → **Repair or replace.**

OK

5 Check for spark and ignition (See Pub. No. RM519E on page IG–3).

NG → **Repair or replace.**

OK

6 Check fuel pressure (See page DI–4).

NG → **Check and repair fuel pump, pressure regulator, fuel pipe line and filter.**

OK

7	Check exhaust gas leak on exhaust system.

NG → Repair or replace.

OK ↓

8	Check output voltage A/F sensor (See page DI–44 on step 2).

OK → Go to step 10.

NG ↓

9	Check for open and short in harness and connector between engine ECU and A/F sensor (See page IN–20).

NG → Repair or replace harness or connector.

OK ↓

Replace A/F sensor.

10	Perform confirmation driving pattern (See page DI–44 on step 9).

Go ↓

11	Is there DTC P0171 or P0172 being output again?

YES → Check and replace engine ECU (See page IN–20).

NO ↓

12	Did vehicle runs out of fuel in past?

NO → Check for intermittent problems (See page DI–4).

YES

DTC P0171 or P0172 is caused by shortage of fuel.

D19PN–01

DTC	P0300/93	Random/Multiple Cylinder Misfire Detected

DTC	P0301/93	Cylinder 1 Misfire Detected

DTC	P0302/93	Cylinder 2 Misfire Detected

DTC	P0303/93	Cylinder 3 Misfire Detected

DTC	P0304/93	Cylinder 4 Misfire Detected

DTC	P0305/93	Cylinder 5 Misfire Detected

DTC	P0306/93	Cylinder 6 Misfire Detected

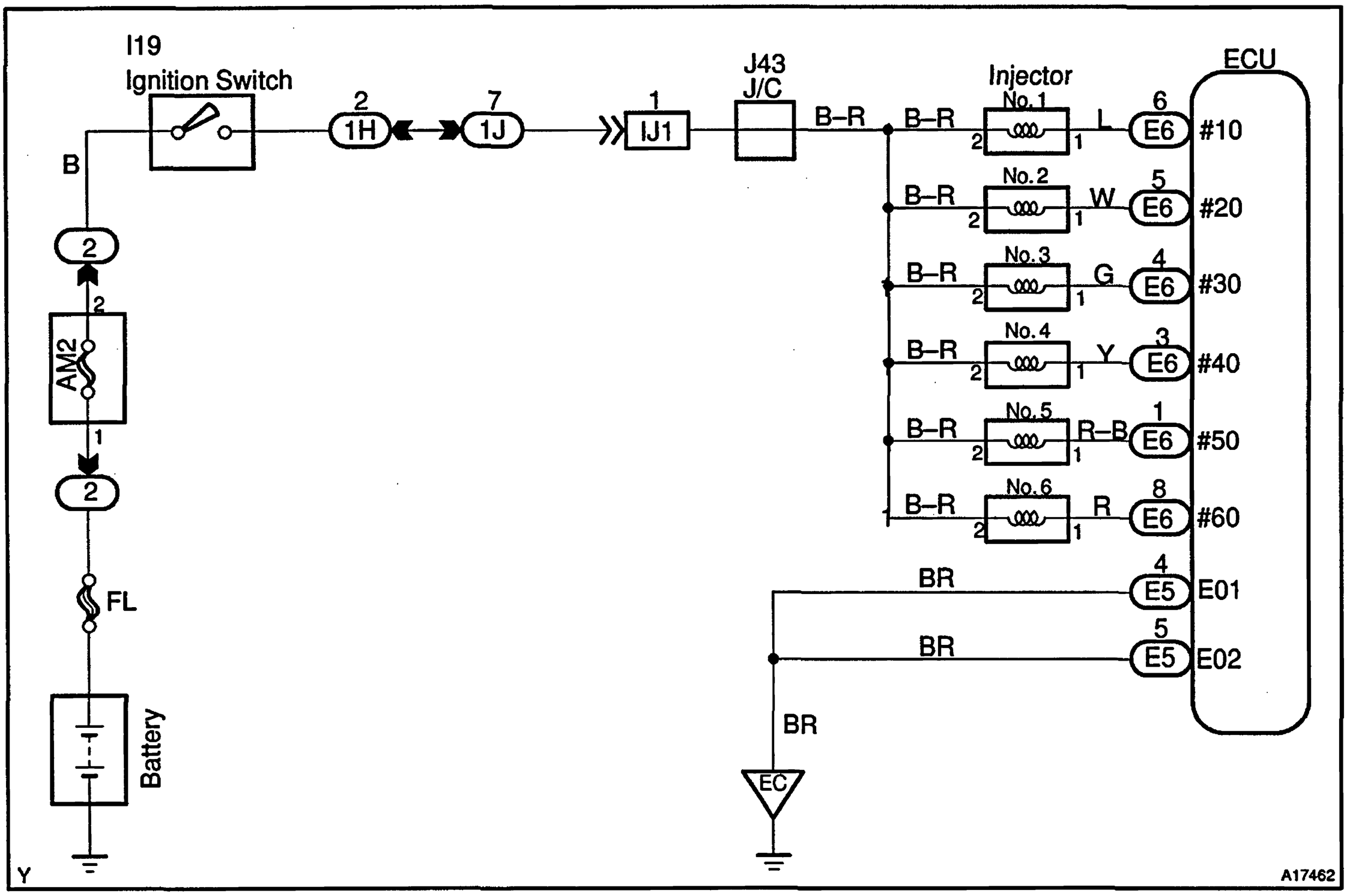
CIRCUIT DESCRIPTION

Misfire: The engine ECU uses the crankshaft position sensor and camshaft position sensor to monitor changes in the crankshaft rotation for each cylinder. The engine ECU counts the number of times that the engine speed change rate indicates that misfire has occurred. When the misfire rate equals to or exceeds the count indicating that the engine condition has deteriorated, the MIL will light up.
If the misfire rate is high enough and the driving conditions causes the catalyst to overheat, when misfiring occurs, the MIL will blink.

DTC No.	DTC Detecting Condition	Trouble Area
P0300/93	Misfiring of random cylinders is detected during any particular 200 or 1,000 revolutions	• Open or short in engine wire • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Air flow meter • Water temperature sensor • Compression pressure • Valve clearance • Valve timing • Engine ECU
P0301/93 P0302/93 P0303/93 P0304/93 P0305/93 P0306/93	For any particular 200 revolutions for engine, misfiring is detected which can cause catalyst to overheat (This causes MIL to blink)	
	For any particular 1,000 revolutions of engine, misfiring is detected which causes a deterioration in emission (2 trip detection logic)	

HINT:
When the 2 or more codes for a misfiring cylinder are recorded repeatedly but no Random Misfire code is recorded, it indicates that the misfires were detected and recorded at different times.

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN

(a) Read the DTC and the freeze frame data on the hand–held tester.
(b) Set to the check mode on the hand–held tester (See page DI–4).
(c) Drive the vehicle several times to see the engine speed, load and its surrounding range shown with the ENGINE SPD, CALC LOAD in the freeze frame data or the MISFIRE RPM, MISFIRE LOAD in the data list.

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

HINT:

In order to memorize DTC of misfire, it is necessary to drive around MISFIRE RPM, MISFIRE LOAD in the data list for the following period of time.

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

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

INSPECTION PROCEDURE

HINT:

- If some DTC besides misfire are memorized simultaneously, first perform the troubleshooting for them.
- Read freeze frame data on the hand–held tester. Because freeze frame data 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 a malfunction.
- If the misfire does not occur when the vehicle is brought to the workshop, misfire can be confirmed by reproducing the condition or freeze frame data. Also, after the repair, confirm that there is no misfire. (See the confirmation driving pattern)
- When any of SHORT FT #1, LONG FT #1, SHORT FT #2 or LONG FT #2 in the freeze frame data is over the range of ±20 %, there is a possibility that the air–fuel ratio is inclining either to "rich" (–20 % or less) or "lean" (+20 % or more).
- When COOLANT TEMP in the freeze frame data is less than 80°C (176°F), there is a possibility that misfire occurs only during the engine warming up.
- If the misfire cannot be reproduced, the reason may be because of the driving with lack of fuel, the use of improper fuel, a stain of ignition plug, and etc.

1	**Check wire harness, connector and vacuum hose in engine room.**

CHECK:

(a) Check the connection conditions of wire harness and connector.

(b) Check the disconnection, piping and break of vacuum hose.

NG → **Repair or replace, then confirm that there is no misfire (See the confirmation driving pattern).**

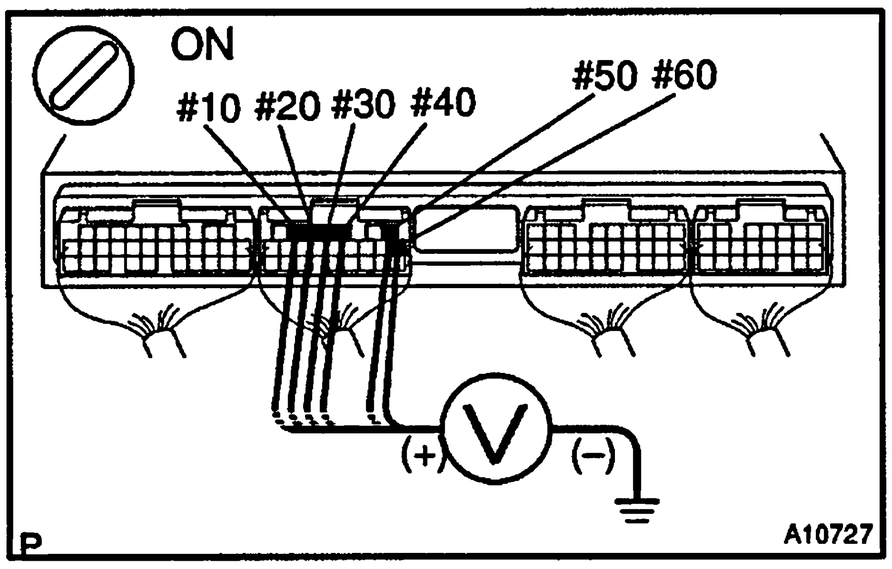
OK

2	**Check spark plug and spark of misfiring cylinder (See Pub No. RM519E on page IG–3).**

NG → **Replace or check ignition system (See Pub No. RM519E on page IG–3).**

OK

3	Check voltage of engine ECU terminal for injector of failed cylinder.



PREPARATION:

(a) Remove the glove compartment box.

(b) Turn the ignition switch ON.

CHECK:

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

OK:

9 – 14 V

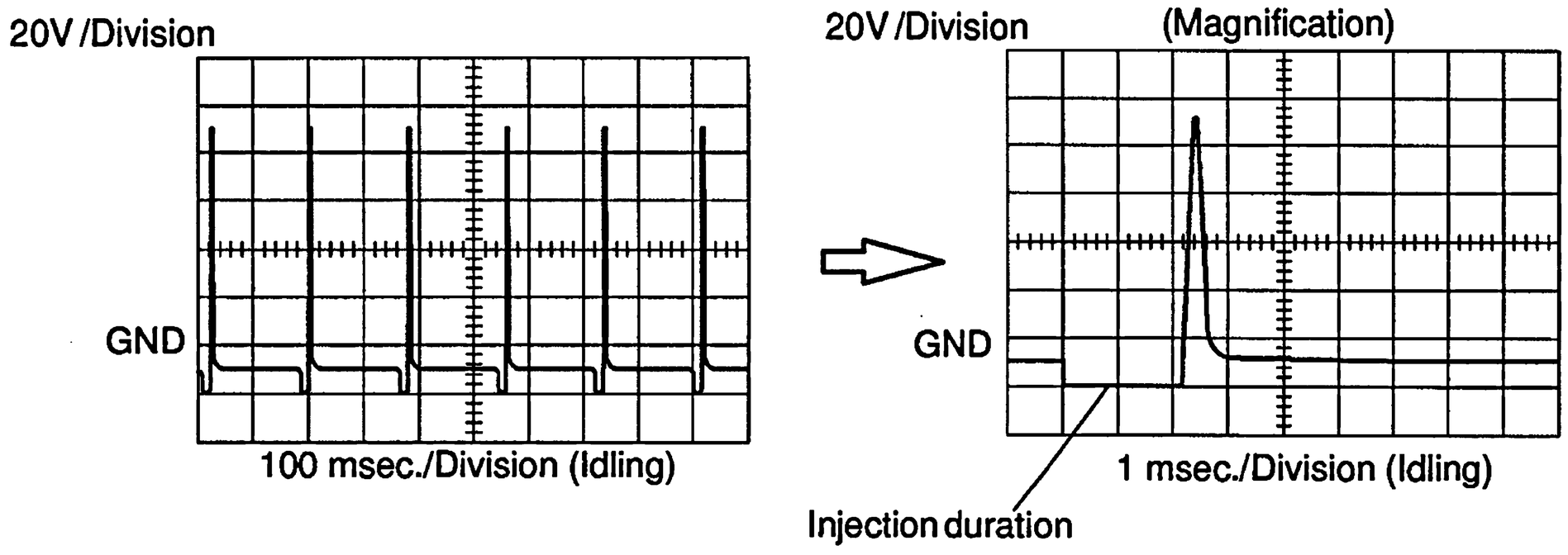
Reference: INSPECTION USING OSCILLOSCOPE

With the engine idling, check the waveform between terminals #10 – #60 and E01 of the ECU connector.

HINT:

The correct waveform is as shown in the illustration.

Injector Signal Waveform



OK	Go to step 5.

NG

4	Check resistance of injector of misfiring cylinder (See Pub No. RM519E on page EG–140).

NG → Replace injector.

OK

Check for open and short in harness and connector between injector and engine ECU (See page IN–20).

5	Check fuel pressure (See page DI–4).

NG → Check and repair fuel pump, fuel pipe line and filter.

OK

6	Check injector injection (See Pub No. RM519E on page EG–140).

NG → Replace injector.

OK

7	Check air flow meter (See page DI–54) and engine coolant temperature sensor (See page DI–32).

NG → Repair or replace.

OK

Check compression pressure, valve clearance and valve timing.

D6AW–02

DTC	P0325/52	Knock Sensor 1 Circuit Malfunction

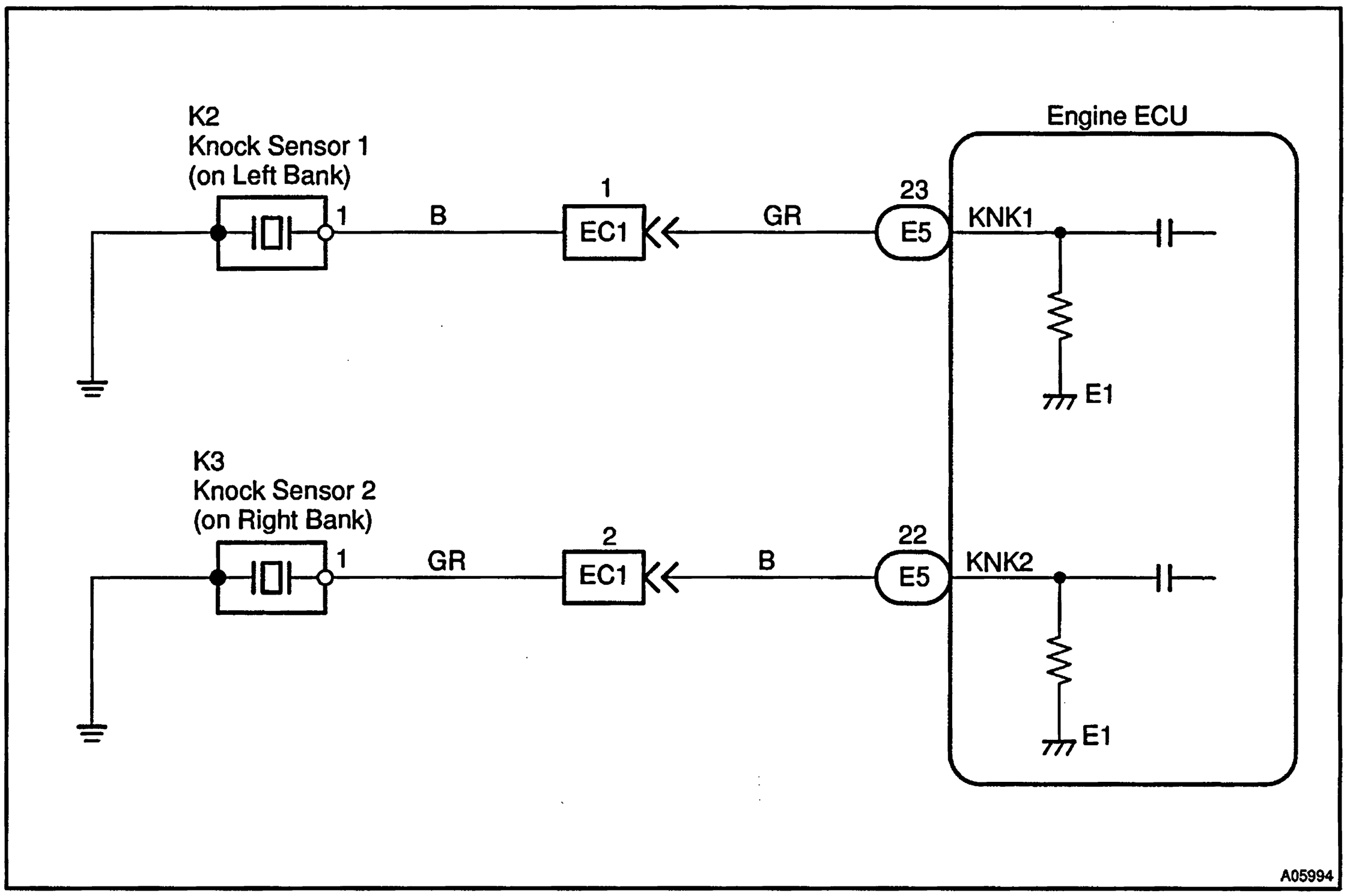
DTC	P0330/55	Knock Sensor 2 Circuit Malfunction

CIRCUIT DESCRIPTION

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

DTC No.	DTC Detecting Condition	Trouble Area
P0325/52	No knock sensor 1 signal to engine ECU with engine speed between 1,750 rpm and 5,600 rpm	• Open or short in knock sensor 1 circuit • Knock sensor 1 (looseness) • Engine ECU
P0330/55	No knock sensor 2 signal to engine ECU with engine speed between 1,750 rpm and 5,600 rpm	• Open or short in knock sensor 2 circuit • Knock sensor 2 (looseness) • Engine ECU

WIRING DIAGRAM



A05994

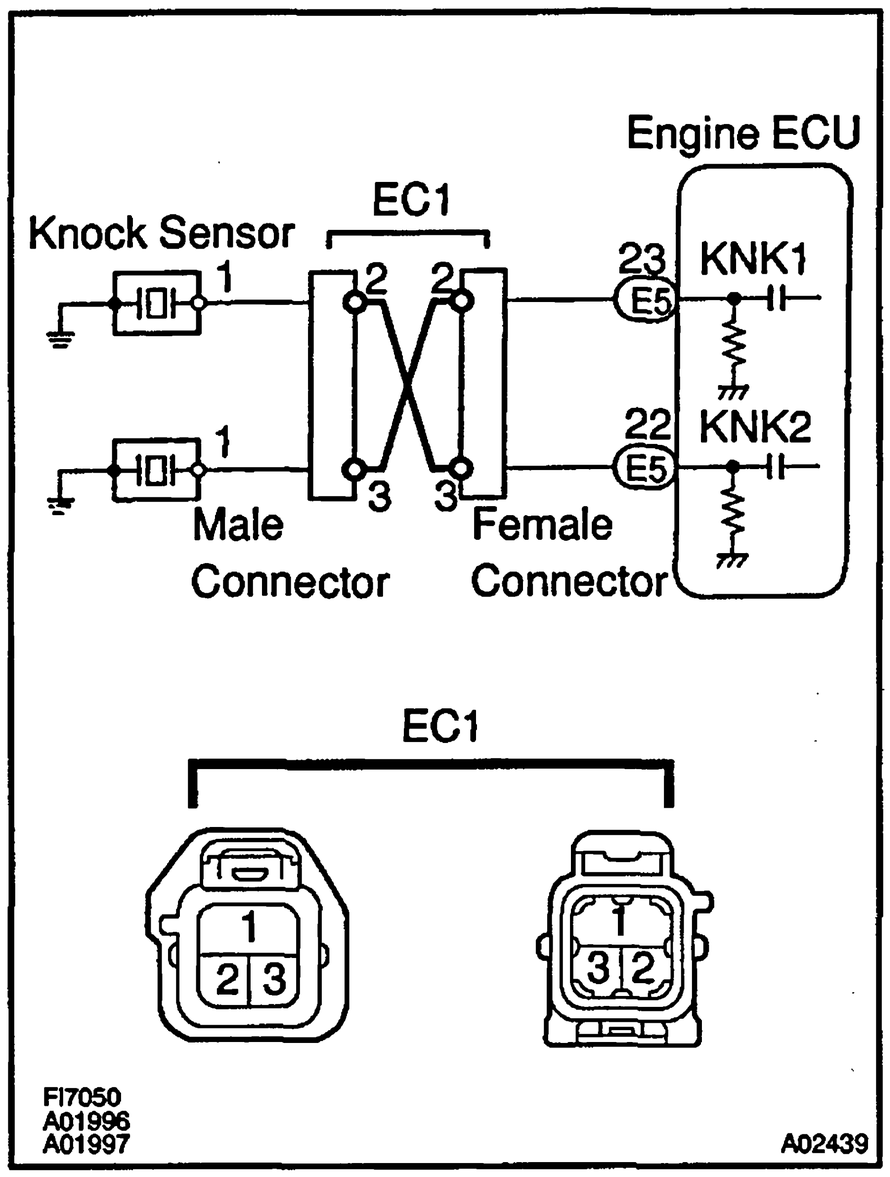
INSPECTION PROCEDURE

HINT:

- DTC P0325/52 is for the left bank knock sensor circuit.
- DTC P0330/55 is for the right bank knock sensor circuit.
- Read freeze frame data on the hand–held tester. Because freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of a malfunction.

When using hand–held tester:

1	**Check knock sensor circuit.**



PREPARATION:

(a) Connect the hand–held tester to the DLC3.
(b) Disconnect the EC1 connector.
(c) Connect the terminals of the disconnected EC1 male connector and EC1 female as follows.

Male connector ↔ Female connector
Terminal 1 ↔ Terminal 2
Terminal 2 ↔ Terminal 1

(d) Turn the ignition switch ON and switch the hand–held tester main switch ON.
(e) After the engine is warmed up, perform a quick racing to 4,000 rpm 3 times.

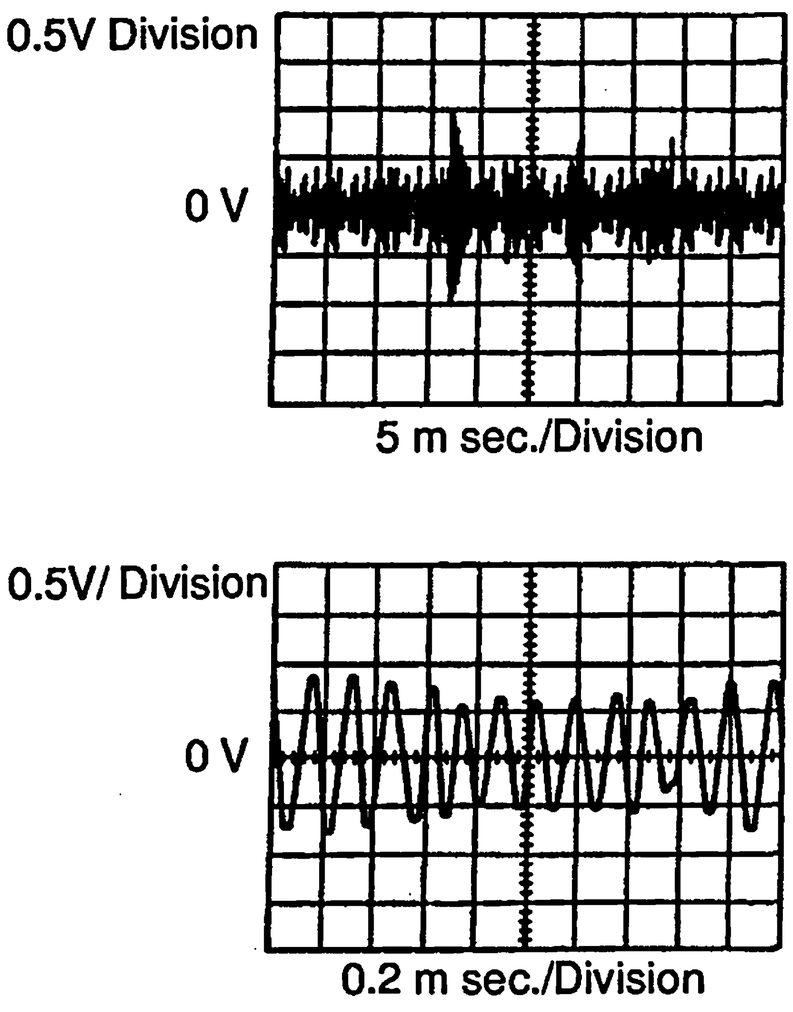
CHECK:

Check the DTC.

RESULT:

A	DTC same as when vehicle brought in. P0325/52 → P0325/52 or P0330/55 → P0330/55
B	DTC different to when vehicle brought in. P0325/52 → P0330/55 or P0330/55 → P0325/52

KNK signal waveform



Reference: INSPECTION USING OSCILLOSCOPE

- With the engine racing (4,000 rpm) check the waveform between terminal KNK1, KNK2 of the engine ECU connector and body ground.

HINT:

The correct waveforms are as shown in the illustration.

- Spread the time on the horizontal axis, and confirm that period of the wave is 0.14 msec (Normal mode vibration frequency of knock sensor: 7.1 kHz).

HINT:

If the normal mode vibration frequency is not 7.1 kHz, the sensor malfunctions.

A	**Go to step 3.**

B

2	**Check for open and short in harness and connector between EC1 connector and engine ECU (See page IN–20).**

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

OK

Check and replace engine ECU (See page IN–20).

3	**Check for open and short in harness and connector between EC1 connector and knock sensor (See page IN–20).**

HINT:

- If DTC P0325/52 has changed to P0330/55, check the knock sensor circuit on the left bank.
- If DTC P0330/55 has changed to P0325/52, check the knock sensor circuit on the right bank.

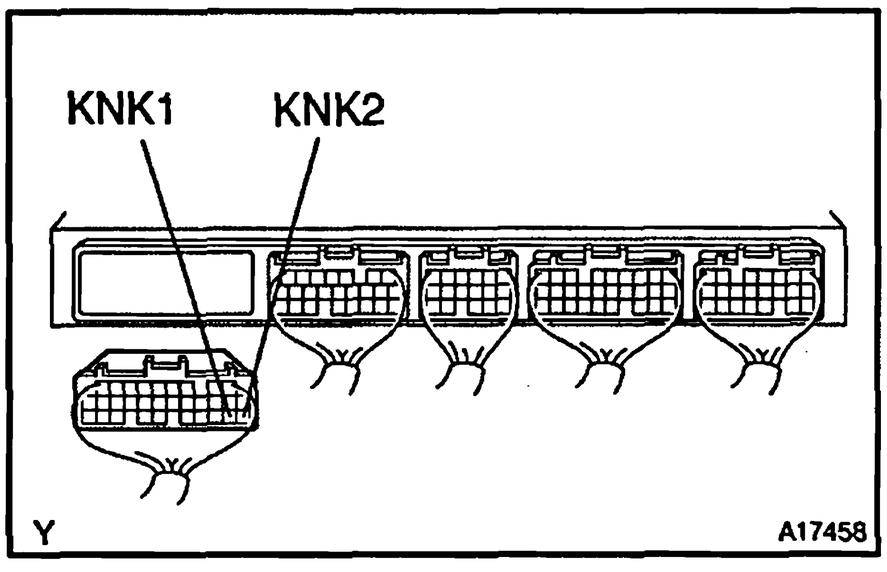
NG → **Repair or replace harness or connector.**

OK

Replace knock sensor.

When not using hand–held tester:

1	**Check continuity between terminal KNK1, KNK2 of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Disconnect the E5 connector of the engine ECU.

CHECK:

Check that there is no continuity between terminal KNK1, KNK2 of the engine ECU connector and body ground.

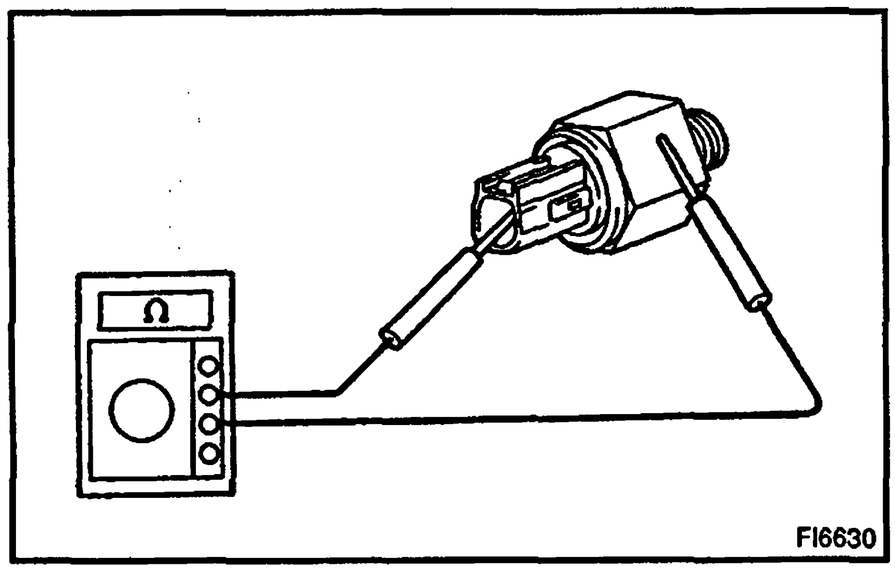
OK:

No continuity

OK → **Go to step 3.**

NG

2	**Check knock sensor.**



PREPARATION:
Disconnect the knock sensor connector.
CHECK:
Check that there is no continuity between the knock sensor terminal and the body.
OK:
No continuity

NG → **Replace knock sensor.**

OK

3	**Check for open and short in harness and connector between engine ECU and knock sensor (See page IN–20).**

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

OK

4	**Does malfunction disappear when a good knock sensor is installed?**

YES → **Replace knock sensor.**

NO

Check and replace engine ECU (See page IN–20).

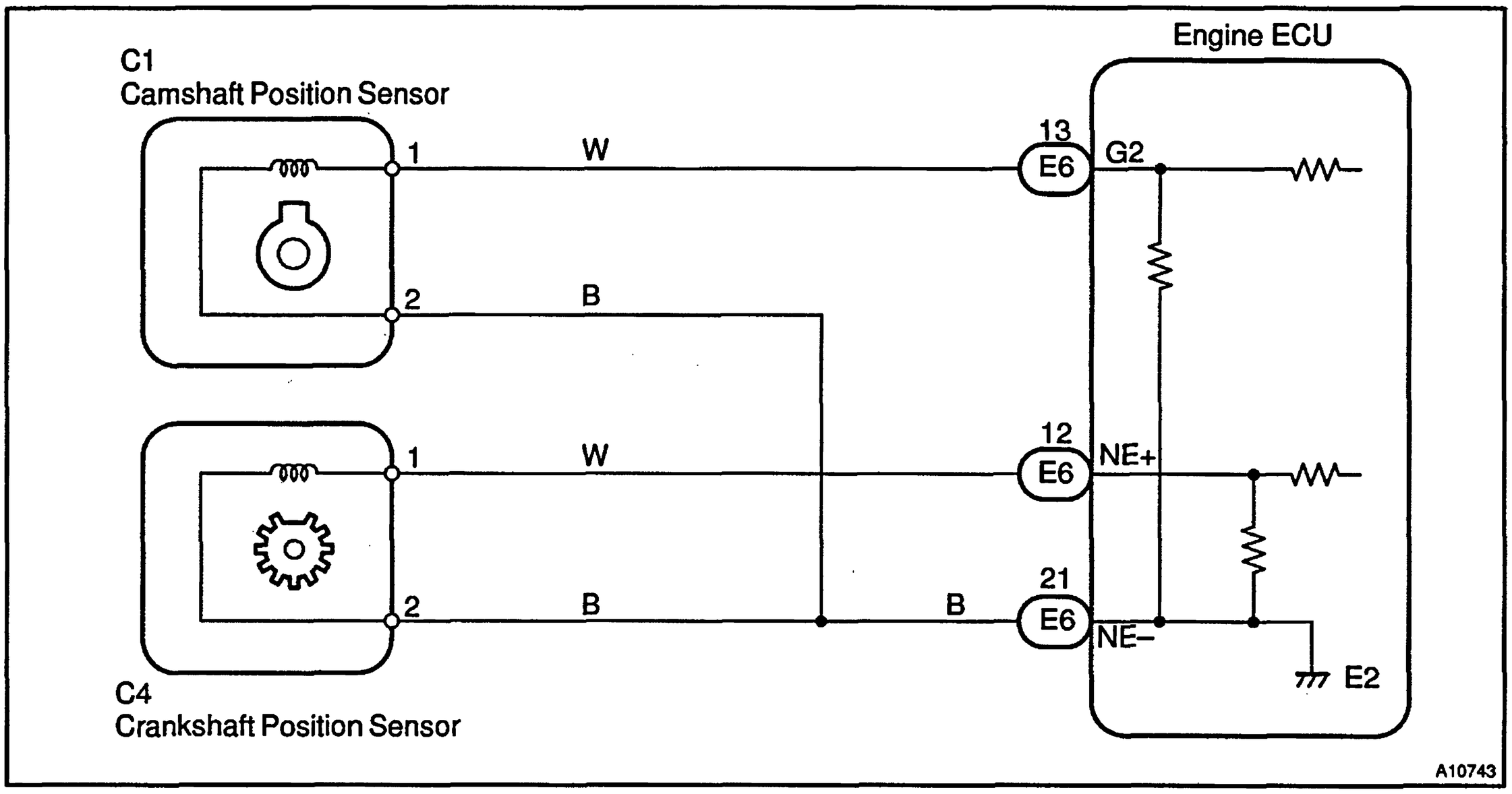
DTC	P0335/12, 13	Crankshaft Position Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

The crankshaft position sensor, which is consists of a magnet, iron core and pick–up coil, is installed on the oil pump body, and the NE signal plate with 34 teeth is installed on the crankshaft.
The NE signal plate rotates with the crankshaft, and this rotation generates an electrical signal every time a tooth of this signal plate passes the crankshaft position sensor. That is, 34 electrical signals occur for every crankshaft rotation. Based on this signal, the engine ECU detects the crankshaft angle and the engine speed.

DTC No.	DTC Detecting Condition	Trouble Area
P0335/12, 13	No crankshaft position sensor signal to engine ECU during cranking	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Starter • Engine ECU
	No crankshaft position sensor signal to engine ECU with engine speed 600 rpm or more	

WIRING DIAGRAM

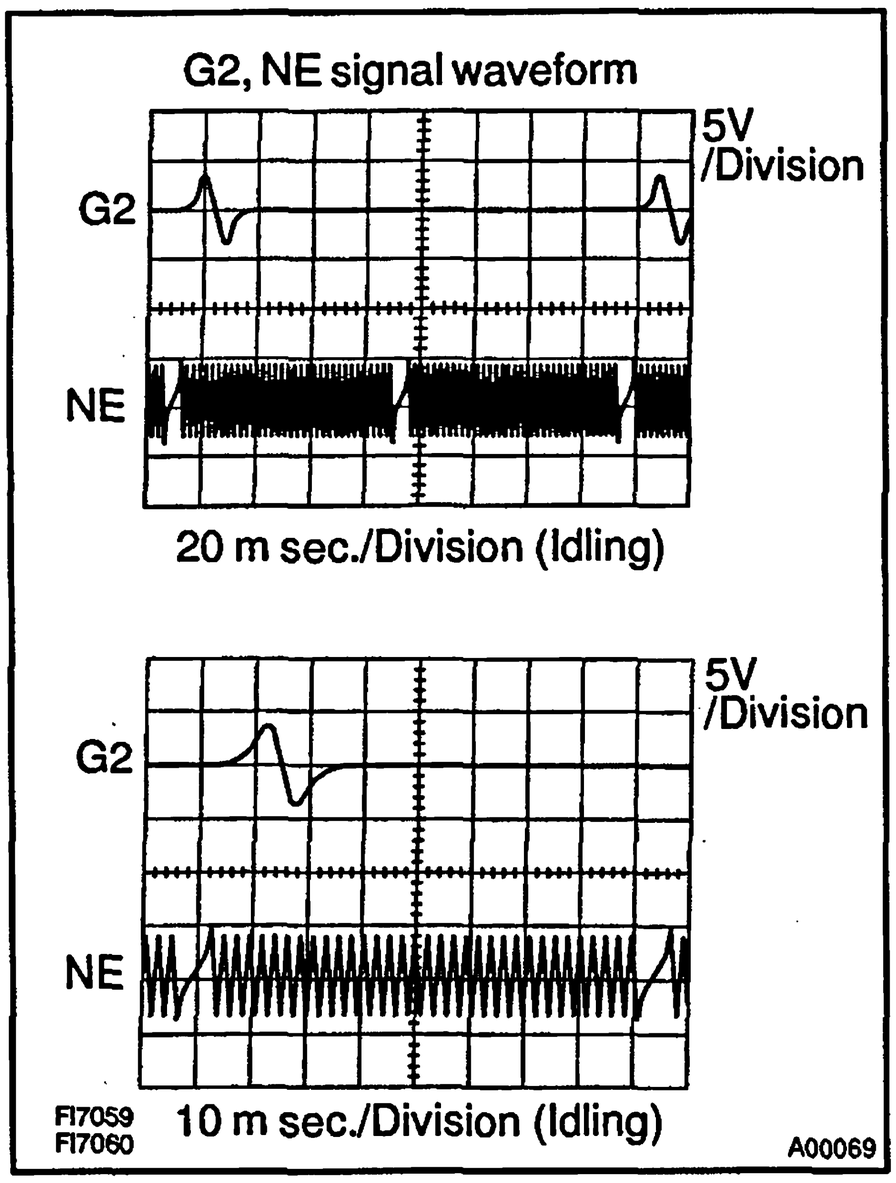


INSPECTION PROCEDURE

HINT:

- Perform troubleshooting of DTC P0335/12, 13 first. If no trouble is found, troubleshoot the following mechanical systems.
- Read freeze frame data on the hand–held tester. Because freeze frame data 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 warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Check resistance of crankshaft position sensor (See Pub. No. RM519E on page IG–3).**



Reference: INSPECTION USING OSCILLOSCOPE

During cranking or idling, check the waveform between terminals G2 and NE–, NE and NE– of the engine ECU connector.

HINT:

The correct waveforms are as shown in the illustration.

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–20).**

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

OK

3	Inspect sensor installation and teeth of crankshaft timing pulley.

NG → Tighten sensor.
Replace crankshaft timing pulley.

OK

Check and replace engine ECU
(See page IN–20).

D18AY-02

DTC	P0340/12	Camshaft Position Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

The camshaft position sensor (G2 signal) consists of a signal plate and pickup coil.
The G2 signal plate has 1 tooth, on its outer circumference, and is mounted on the left bank camshafts.
When the camshafts rotate, the protrusion on the signal plate and the air gap on the pickup coil change, causing fluctuations in the magnetic field and generating an electromotive force in the pickup coil.
The NE signal plate has 34 teeth and is mounted on the crankshaft. The NE signal sensor generates 34 signals for every engine revolution. The engine ECU detects the standard crankshaft angle based on the G2 signal and the actual crankshaft angle and the engine speed by the NE signals.

DTC No.	DTC Detecting Condition	Trouble Area
P0340/12	No camshaft position sensor signal to engine ECU during cranking	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Starter • Engine ECU
	No camshaft position sensor signal to engine ECU with engine speed 600 rpm or more	

WIRING DIAGRAM

Refer to DTC P0335/12, 13 on page DI–69.

INSPECTION PROCEDURE

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

1	**Check resistance of camshaft position sensor (See Pub. No. RM519E on page IG–3).**

Reference: INSPECTION USING OSCILLOSCOPE (See page DI–69 on step 1)

NG → **Replace camshaft position sensor.**

OK

2	**Check for open and short in harness and connector between engine ECU and camshaft position sensor (See page IN–20).**

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

OK

3	Inspect sensor installation.

NG → Tighten sensor.

OK →

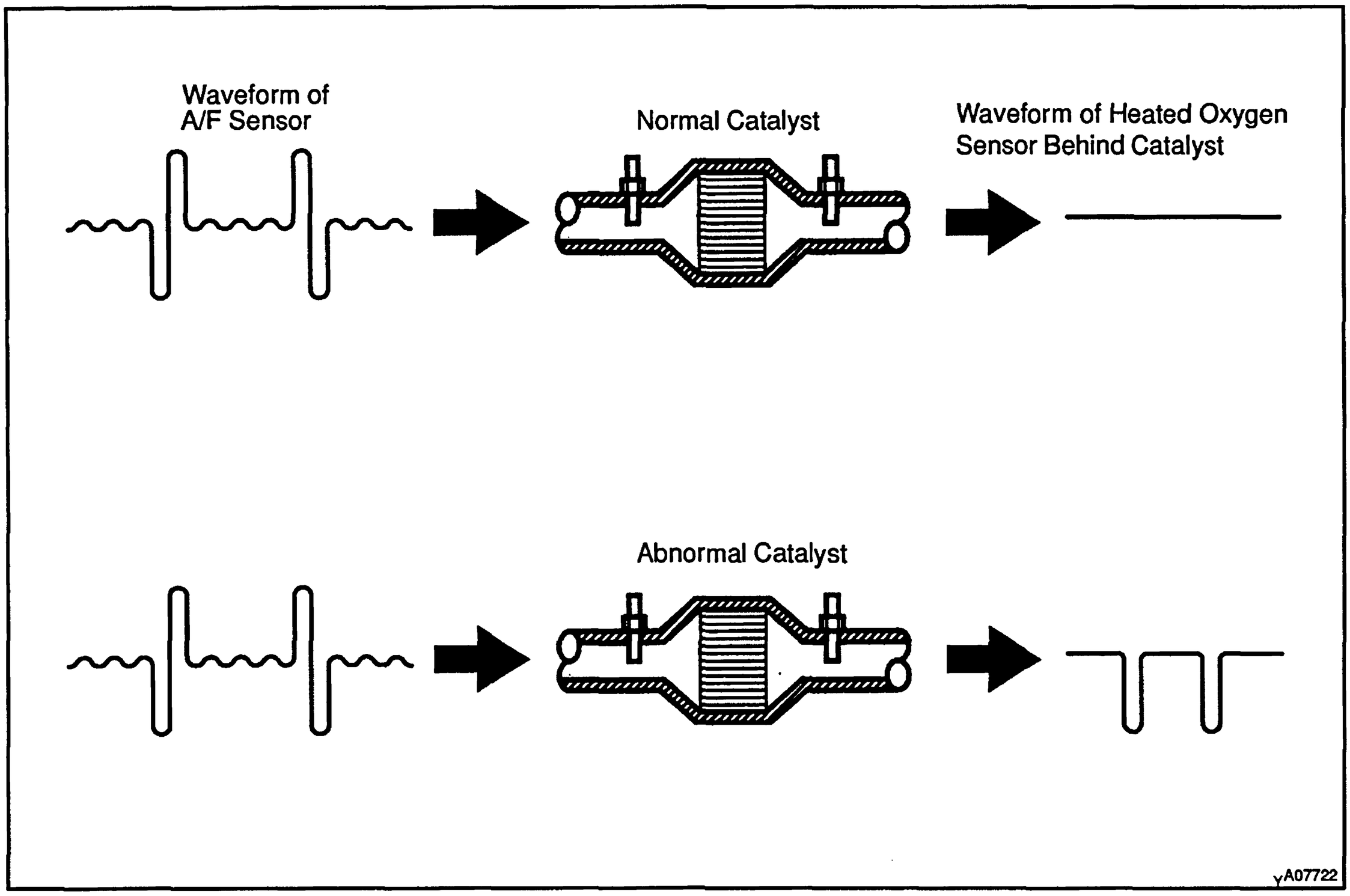
Check and replace engine ECU (See page IN–20).

DI9PO–01

DTC	P0420/94	Catalyst System Efficiency Below Threshold (Bank 1)

CIRCUIT DESCRIPTION

The engine ECU observes the waveform of the heated oxygen sensor located behind the catalyst to determine whether the catalyst performance has deteriorated. If the catalyst is functioning normally, the waveform of the heated oxygen sensor located behind the catalyst switches back and forth between rich and lean much more slowly. On the contrary, when the waveform of the heated oxygen sensor located behind the catalyst alternates flatteringly between rich and lean, it indicates that the catalyst performance has deteriorated.



DTC No.	DTC Detecting Condition	Trouble Area
P0420	After engine and catalyst are warmed up, and while vehicle is driven within set vehicle and engine speed range, waveform of heated oxygen sensor alternates flatteringly between rich and lean (2 trip detection logic)	• Exhaust gas leak on exhaust system • Heated oxygen sensor • Three–way catalytic converter

INSPECTION PROCEDURE

HINT:

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

1	Are there any other codes (besides DTC P0420/94) being output?

YES → Go to relevant DTC chart (See page DI–15).

NO

2	Check exhaust gas leak on exhaust system.

NG → Repair or replace.

OK

3	Check heated oxygen sensor (See page DI–52).

NG → Repair or replace.

OK

Replace No.1 and No.2 exhaust pipes (TWCs).

D9PP–01

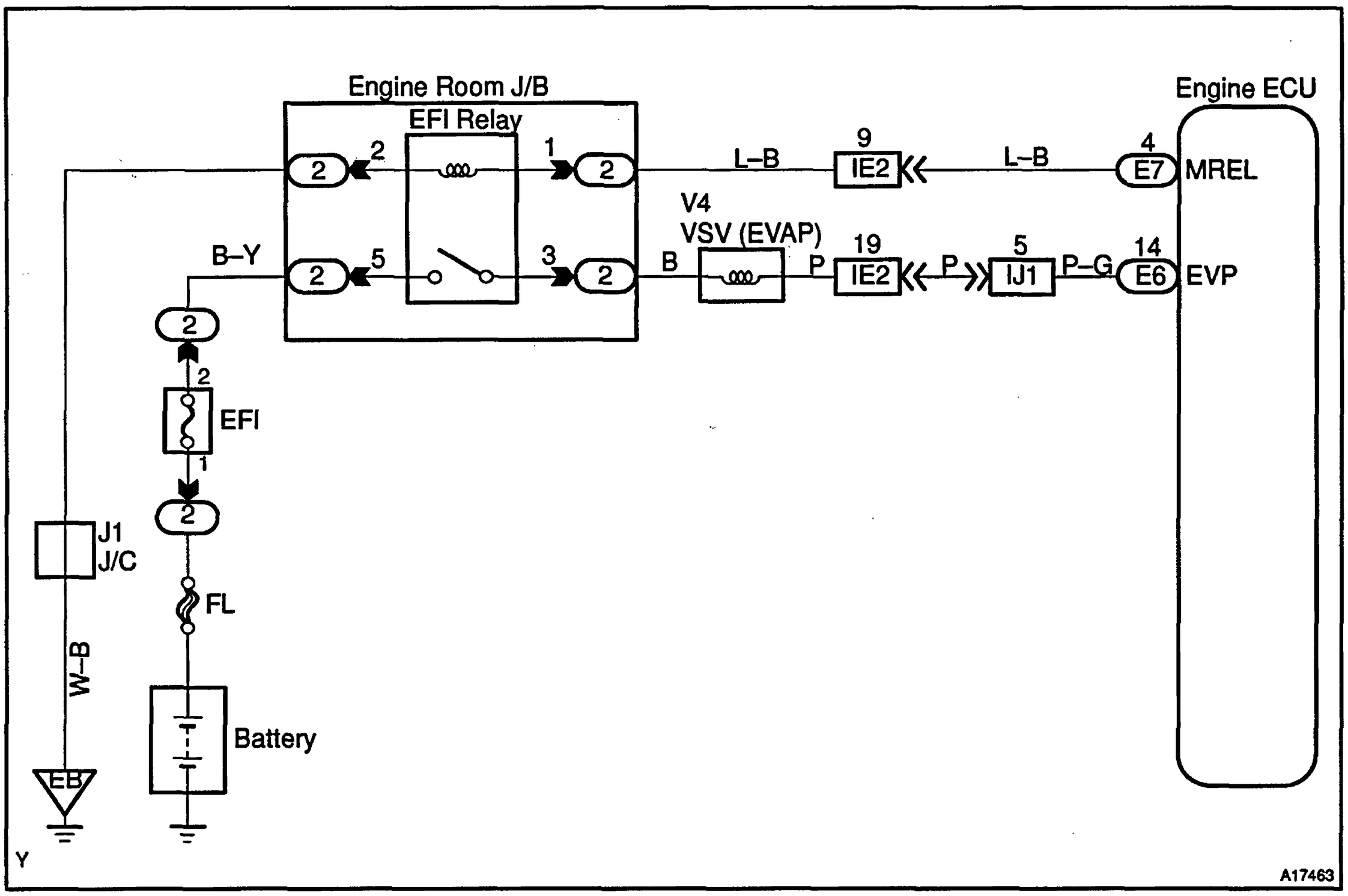
DTC	P0443/94	Evaporative Emission Control System Purge Control Vent Control Malfunction

CIRCUIT DESCRIPTION

To reduce HC emissions, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.
The engine ECU changes the duty signal to the VSV for the EVAP so that the intake quantity of HC emissions can be appropriate for the driving conditions (engine load, engine speed, vehicle speed, etc.) after the engine is warmed up.

DTC No.	DTC Detecting Condition	Trouble Area
P0443/94	Proper response to engine ECU command does not occur	• Open or short in VSV circuit for EVAP • VSV for EVAP • Engine ECU

WIRING DIAGRAM



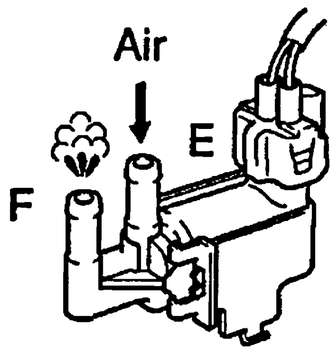
INSPECTION PROCEDURE

When using hand–held tester:

HINT:

Read freeze frame data using the hand–held tester. Because freeze frame data 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.

1	**Check operation of VSV for EVAP on hand–held tester.**



PREPARATION:

Select the ACTIVE TEST mode on the hand–held tester.

CHECK:

Check the operation of the VSV when the VSV is operated by the hand–held tester.

OK:

VSV is ON:

Air from port E flows out through port F.

VSV is OFF:

Air from port E is flows out through the air filter.

NG → **Replace VSV for EVAP.**

OK

2	**Check for open and short in harness and connector between EFI main relay and engine ECU (See page IN–20).**

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

OK

Check and replace engine ECU (See page IN–20).

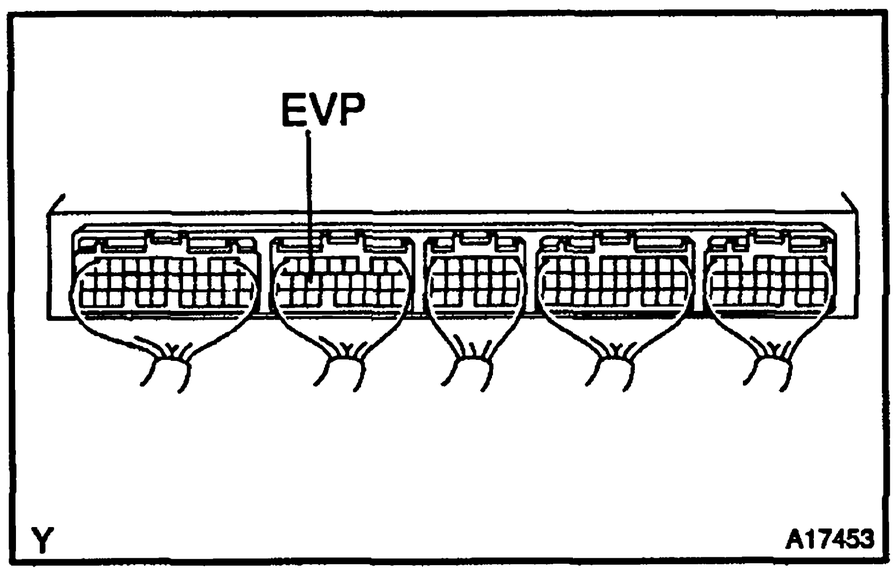
When not using hand–held tester:

1	Check VSV for EVAP (See page EC–3).

NG → Replace VSV for EVAP.

OK

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



PREPARATION:
Turn the ignition switch ON.
CHECK:
Measure the voltage between terminal EVP of the engine ECU connector and the body ground.
OK:
Voltage: 9 – 14 V

NG → Check for open and short in harness and connector between EFI main relay and engine ECU (See page IN–20).

OK

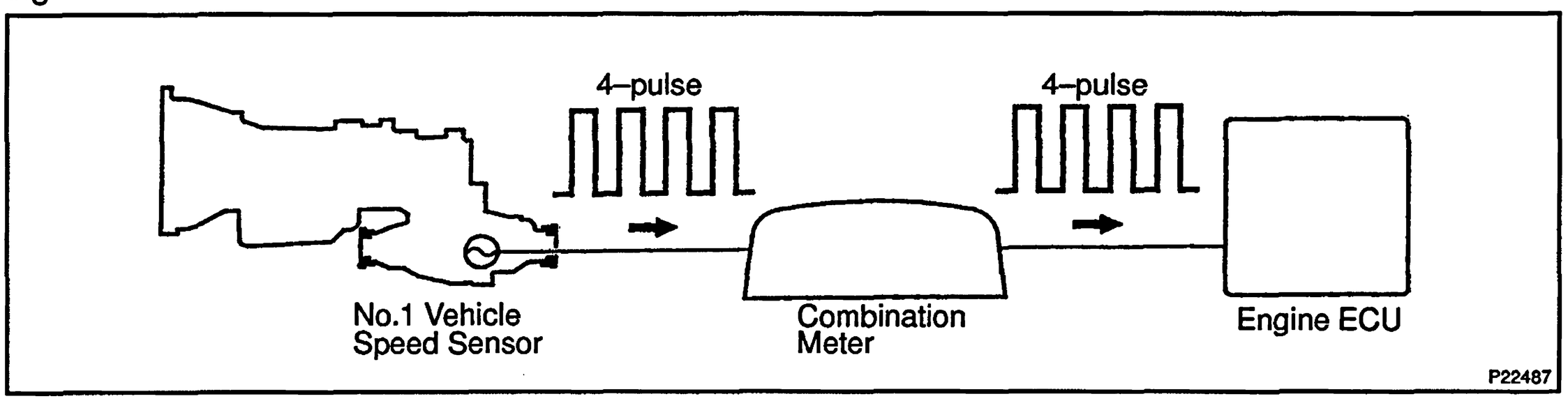
Check and replace engine ECU (See page IN–20).

DI6AZ–02

DTC	P0500/42	Vehicle Speed Sensor Malfunction

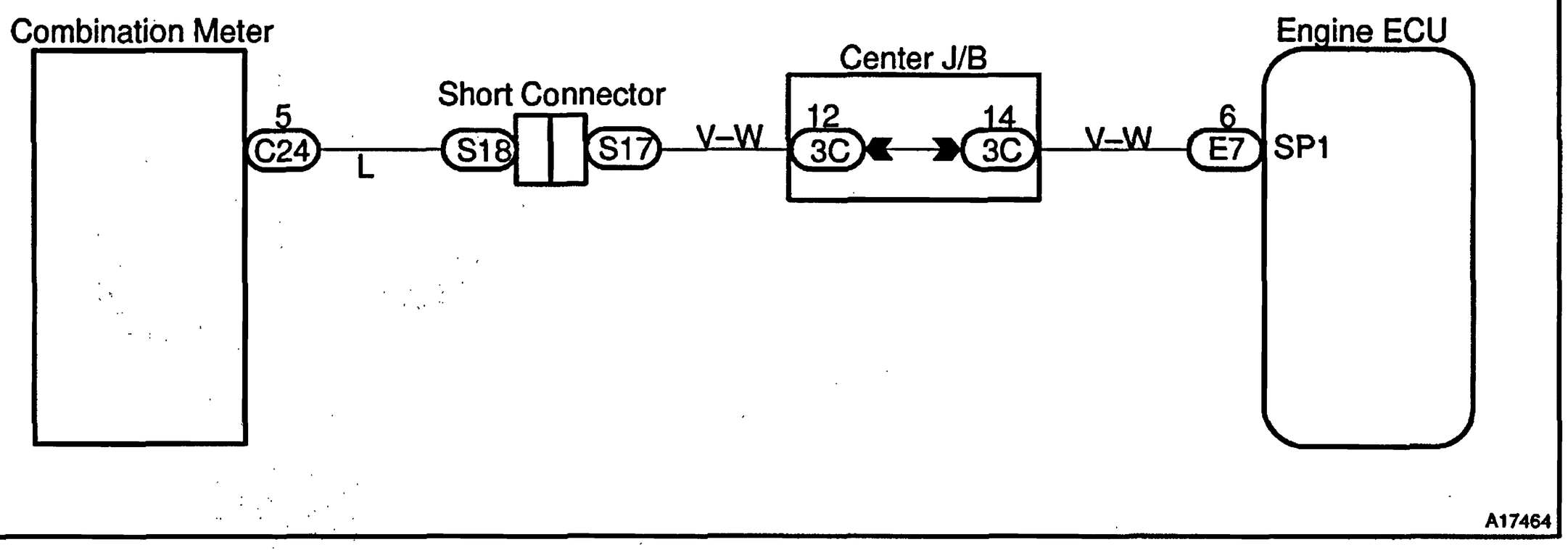
CIRCUIT DESCRIPTION

The No.1 vehicle speed sensor outputs a 4 – pulse signal for every revolution of the rotor shaft, which is rotated by the transmission output shaft via the driven gear. After this signal is converted into a more precise rectangular wavefrom in the waveform shaping circuit inside the combination meter, it is then transmitted to the engine ECU. The engien ECU determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	DTC Detecting Condition	Trouble Area
P0500/42	No vehicle speed sensor signal to engine ECU under conditions (a) and (b): (a) Neutral start switch is OFF (b) Vehicle is being driven	• Open or short in No.1 vehicle speed sensor circuit • No.1 vehicle speed sensor • Combination meter • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

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

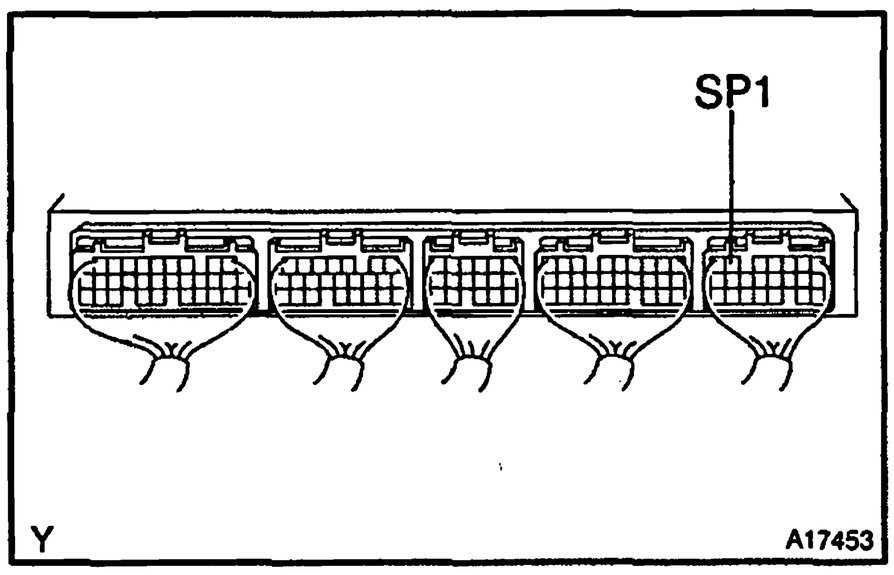
1	**Check operation of speedometer.**

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 circuit.**

OK

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

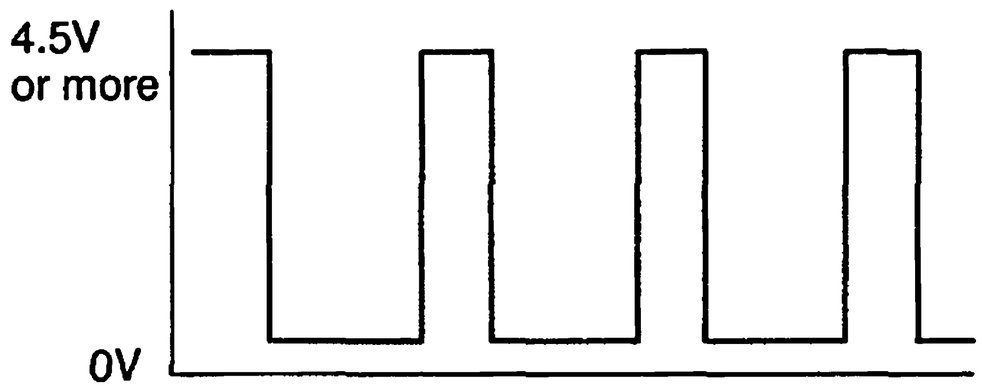


PREPARATION:
(a) Remove the glove compartment door.
(b) Shift the shift lever to neutral.
(c) Jack up a rear wheel.
(d) Turn the ignition switch ON.

CHECK:
Measure the voltage between terminal SP1 of the engine ECU connector and the 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.**

OK

Check and replace engine ECU (See page IN–20).

D9PQ–01

DTC	P0505/33	Idle Control System Malfunction

CIRCUIT DESCRIPTION

The idle speed is controlled by the Electric Throttle Control System (ETCS).
The ETCS is composed of the throttle motor to operate the throttle valve, the magnetic clutch to connect the throttle motor with the throttle valve, the throttle position sensor to detect the opening angle of the throttle valve, the accelerator pedal position sensor to detect the accelerator pedal position, the engine ECU to control the ETCS and the one valve type throttle body.
The engine ECU controls the throttle motor to make the throttle valve opening angle properly for the target idle speed.

DTC No.	DTC Detecting Condition	Trouble Area
P0505	Idle speed continues to vary greatly from target speed (2 trip detection logic)	• Air induction system • ETCS

INSPECTION PROCEDURE

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

1	**Are there any other codes (besides P0505/33) being output?**

YES → **Go to relevant DTC chart (See page DI–15).**

NO

2	**Check air induction system.**

NG → **Repair or replace.**

OK

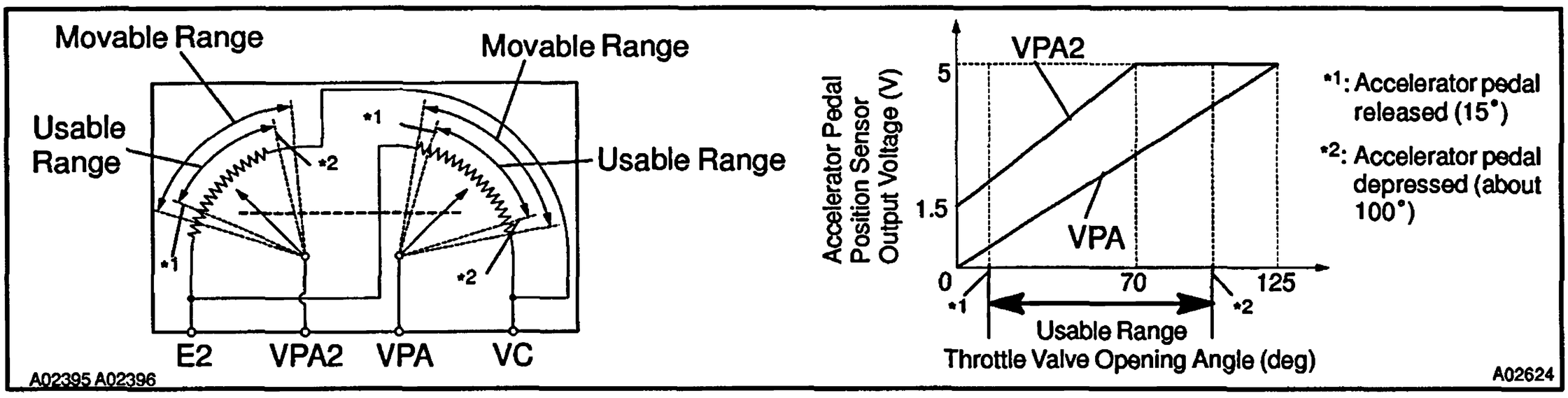
Check throttle body (See page FI–1).

DI9PR–01

DTC	P1120/19	Accelerator Pedal Position Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

The accelerator pedal position sensor is mounted on the throttle body and it has 2 sensors to detect the accelerator position and a malfunction of the accelerator position sensor's own.
The accelerator pedal position sensor is connected with the accelerator pedal by the accelerator wire and the voltage applied to terminals VPA and VPA2 of the engine ECU changes between 0 V and 5 V in proportion to the opening angle of the accelerator pedal.
The engine ECU judges the current opening angle of the accelerator pedal from these signals input from terminals VPA and VPA2 and the engine ECU controls the throttle motor based on these signals.
If this DTC is stored, the engine ECU shuts down the power for the throttle motor and the magnetic clutch, and the throttle valve is fully closed by the return spring.However, the opening angle of the throttle valve can be controlled by the accelerator pedal through the throttle cable.

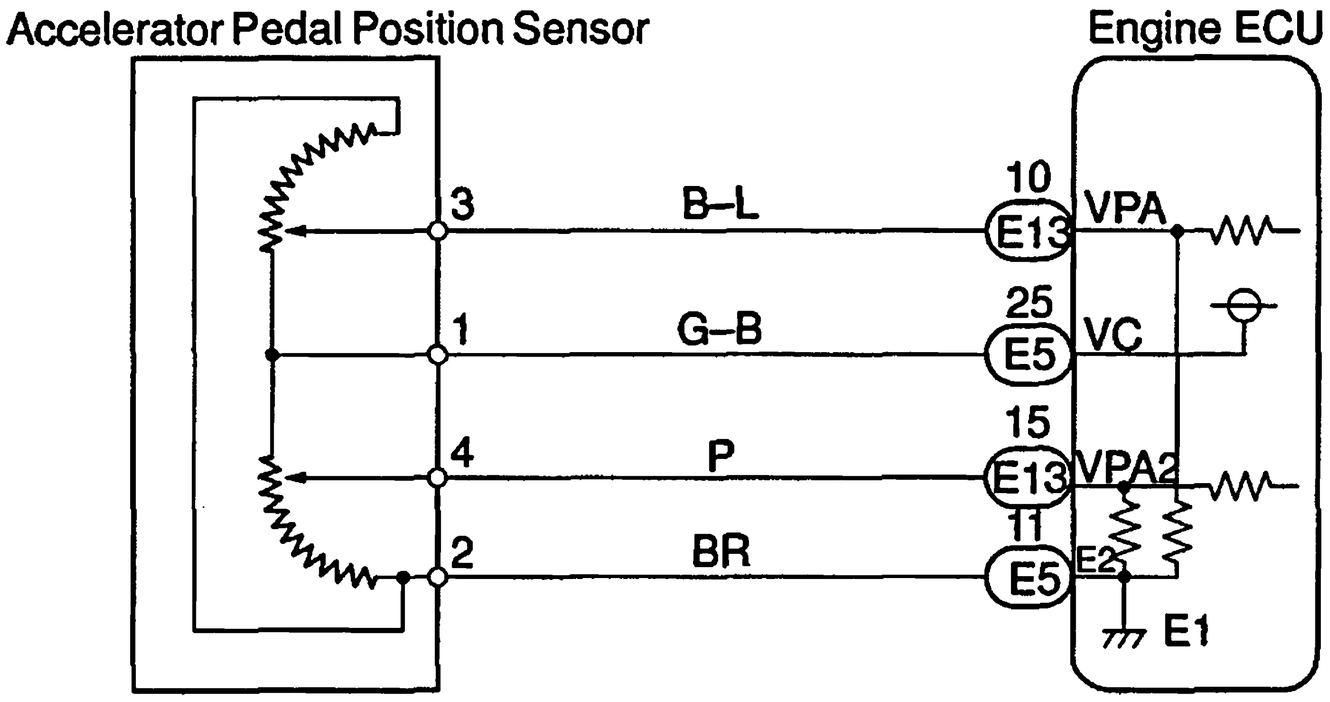


DTC No.	DTC Detection Condition	Trouble Area
P1120/19	Condition (a), (b), (c), (d) or (e) continues for 0.5 seconds when IDL is OFF: (a) VPA ≦ 0.2 V (b) VPA2 ≦ 0.5 V (c) VPA ≧ 4.7 V (d) When VPA ≧ 0.2 V and ≦ 1.8 V, and VPA2 ≧ 4.97 V (e) VPA–VPA2 ≦ 0.02 V, or VPA2–VPA ≦ 0.02 V	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • Engine ECU
	Condition (a) continues for 2.0 seconds: (a) VPA ≦ 0.2 V and VPA2 ≦ 0.5 V	

HINT:
After confirming DTC P1120/19, use the hand–held tester to confirm the throttle valve opening percentage.

Accelerator pedal position expressed as voltage				Trouble area
Accelerator pedal released		Accelerator pedal depressed		
ACCEL POS #1	ACCEL POS #2	ACCEL POS #1	ACCEL POS #2	
0 V	0 V	0 V	0 V	VC circuit open
0 V	1.8–2.7 V	0 V	4.7–5.1 V	VPA circuit open or ground short
0.3–0.9 V	0 V	3.2–4.7 V	0 V	VPA2 circuit open or ground short
5 V	5 V	5 V	5 V	E2 circuit open

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs P0110/24, P0115/22, P0120/41, and P1120/19 are output simultaneously, E2 (sensor ground) may be open.
- Read freeze frame data on the hand–held tester. Because freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of a malfunction.

When using hand–held tester:

1	**Read voltage for accelerator pedal position sensor data on hand–held tester.**

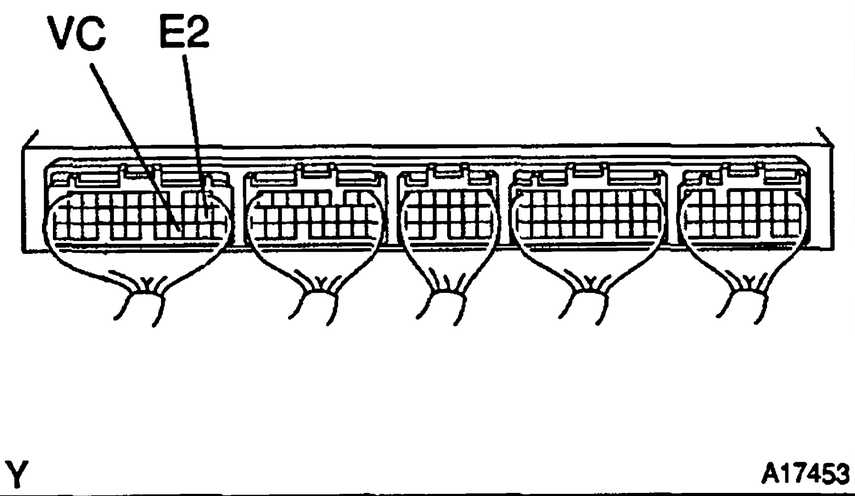
OK:

Accelerator Pedal	VPA	VPA2
Released	0.3 – 0.9 V	1.8 – 2.7 V
Depressed	3.2 – 4.7 V	4.7 – 5.1 V

OK → **Check and replace engine ECU (See page IN–20).**

NG

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



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

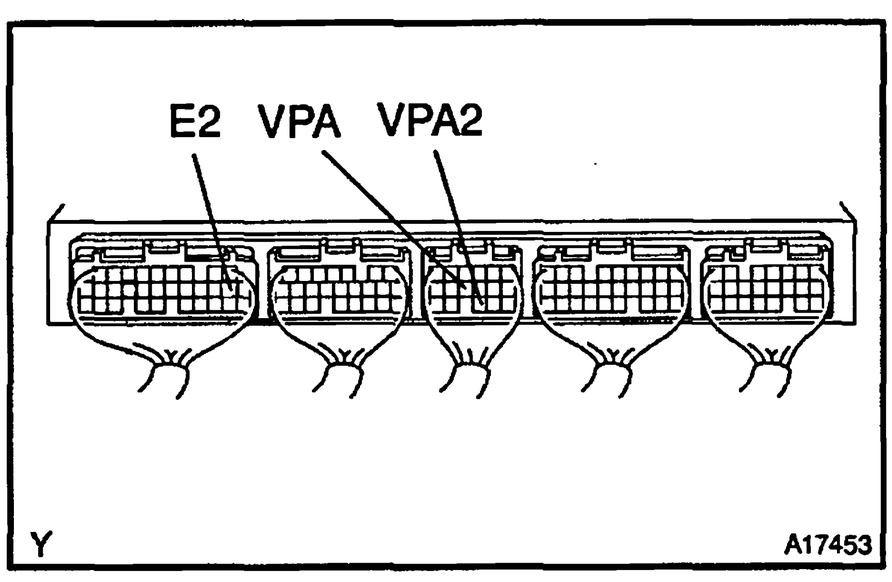
CHECK:
Measure the voltage between terminals VC and E2 of the engine ECU connector.

OK:
4.5 – 5.5 V

NG → **Check and replace engine ECU (See page IN–20).**

OK

3	Check voltage between terminals VPA and E2, and VPA2 and E2 of engine ECU connector.



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

CHECK:
Measure the voltage between terminals VPA and E2, and VPA2 and E2 of the engine ECU connector.

OK:

Accelerator pedal	Voltage	
	VPA – E2	VPA2 – E2
Released	0.3 – 0.9 V	1.8 – 2.7 V
Depressed	3.2 – 4.7 V	4.7 – 5.1 V

OK → **Check and replace engine ECU (See page IN–20).**

NG

4	Check accelerator pedal position sensor (See page FI–1).

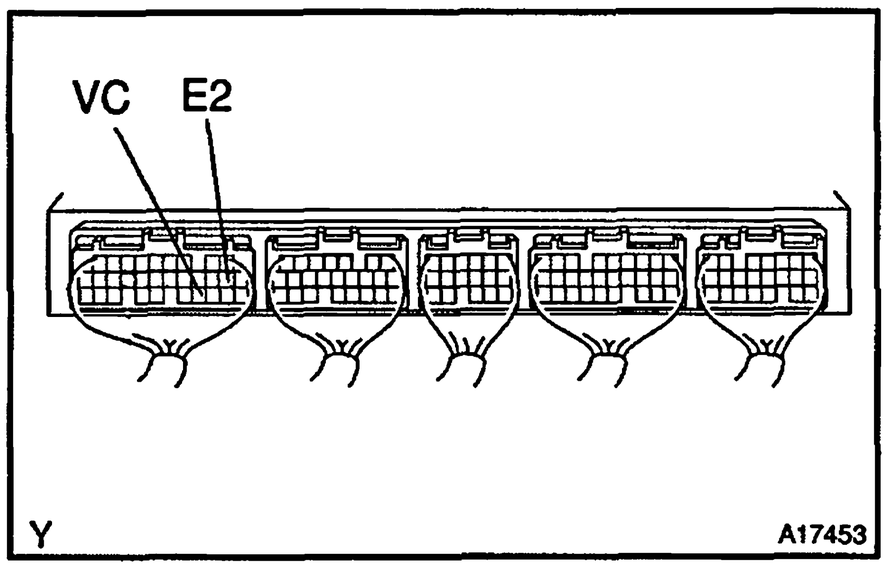
NG → Replace accelerator pedal position sensor (See page FI–4).

OK

Check for open and short in harness and connector in VC, VPA, VPA2 and E2 circuits between engine ECU and accelerator pedal position sensor (See page IN–20).

When not using hand–held tester:

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



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

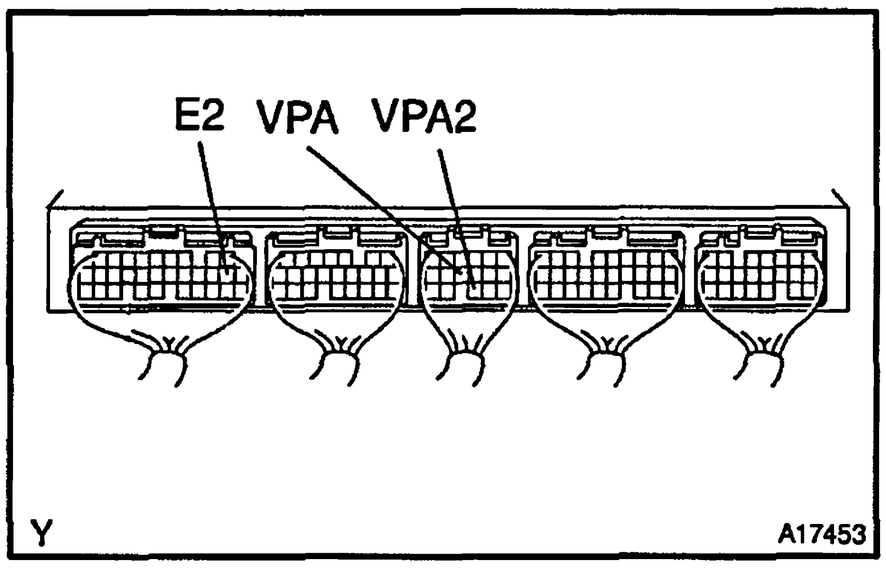
CHECK:
Measure the voltage between terminals VC and E2 of the engine ECU connector.

OK:
4.5 – 5.5 V

NG → Check and replace engine ECU (See page IN–20).

OK

2	Check voltage between terminals VPA and E2, and VPA2 and E2 of engine ECU connector.



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

CHECK:
Measure the voltage between terminals VPA and E2, and VPA2 and E2 of the engine ECU connector.

OK:

Accelerator pedal	Voltage	
	VPA – E2	VPA2 – E2
Released	0.3 – 0.9 V	1.8 – 2.7 V
Depressed	3.2 – 4.7 V	4.7 – 5.1 V

OK → Check and replace engine ECU (See page IN–20).

NG

3	Check accelerator pedal position sensor (See page FI–1).

NG → Replace accelerator pedal position sensor (See page FI–4).

OK

Check for open and short in harness and connector in VC, VPA, VPA2 and E2 circuits between engine ECU and accelerator pedal position sensor (See page IN–20).

DTC	P1121/19	Accelerator Pedal Position Sensor Range/ Performance Problem

CIRCUIT DESCRIPTION

Refer to DTC P1120/19 on page DI–82.

DTC No.	DTC Detection Condition	Trouble Area
P1121/19	Condition (a) continues for 0.5 seconds when IDL is OFF: (a) Difference between VPA and VPA2 is out of threshold	• Accelerator pedal position sensor

INSPECTION PROCEDURE

HINT:

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

Replace accelerator pedal position sensor (See page FI–1).

DI9PT–01

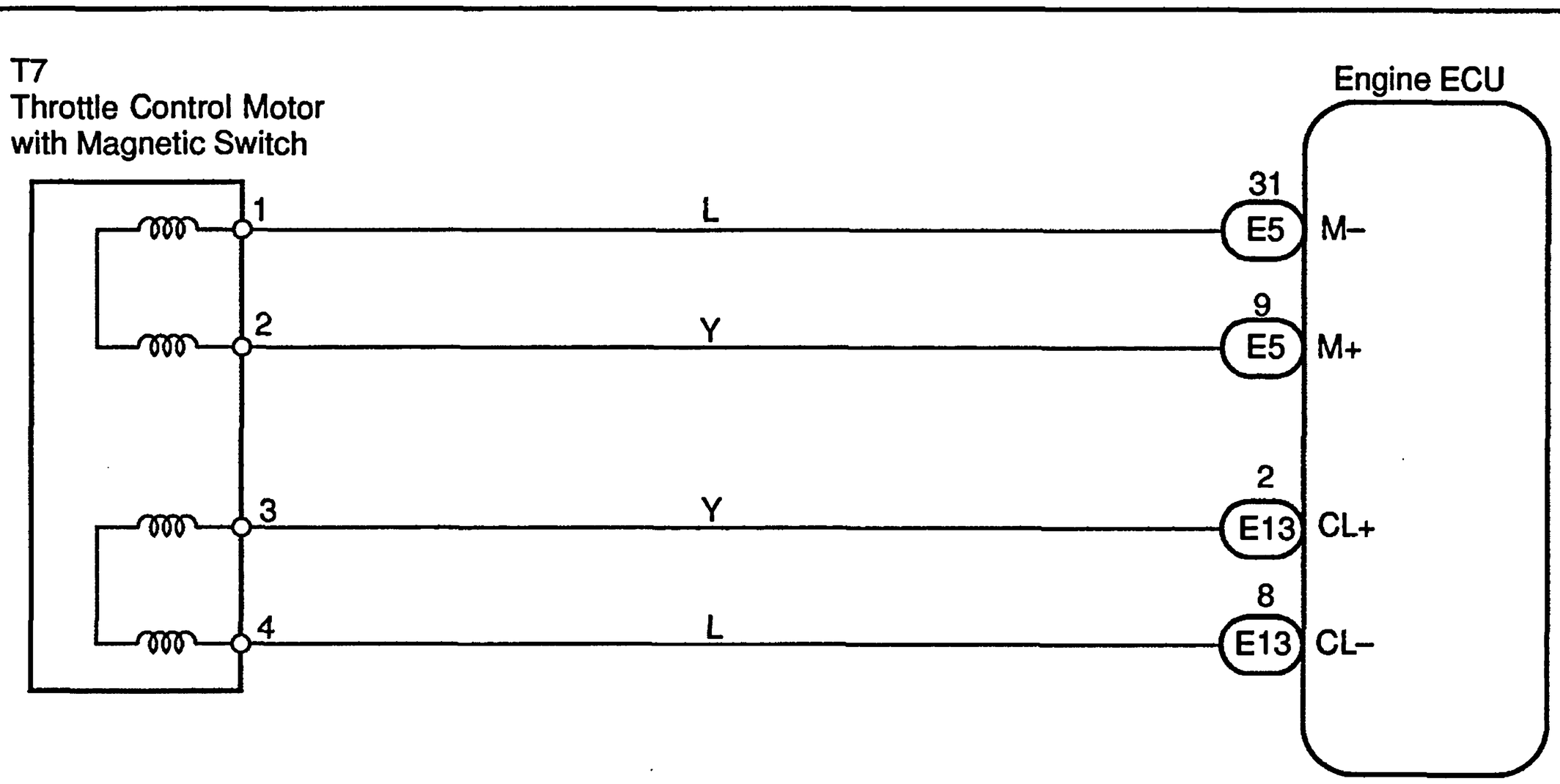
DTC	P1125/89	Throttle Control Motor Circuit Malfunction

CIRCUIT DESCRIPTION

The throttle motor is operated by the engine ECU and it opens and closes the throttle valve.
The opening angle of the throttle valve is detected by the throttle position sensor on the throttle body. And it provides feedback to the engine ECU to control the throttle motor so that the throttle valve opening angle can be appropriate for the driving condition.If this DTC is stored, the engine ECU shuts down the power for the throttle motor and the magnetic clutch, and the throttle valve is fully closed by the return spring.
However, the opening angle of the throttle valve can be controlled by the accelerator pedal through the throttle cable.

DTC No.	DTC Detecting Condition	Trouble Area
P1125	Conditions (a) and (b) continue for 0.5 seconds: (a) Throttle control motor output duty ≧ 80 % (b) Throttle control motor current < 0.5 A	• Open or short in throttle control motor circuit • Throttle control motor • Engine ECU
	Throttle control motor current ≧ 16 A	
	Condition (a) continues for 0.6 seconds: (a) Throttle control motor current ≧ 7 A	

WIRING DIAGRAM



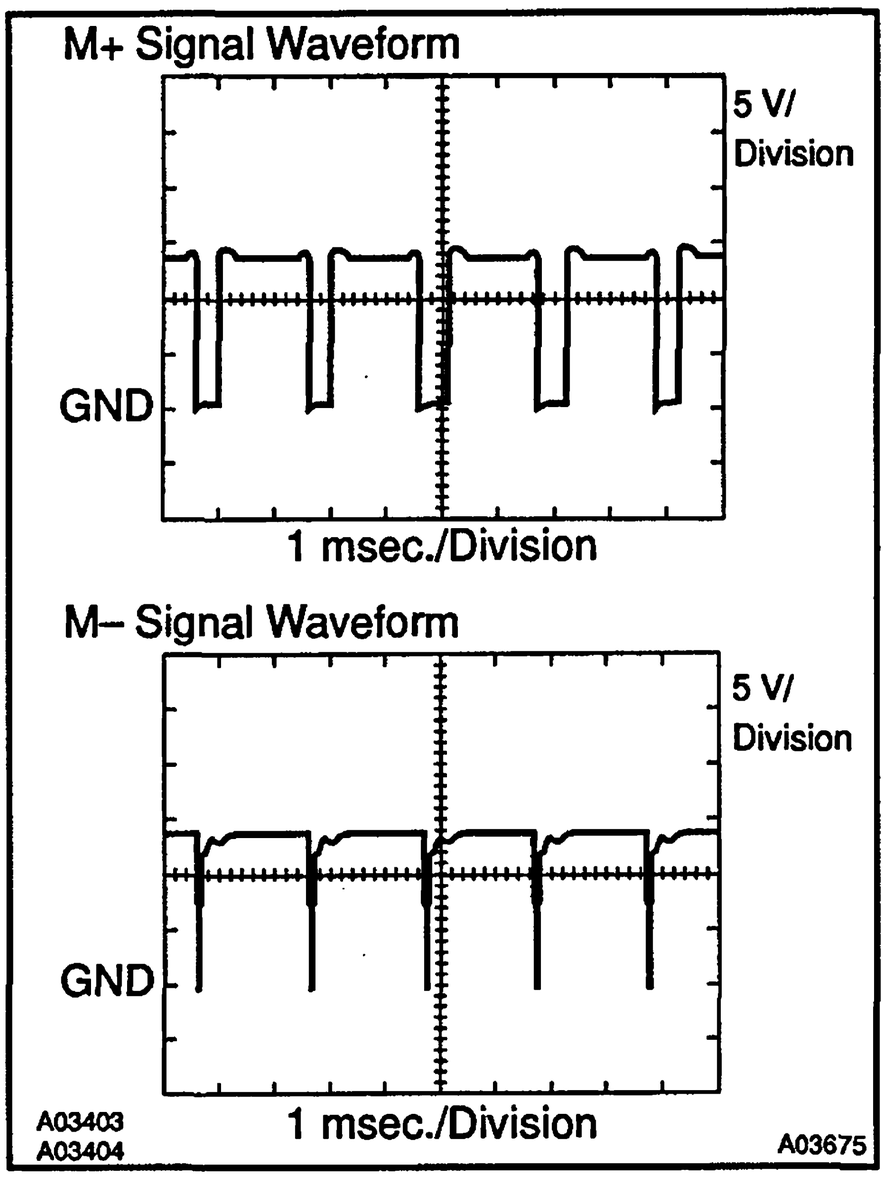
A02990

A09802

INSPECTION PROCEDURE

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

1	**Check throttle control motor circuit.**



PREPARATION:

(a) Connect an oscilloscope between terminals M+ or M– and E1 of the engine ECU connector.

(b) Start the engine.

CHECK:

Check the waveform between terminals M+ or M– and E1 of the engine ECU when the engine is idling.

OK:

The correct waveforms are as shown in the illustration.

HINT:

The waveform frequency varies depending on the throttle opening.

NG → **OK** → **Check and replace engine ECU (See page IN–20).**

2	**Check throttle control motor (See page FI–1).**

NG → **Replace throttle control motor (See page FI–4)**

OK

3	**Check for open and short in harness and connector between throttle control motor and engine ECU (See page IN–20).**

NG → **Repair or replace.**

OK

Check and replace engine ECU (See page IN–20).

DI9PU–01

DTC	P1126/89	Magnetic Clutch Circuit Malfunction

CIRCUIT DESCRIPTION

The magnetic clutch is mounted between the throttle motor and the valve, and it connects the throttle motor with the throttle valve.Therefore, the throttle motor opens and closes the throttle valve through the magnetic clutch.

If the electric throttle control system has a malfunction, the magnetic clutch separates the throttle motor from the throttle valve in order that the throttle motor should not operate the throttle valve.

If this DTC is stored, the engine ECU shuts down the power for the throttle motor and the magnetic clutch, and the throttle valve is fully closed by the return spring.However, the opening angle of the throttle valve can be controlled by the accelerator pedal through the throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P1126/89	Condition (a) continues for 0.8 seconds: (a) Magnetic clutch current ≧ 1.4 A or ≦ 0.4 A	• Open or short in magnetic clutch circuit • Magnetic clutch • Engine ECU
	Condition (a) continues for 1.5 seconds: (a) Magnetic clutch current ≧ 1.0 A or ≦ 0.8 A	

WIRING DIAGRAM

Refer to DTC P1125/89 on page DI–88.

INSPECTION PROCEDURE

HINT:

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

1	**Check magnetic clutch circuit.**

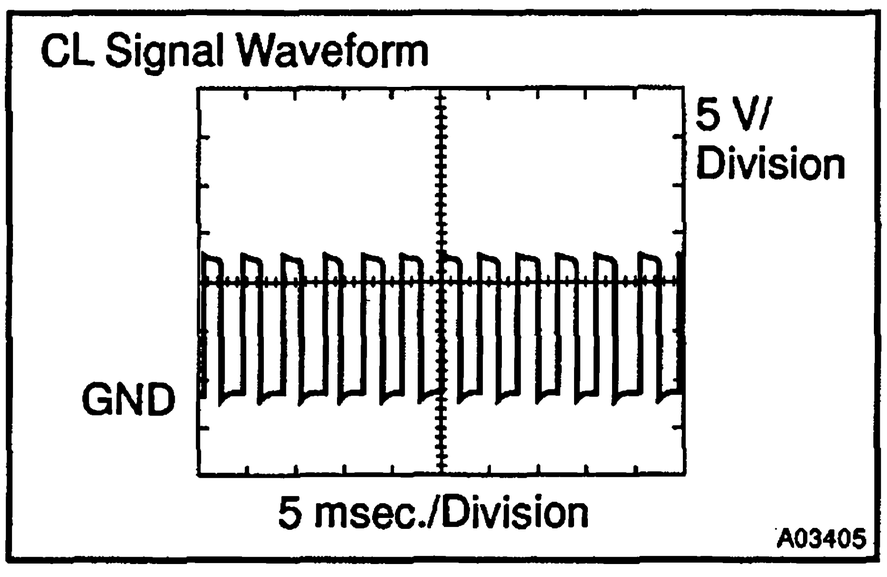
When using hand–held tester:

CHECK:

Read the magnetic clutch current value on the hand–held tester.

OK:

0.8 – 1.0 A



When not using hand–held tester:

PREPARATION:

(a) Connect an oscilloscope between terminals CL+ and CL– of the engine ECU connector.

(b) Start the engine.

CHECK:

Check the waveform between terminals CL+ and CL– of the engine ECU connector when the engine is idling.

OK:

The correct waveform is as shown in the illustration.

NG → Go to step 4.

OK

2	Check magnetic clutch (See page FI–1).

NG → Replace throttle body (See page FI–4).

OK

3	Check for open and short in harness and connector between magnetic clutch and engine ECU (See page IN–20).

NG → Repair or replace.

OK

4	Check operation of magnetic clutch.

CHECK:

(a) Clear the DTC.
(b) Turn the ignition switch ON.
(c) Start the engine.
(d) Turn the ignition switch OFF and wait for 3 seconds.
(e) Turn the ignition switch ON.

OK:

DTC P1126/89 is not stored.

NG → Replace throttle body (See page FI–4).

OK

Check and replace engine ECU (See page IN–20).

DI9FV–01

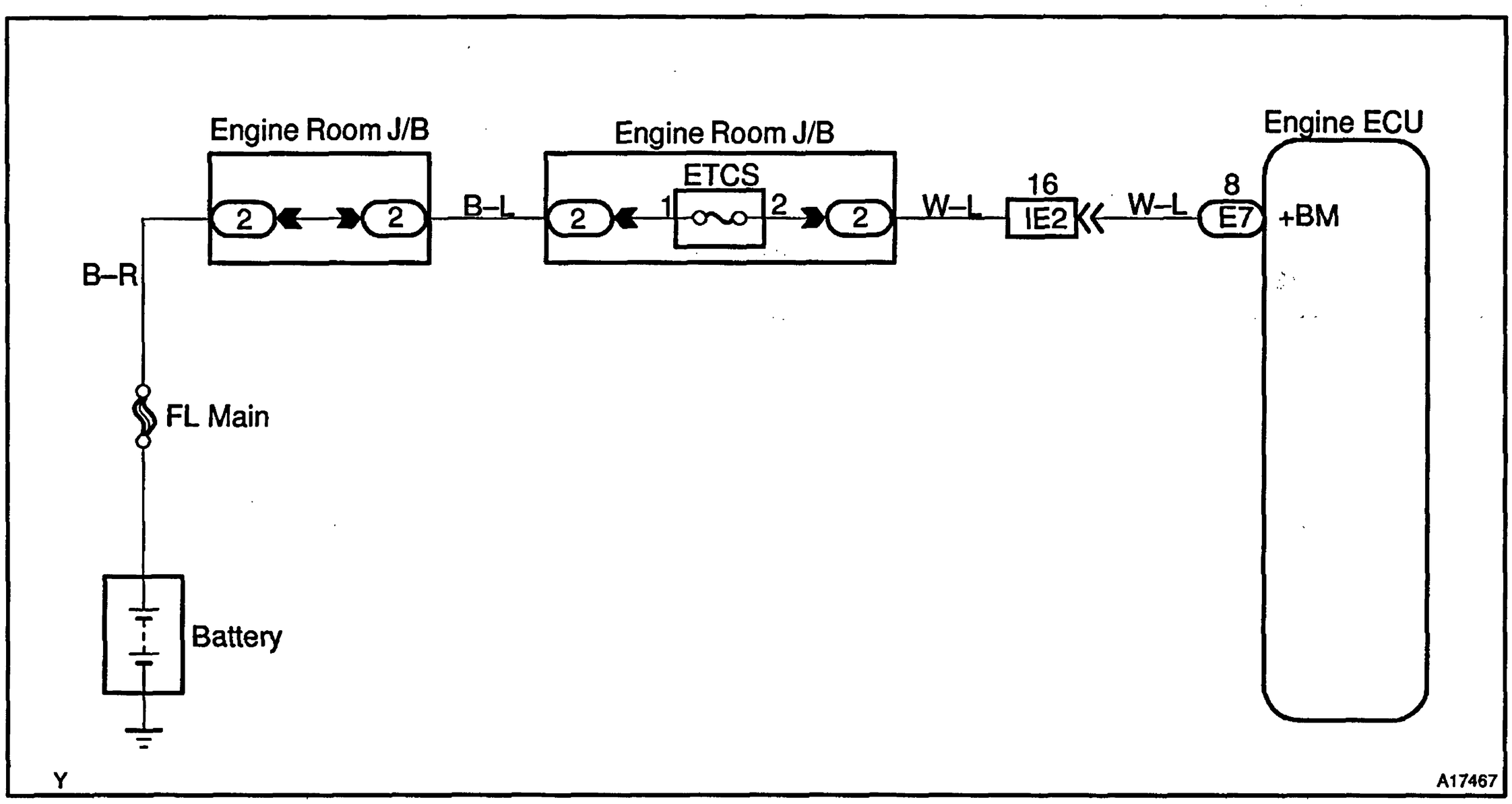
DTC	P1127/89	ETCS Actuator Power Source Circuit Malfunction

CIRCUIT DESCRIPTION

In the ETCS power source, battery voltage is supplied all time.

DTC No.	DTC Detection Condition	Trouble Area
P1127/89	Open in ETCS power source circuit	• ETCS power source circuit • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

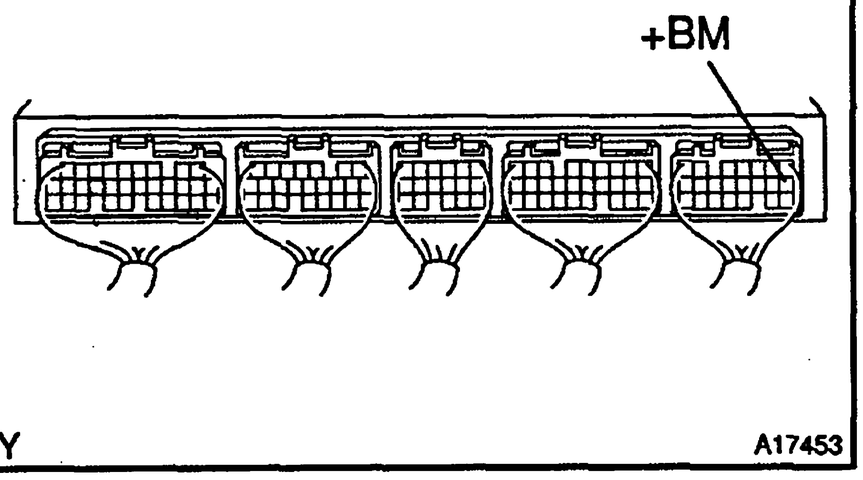
Read freeze frame data on the hand–held tester. Because freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, a engine was warmed up or not, the air–fuel ratio was lean or rich, etc.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

1	Check ETCS fuse.

NG → Check for short in all harness and components connected to ETCS fuse.

OK →

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



PREPARATION:

Remove the glove compartment door.

CHECK:

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

OK:

9 – 14 V

OK → **Check and replace ECU (See page IN–20).**

NG

Check and repair harness or connector between battery and ETCS fuse, and ETCS fuse and engine ECU (See page IN–20).

DI8PW-01

DTC	P1128/89	Throttle Control Motor Lock Malfunction

CIRCUIT DESCRIPTION

The throttle motor and clutch built in the throttle body operate the throttle valve which opening angle is controlled, depending on the driving condition, by the throttle control motor, and the throttle control motor is controlled by the engine ECU, based on each signal from the sensors.
If the throttle control motor malfunctions, power source flowing to the throttle control motor and clutch is cut and the valve is fully closed. However, the throttle valve can be operated by the accelerator pedal through the throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P1128/89	Lock throttle control motor during controlling throttle control motor	• Throttle control motor • Throttle body

INSPECTION PROCEDURE

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

1	**Check throttle control motor (See page FI–1).**

NG → **Replace throttle body (See page FI–4).**

OK

2	**Visually check throttle valve.**

PREPARATION:
Remove the intake air connector.
CHECK:
Check whether or not a foreign body is caught between the throttle valve and the housing.

NG → **Remove a foreign body and clean throttle body.**

OK

Replace throttle body.

D19PX–01

DTC	P1129/89	Electric Throttle Control System Malfunction

CIRCUIT DESCRIPTION

The Electric Throttle Control System (ETCS) is composed of the throttle motor to operate the throttle valve, the electromagnetic clutch to connect the throttle motor with the throttle valve, the throttle position sensor to detect the opening angle of the throttle valve, the accelerator pedal position sensor to detect the accelerator pedal position, the engine ECU to control the ETCS and the one valve type throttle body. The engine ECU controls the throttle motor to make the throttle valve opening angle properly in response to the driving condition.

The throttle position sensor which is mounted on the throttle body detects the opening angle of the throttle valve, and it provides feedback to the engine ECU to control the throttle motor.

If the ETCS has a malfunction, the engine ECU shuts down the power for the throttle motor and the magnetic clutch, and the throttle valve is fully closed by the return spring. However, the opening angle of the throttle valve can be controlled by the accelerator pedal through the throttle cable.

DTC No.	DTC Detecting Condition	Trouble Area
P1129/89	Throttle opening angle continues to vary greatly from target throttle opening angle	• ETCS • Engine ECU

WIRING DIAGRAM

Refer to DTC P1125/89 on page DI–88.

INSPECTION PROCEDURE

HINT:

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

Replace engine ECU, and clear DTC. If DTC P1129/89 is displayed again, and then replace throttle body.

DTC	P1130/21	A/F Sensor Circuit Range/Performance Malfunction (Bank 1 Sensor 1)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 on page DI–44.

DTC No.	DTC Detecting Condition	Trouble Area
P1130/21	Output voltage * of A/F sensor remains at 3.8 V or more, or 2.8 V or less, during engine running after engine is warmed up (2 trip detection logic) *: Output value changes inside engine ECU only	• Open or short in A/F sensor circuit • A/F sensor • Air induction system • Fuel pressure • Injector • Engine ECU
	Output voltage * of A/F sensor does not change from 3.30 V, during engine running after engine is warmed up (2 trip detection logic) *: Output value changes inside engine ECU only	
	Open or short in A/F sensor circuit (2 trip detection logic)	

HINT:

- After confirming DTC P1130/21, use the hand–held tester to confirm the output voltage of the A/F sensor (AFS B1 S1/O2S B1 S1) from the CURRENT DATA.
- The A/F sensor's output voltage and the short–term fuel value can be read on the hand–held tester.
- The engine ECU controls the voltage of AF1+ and AF1– terminals of the engine ECU to the fixed voltage. Therefore, it is impossible to confirm the A/F sensor output voltage without a hand–held tester.

WIRING DIAGRAM

Refer to DTC P0125/91 on page DI–44.

INSPECTION PROCEDURE

HINT:

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

1	**Are there any other codes (besides DTC P1130/21) being output?**

YES → **Go to relevant DTC chart.**

NO

2	Read value for voltage output of A/F sensor on hand–held tester. (See page DI–44 on step 2)

OK → Go to step 8.

NG

3	Check for open and short in harness and connector between engine ECU and A/F sensor (See page IN–20).

NG → Repair or replace harness or connector.

OK

4	Check resistance of A/F sensor heater (See page DI–44).

NG → Replace A/F sensor.

OK

5	Check air induction system.

NG → Repair or replace.

OK

6	Check fuel pressure (See page DI–4).

NG → Check and repair fuel pump, pressure regulator, fuel pipe line and filter.

OK

7	Check injector injection (See Pub. No. RM 519E on page EG–140).

NG → Replace injector.

OK →

Replace A/F sensor.

8	Perform confirmation driving pattern (See page DI–44 on step 9).

Go →

9	Is there DTC P1130/21 being output again?

YES → Check and replace engine ECU (See page IN–20).

NO →

10	Did vehicle runs out of fuel in past?

NO → Check for intermittent problems (See page DI–4).

YES →

DTC P1130/21 is caused by shortage out of fuel.

DTC	P1133/21	A/F Sensor Circuit Response Malfunction (Bank 1 Sensor 1)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 on page DI–44.

DTC No.	DTC Detecting Condition	Trouble Area
P1133/21	After engine is warmed up and during vehicle driving at engine speed 1,400 rpm or more and vehicle speed 60 km/h (38 mph) or more. If response characteristic of A/F sensor becomes deteriorated (2 trip detection logic)	• Open or short in A/F sensor circuit • A/F sensor • Air induction system • Fuel pressure • Injector • Engine ECU

WIRING DIAGRAM

Refer to DTC P0125/91 on page DI–44.

INSPECTION PROCEDURE

HINT:

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

1	**Are there any other codes (besides DTC P1133/21) being output?**

YES → **Go to relevant DTC chart.**

NO

2	**Read value for voltage output of A/F sensor on hand–held tester.** **(See page DI–44 on step 2)**

OK → **Go to step 8.**

NG

3	Check for open and short in harness and connector between engine ECU and A/F sensor (See page IN–20).

NG → Repair or replace harness or connector.

OK

4	Check resistance of A/F sensor heater (See page DI–44).

NG → Replace A/F sensor.

OK

5	Check air induction system.

NG → Repair or replace.

OK

6	Check fuel pressure (See page DI–4).

NG → Check and repair fuel pump, pressure regulator, fuel pipe line and filter.

OK

7	Check injector injection (See Pub No. RM519E on page EG–140).

NG → Replace injector.

OK

Replace A/F sensor.

8	Perform confirmation driving pattern (See page DI–44 on step 9).

Go

9	Is there DTC P1133/21 being output again?

YES → Check and replace ECU (See page IN–20).

NO

10	Did vehicle runs out of fuel in past?

NO → Check for intermittent problems (See page DI–4).

YES

DTC P1133/21 is caused by shortage out of fuel.

DI9C0-01

DTC	P1135	A/F Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 on page DI–44.

DTC No.	DTC Detecting Condition	Trouble Area
P1135	When heater operates, heater current exceeds 8 A (2 trip detection logic)	• Open or short in heater circuit of A/F sensor • A/F sensor heater • Engine ECU
	Heater current of 0.25 A or less when heater operates (2 trip detection logic)	

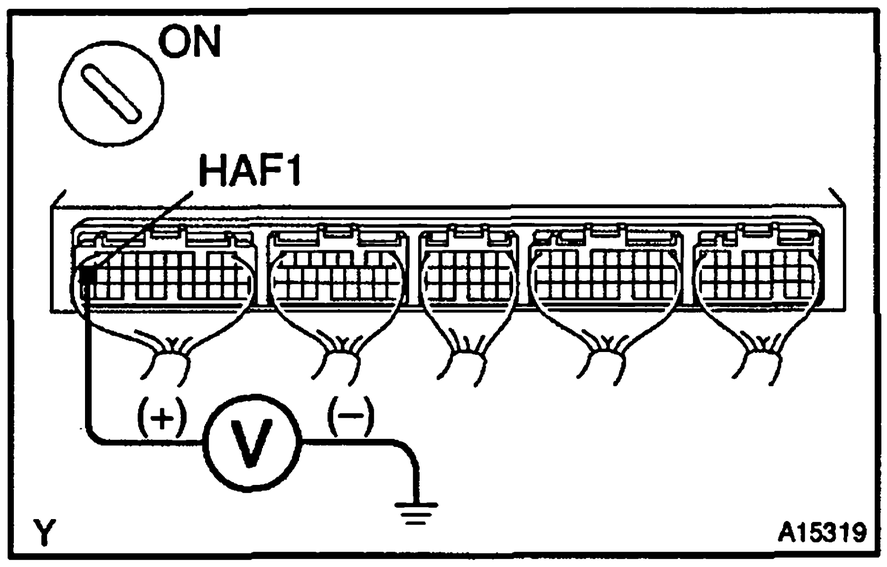
WIRING DIAGRAM

Refer to DTC P0125/91 on page DI–44.

INSPECTION PROCEDURE

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

1	**Check voltage between HAF1 terminal and body ground.**



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

CHECK:
Measure the voltage between HTAF terminal and the body ground.

OK:
9 – 14 V

OK → **Check and replace ECM (See page IN–20).**

NG

2	Check resistance of A/F sensor heater (See page DI–44).

NG → Replace A/F sensor.

OK →

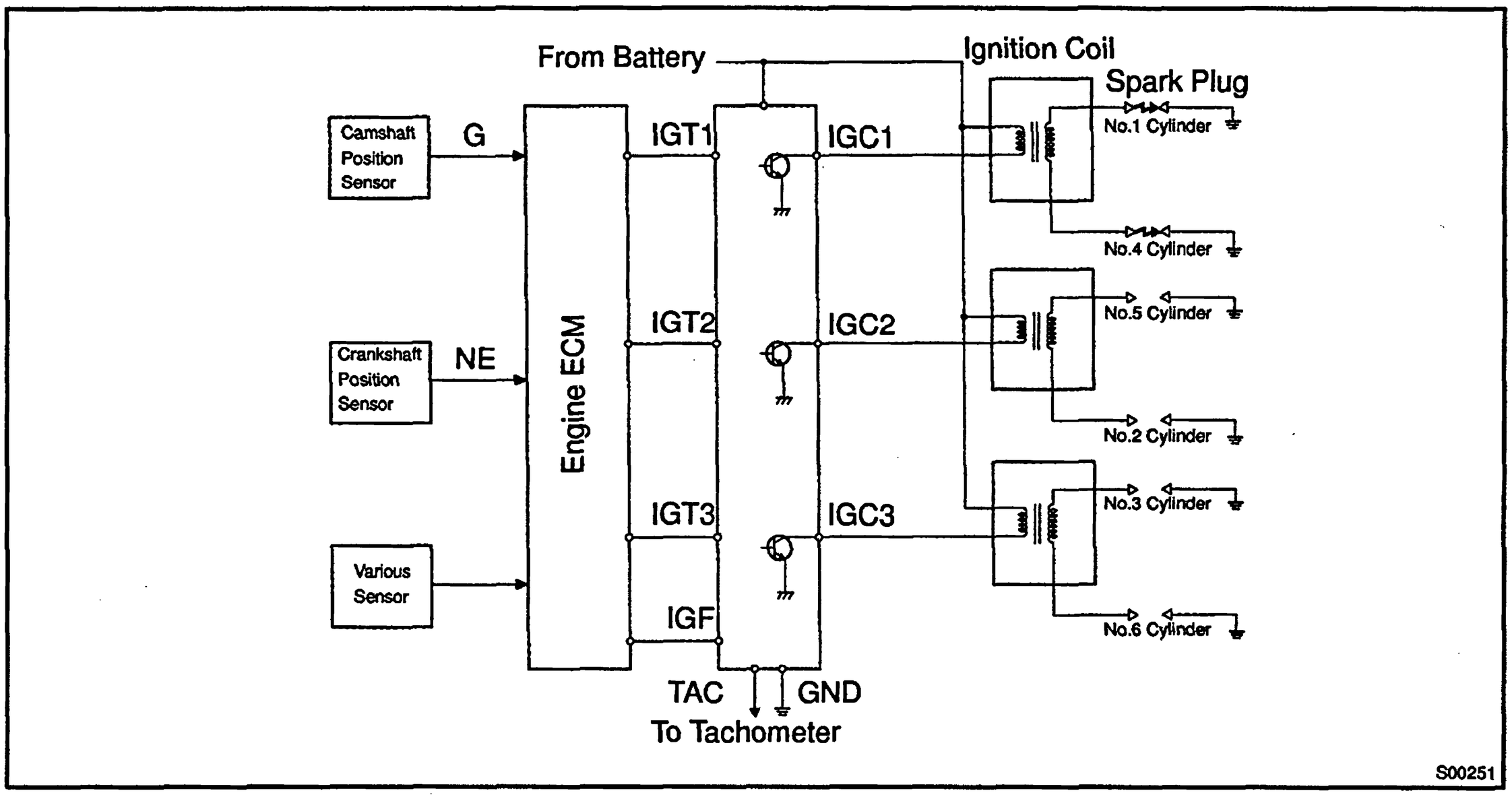
Check and repair harness or connector between EFI main relay (Marking: EFI) and A/F sensor, and A/F sensor and engine ECU (See page IN–20).

DI6B1–02

DTC	P1300/14	Igniter Circuit Malfunction

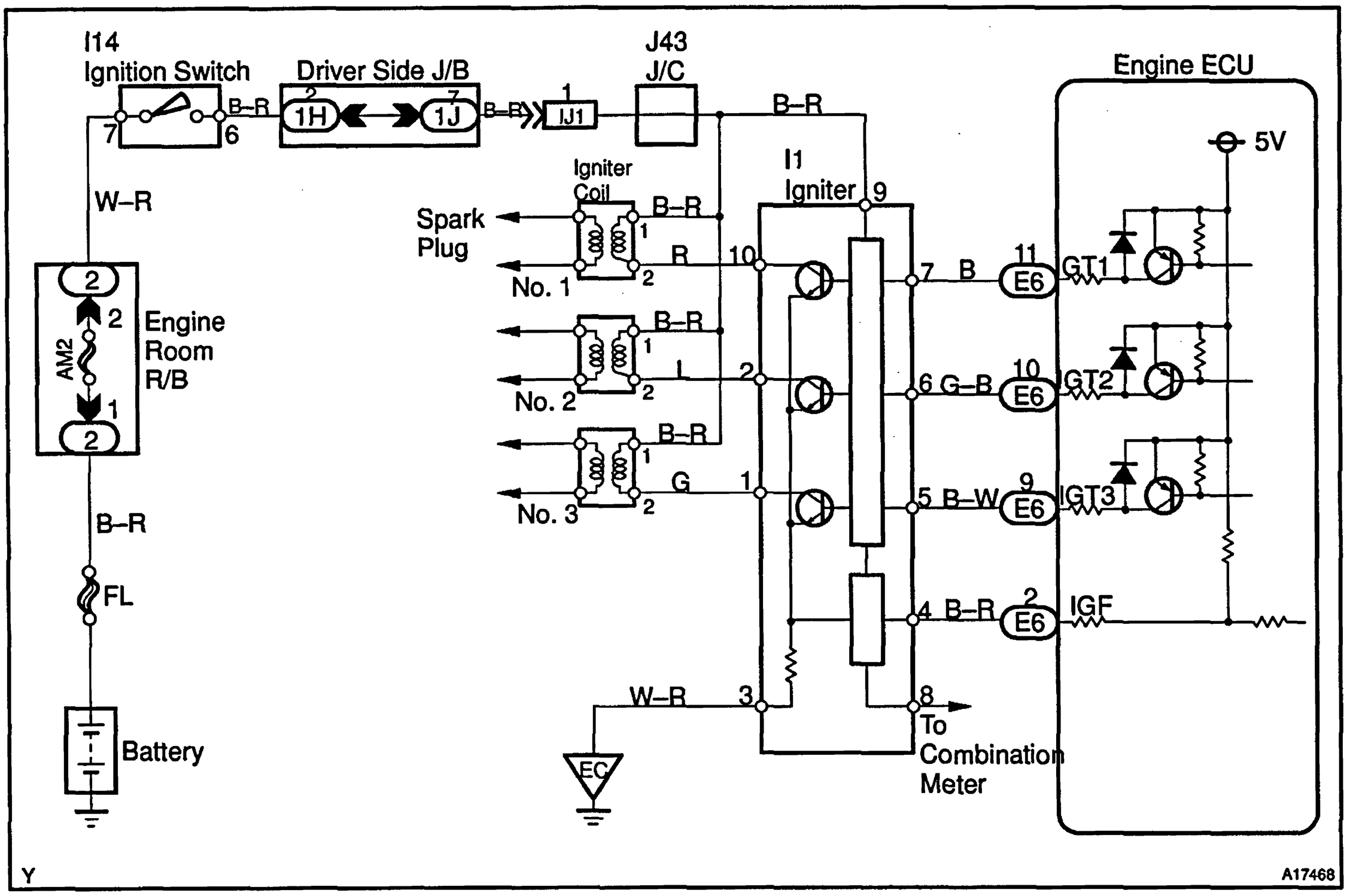
CIRCUIT DESCRIPTION

The DIS (Direct Ignition System) has been adopted. The DIS improves the ignition timing accuracy, reduces high–voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor. The DIS is a 2–cylinder simultaneous ignition system which ignites 2 cylinders simultaneously with one ignition coil. In the 2–cylinder simultaneous ignition system, each of the 2 spark plugs is connected to the end of the secondary winding. High voltage generated in the secondary winding is applied directly to the spark plugs. The sparks of the 2 spark plugs pass simultaneously from the center electrode to the ground electrode. The engine ECU determines the ignition timing and outputs the ignition signals (IGT) to each cylinder. Based on these IGT signals, the igniter controls the primary ignition signals (IGC) for all the ignition coils. At the same time, the igniter also sends an ignition confirmation signal (IGF) as a fail–safe measure to the engine ECU.



DTC No.	DTC Detecting Condition	Trouble Area
P1300/14	Condition (a) is repeated 3 times consecutively during 6 consecutive IGT signals while engine is running (a) IGF signal is not input to engine ECU for 2 or more ignitions	• Open or short in IGF and IGT circuit from igniter to engine ECU • Igniter • Ignition coil • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

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

1	**Check spark plug and spark (See Pub. No. RM519E on page IG–3).**

NG → **Go to step 4.**

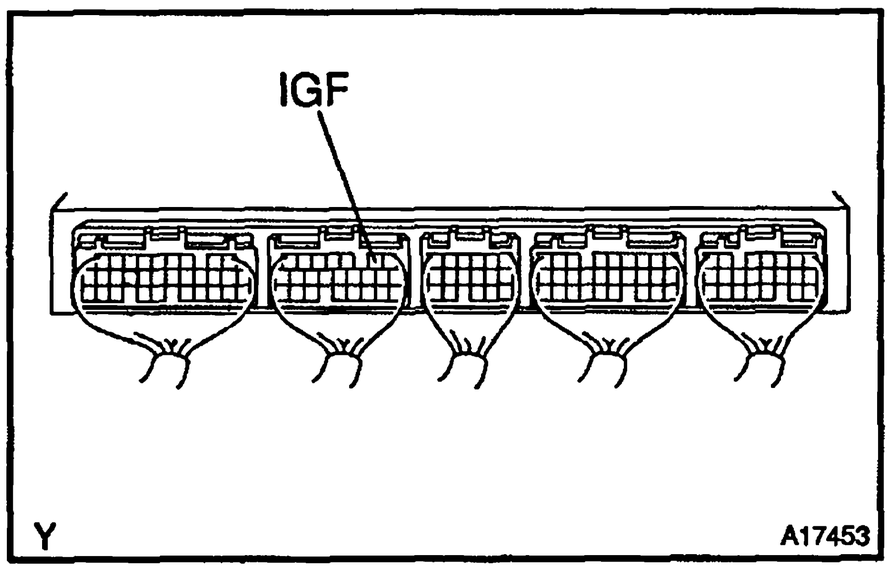
OK

2	**Check for open and short in harness and connector in IGF signal circuit between engine ECU and igniter (See page IN–20).**

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

OK

3	**Disconnect igniter connector and check voltage between terminal IGF of engine ECU connector and body ground.**



PREPARATION:

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

CHECK:

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

OK:

4.5 – 5.5 V

OK → **Replace igniter.**

NG

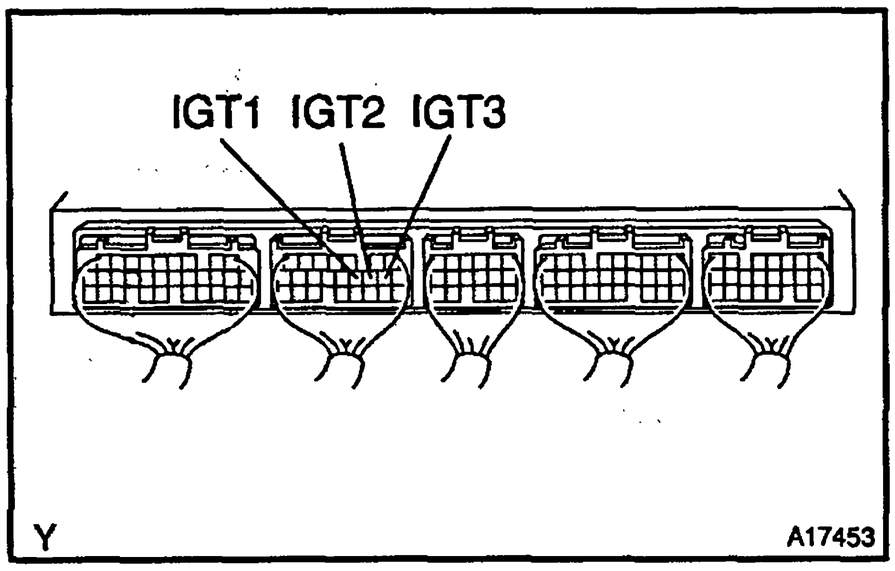
Check and replace engine ECU (See page IN–20).

4	**Check for open and short in harness and connector in IGT 1 – 3 signal circuit between engine ECU and igniter (See page IN–20).**

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

OK

5	**Check voltage between terminals IGT 1 – 3 of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment door.

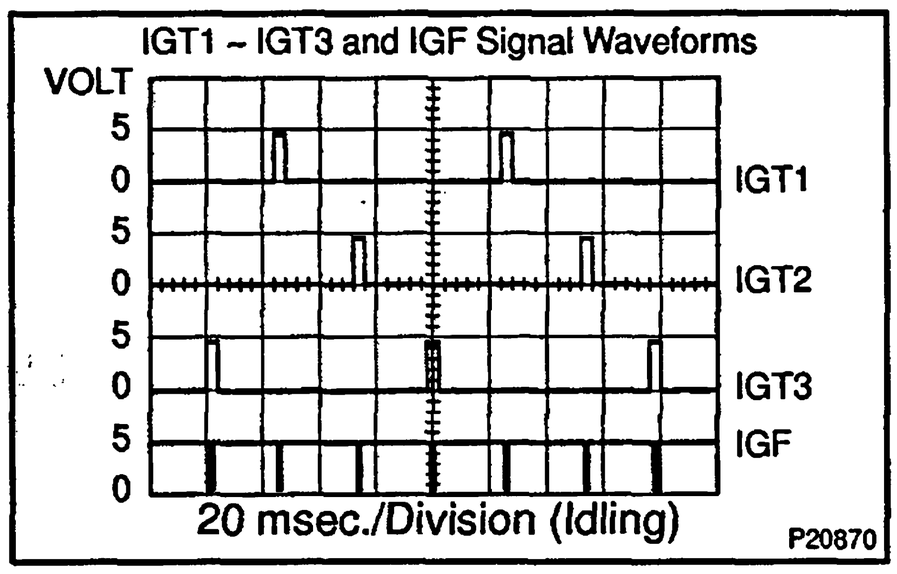
(b) Start the engine.

CHECK:

Measure the voltage between terminal IGT 1 – 3 of the engine ECU connector and the body ground.

OK:

0.1 – 4.5V



Reference: INSPECTION USING OSCILLOSCOPE

During idling, check the waveform between terminals IGT 1 – 3, IGF and E1 of the engine ECU connector.

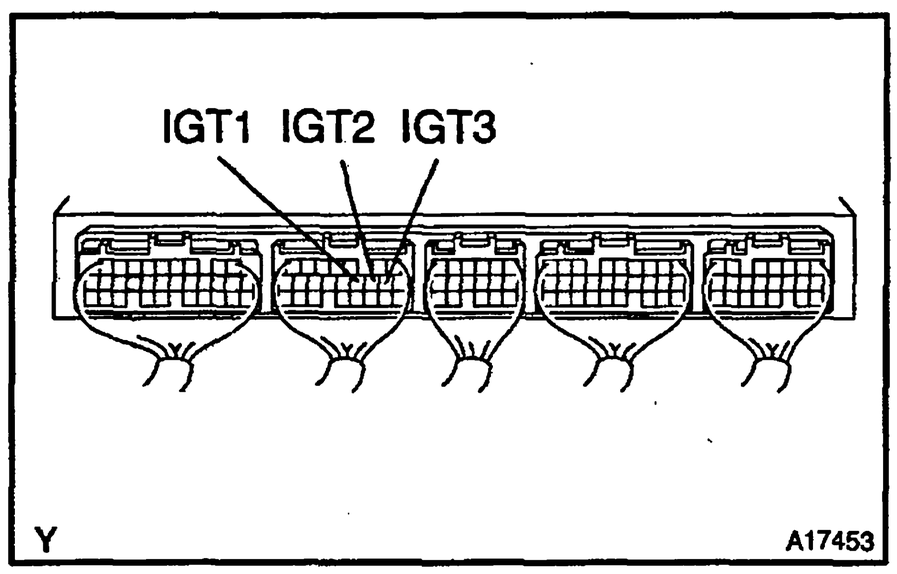
HINT:

The correct waveform is as shown in the illustration.

NG → **Check and replace engine ECU (See page IN–20).**

OK

6	**Disconnect igniter connector and check voltage between terminals IGT 1 – 3 of engine ECU connector and body ground.**



PREPARATION:

(a) Disconnect the igniter connector door.

(b) Remove the glove compartment.

CHECK:

Measure the voltage the between terminals IGT 1 – 3 of the engine ECU connector and the body ground when the engine is cranked.

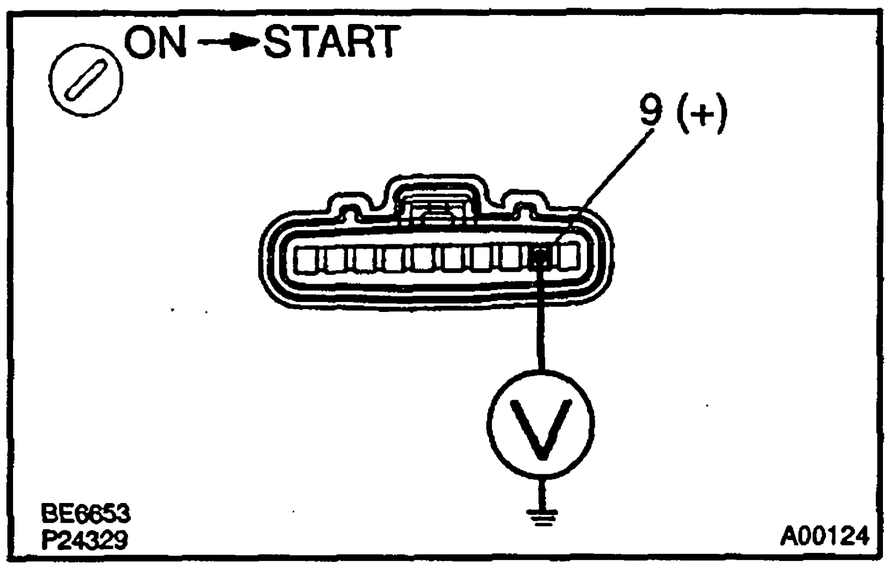
OK:

0.1 – 5.0V

NG → **Check and replace engine ECU (See page IN–20).**

OK

7	**Check voltage between terminal 9 of igniter connector and body ground.**



PREPARATION:
Disconnect the igniter connector.
CHECK:
Measure the voltage between terminal 9 of the igniter connector and the body ground, when the ignition switch is turned from "ON" to "START".
OK:
9 – 14 V

NG → Check and repair igniter power source circuit.

OK

8	**Check for open and short in harness and connector between ignition switch and ignition coil, and ignition coil and igniter (See page IN–20).**

NG → Repair or replace harness or connector.

OK

9	**Check ignition coil (See Pub. No. RM519E on page IG–7).**

NG → Replace ignition coil.

OK

10	**Check EFI main relay (Marking: EFI).**

NG → Replace EFI main relay (Marking: EFI).

OK

Replace igniter.

D6B2–02

DTC	P1335/13	Crankshaft Position Sensor Circuit Malfunction (During engine running)

CIRCUIT DESCRIPTION

Refer to DTC P0335/12, 13 on page DI–69.

DTC No.	DTC Detecting Condition	Trouble Area
P1335/13	No crankshaft position sensor signal to ECM with engine speed 1,500 rpm or more	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Signal plate • Engine ECU

WIRING DIAGRAM

Refer to DTC P0335/12, 13 on page DI–69.

INSPECTION PROCEDURE

Refer to DTC P0335/12, 13 on page DI–69

D9Q1–01

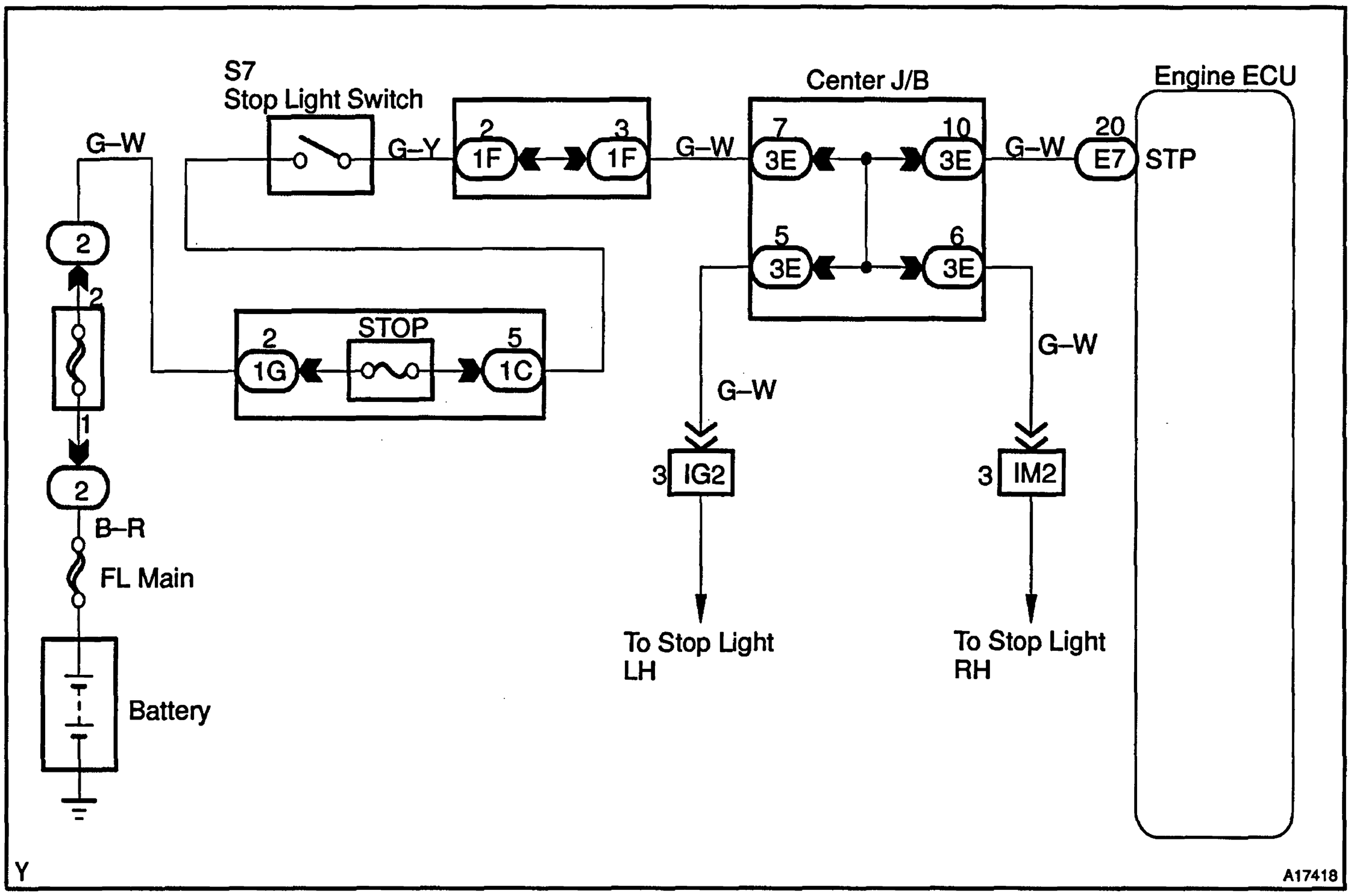
DTC	P1520/52	Stop Light Switch Malfunction

CIRCUIT DESCRIPTION

This circuit is designed to prevent the engine from stalling when brakes are suddenly applied. When the brake pedal is depressed, this switch sends a signal to the engine ECU.

DTC No.	DTC Detection Condition	Trouble Area
P1520/95	No stop light signal continues for 0.5 seconds	• Open or short in stop light switch circuit • Stop light switch • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

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

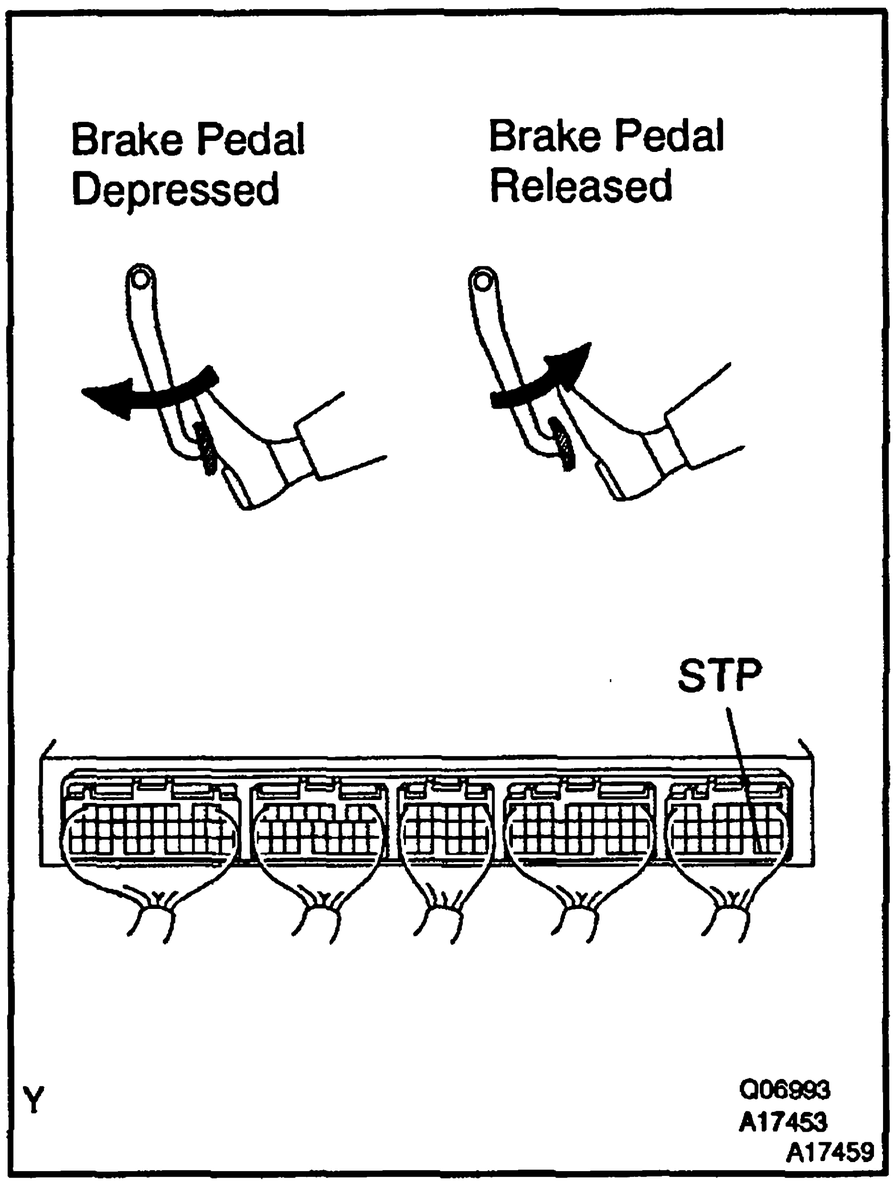
1	Check operation of stop light.

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

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

OK

2	Check STP signal.



When using hand–held tester:
CHECK:
Read the STP signal the a hand–held tester.
OK:

Brake Pedal	STP Signal
Depressed	ON
Released	OFF

When not using hand–held tester:
PREPARATION:
(a) Disconnect the engine ECU with connector from the body panel.
(b) Turn the ignition switch ON.
CHECK:
Measure the voltage between terminal STP of the engine ECU connector and the body ground.
OK:

Brake Pedal	Voltage
Depressed	9.0 – 14 V
Released	Below 1.5 V

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

NG

3	**Check harness and connector between engine ECU and stop light switch (See page IN–10).**

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

OK

Check and replace engine ECU (See page IN–10).

DI9Q2-01

DTC	P1600/96	Engine ECU BATT Malfunction

CIRCUIT DESCRIPTION

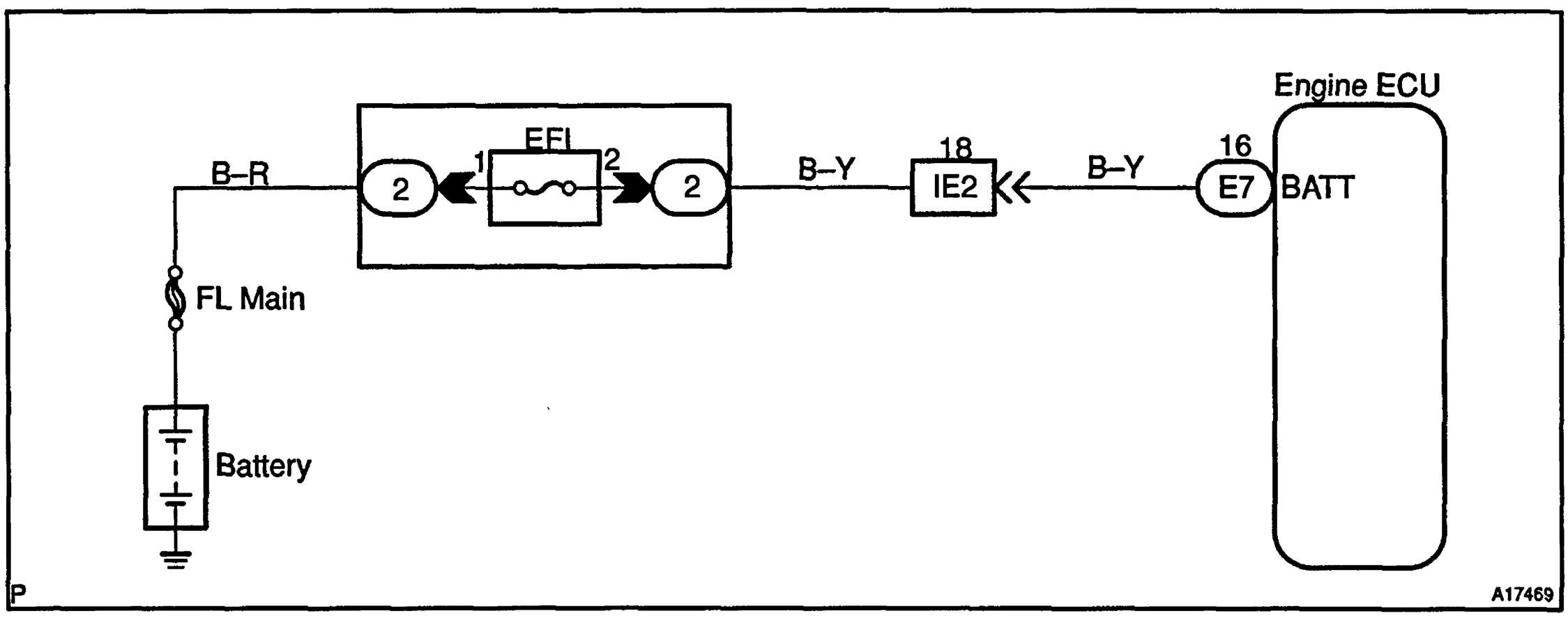
Battery positive voltage is supplied to terminal BATT of the engine ECU even when the ignition switch is OFF.This is for use by the DTC memory and air–fuel ratio adapting control value memory, etc.

DTC No.	DTC Detection Condition	Trouble Area
P1600/96	Open in back up power source circuit	• Open in back up power source circuit • Engine ECU

HINT:

If DTC P1600/96 appears, the engine ECU does not store another DTC.

WIRING DIAGRAM

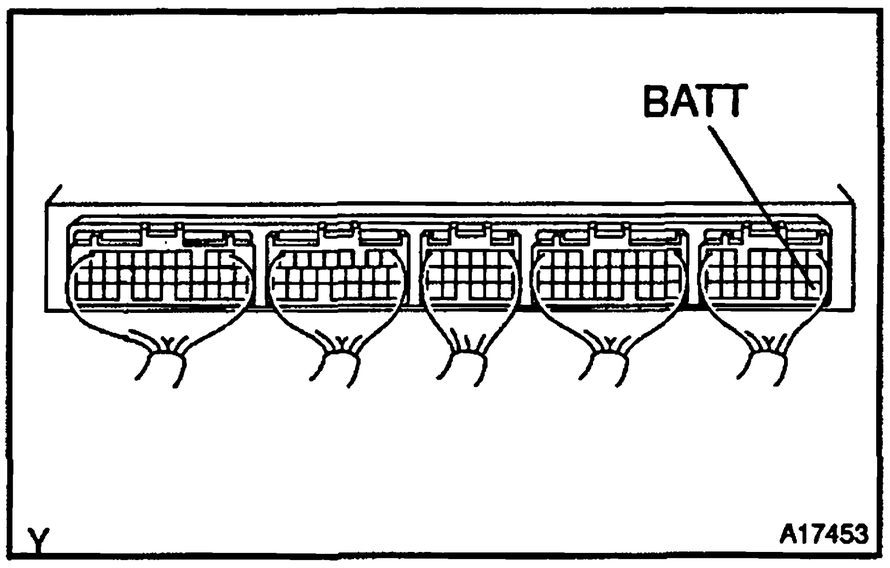


INSPECTION PROCEDURE

HINT:

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

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



PREPARATION:

(a) Disconnect the engine ECU with connector from the body panel.

(b) Turn the ignition switch ON.

CHECK:

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

OK:

9 – 14 V

OK → **Check and replace engine ECU (See page IN–20).**

NG

2	**Check EFI fuse.**

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

OK

Check and repair harness or connector between battery and EFI fuse and engine ECU (See page IN–20).

D19C3–01

DTC	P1633/89	ECU Malfunction (ETCS Circuit)

CIRCUIT DESCRIPTION

Refer to DTC P1129/89 on page DI–96.

INSPECTION PROCEDURE

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

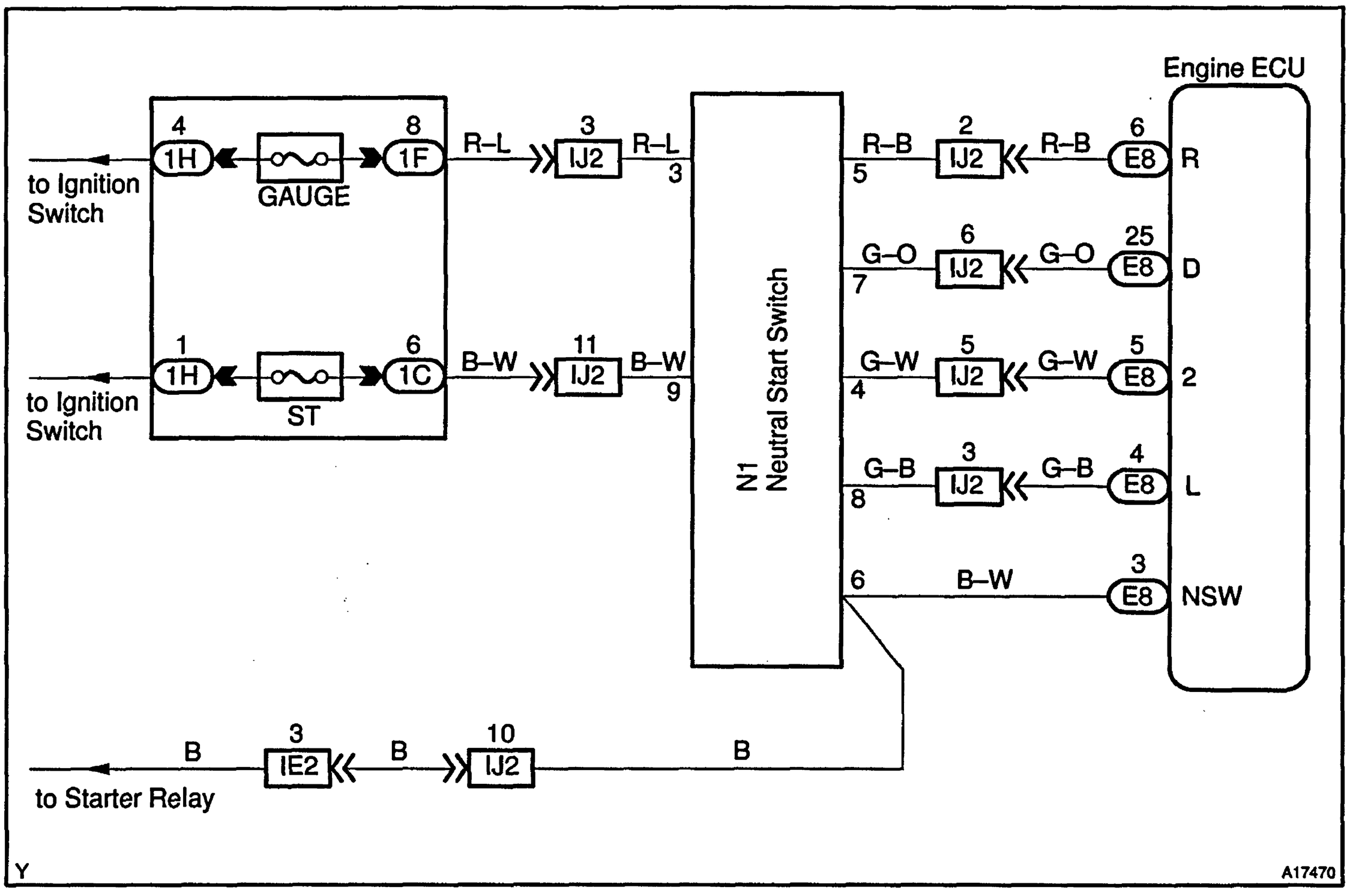
Replace ECU (See page IN–20).

Neutral Start Switch Circuit

CIRCUIT DESCRIPTION

The neutral start switch goes on when the shift lever is in the N or P shift position. When it goes on, terminal NSW of the engine ECU is grounded to the body ground via the starter relay, thus the terminal NSW voltage becomes 0V. When the shift lever is in the D, 2, L or R position, the neutral start switch goes off, so the voltage of engine ECU terminal NSW becomes battery voltage and 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 and for idle speed control (estimated control), etc.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check R, 2, L and NSW signals.**

When using hand–held tester:

PREPARATION:

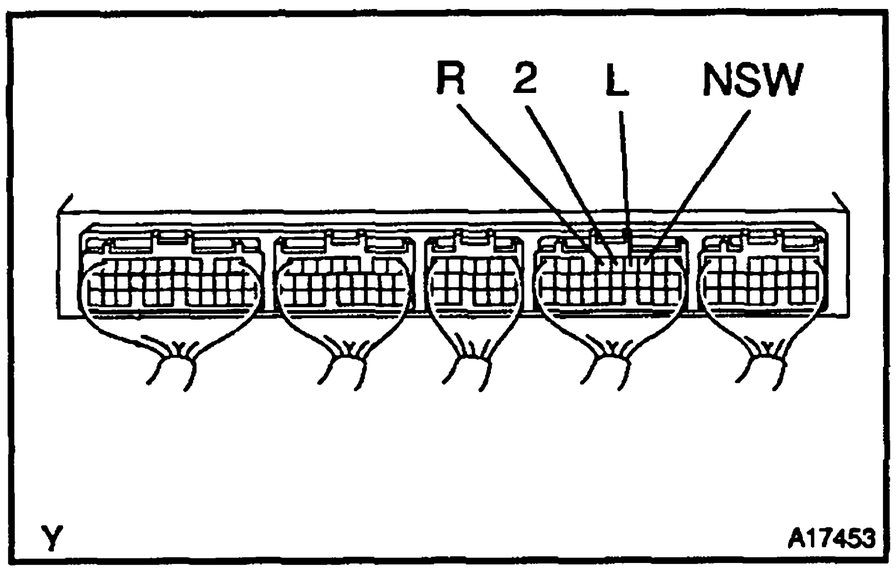
Turn the ignition switch ON.

CHECK:

When shifting the shift lever to the P, R, N, 2, or L positions, read the NSW, R, 2 and L signal on the hand–held tester.

OK:

Shift position	Signal
P, N	NSW OFF → ON
R	R OFF → ON
2	2 OFF → ON
L	L OFF → ON



When not using hand–held tester:

PREPARATION:

Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals R, NSW, 2, L of the engine ECU and the body ground when the shift lever is shifted to the following positions.

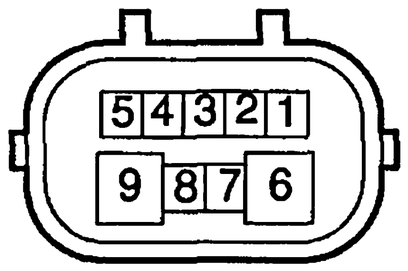
OK:

Position	R–Body ground	NSW–Body ground	2–Body ground	L–Body ground
P, N	Below 1 V	Below 1 V	Below 1 V	Below 1 V
R	7.5 – 14 V	7.5 – 14 V	Below 1 V	Below 1 V
D	Below 1 V	7.5 – 14 V	Below 1 V	Below 1 V
2	Below 1 V	7.5 – 14 V	7.5 – 14 V	Below 1 V
L	Below 1 V	7.5 – 14 V	Below 1 V	7.5 – 14 V

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–21).**

NG

2	Check neutral start switch.



N D06561

PREPARATION:
Remove the neutral start switch connector.

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

OK:

Shift position	Terminal No. to continuity	Terminal No. to continuity
P	1 – 3	6 – 9
R	2 – 3	–
N	3 – 5	6 – 9
D	3 – 7	–
2	3 – 4	–
L	3 – 8	–

NG → **Replace neutral start switch.**

OK ↓

3	Check harness and connector between battery and neutral start switch, neutral start switch and engine ECU (See page IN–20).

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

OK ↓

Check and replace engine ECU (See page IN–20).

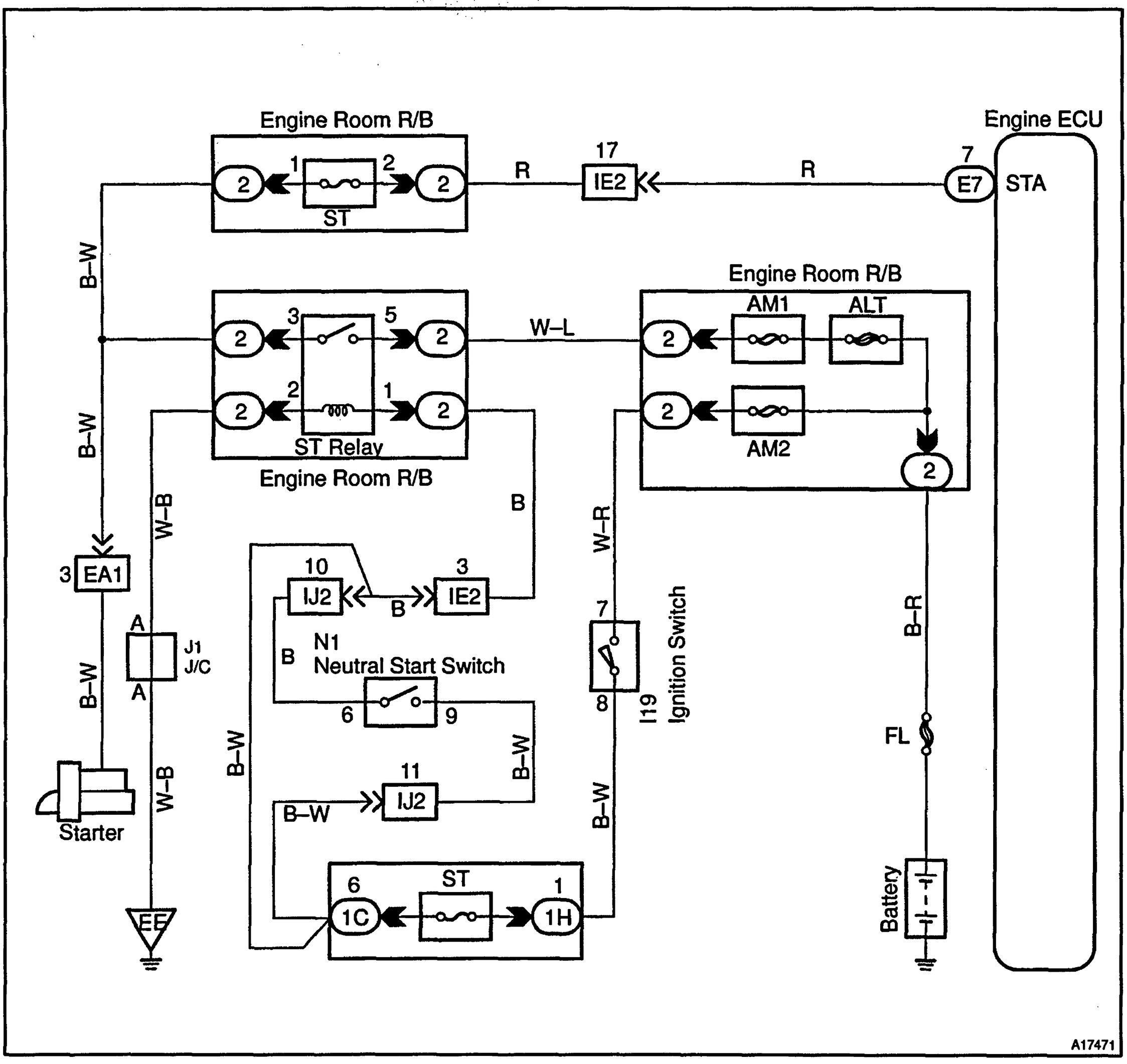
DI6B4–02

Starter Signal Circuit

CIRCUIT DESCRIPTION

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

WIRING DIAGRAM



A17471

INSPECTION PROCEDURE

HINT:

This diagnostic chart is based on the premise that the engine is cranked normally. If the engine is not cranked normally, proceed to the problem symptoms table on page DI–21.

When using hand–held tester

1	**Check STA signal on hand–held tester.**

CHECK:

Read the STA signal on the hand–held tester.

OK:

Ignition Switch Position	ON	START
STA signal	OFF	ON

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–21).**

NG

2	**Check for open in harness and connector between engine ECU and starter relay (Marking: STARTER) (See page IN–20).**

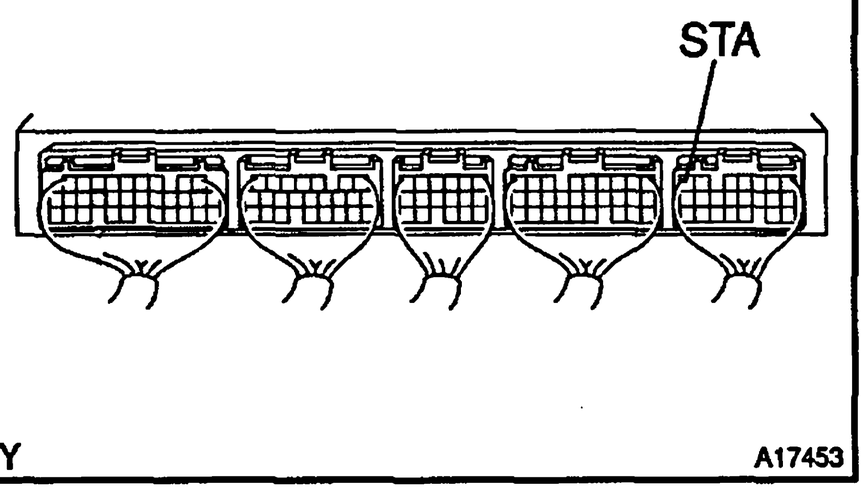
NG → **Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–20).

When not using hand–held tester

1	Check STA voltage of engine ECU.



PREPARATION:
Remove the glove compartment door.
CHECK:
Measure the voltage between terminal STA of the engine ECU connector and the body ground, during the engine cranking.
OK:
6 V or more

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–21).**

NG

2	Check for open in harness and connector between engine ECU and starter relay (Marking: ST) (See page IN–20).

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

OK

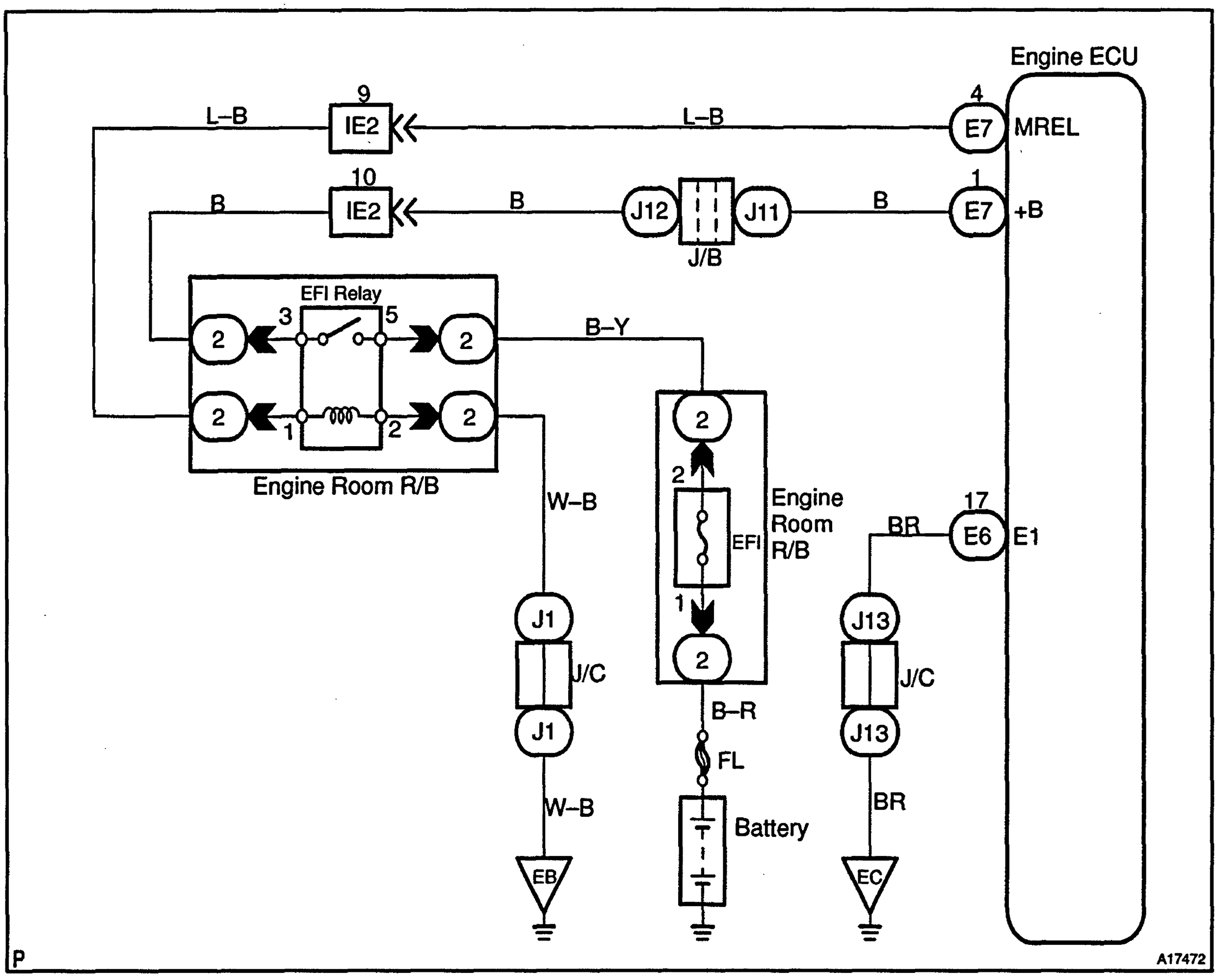
Check and replace engine ECU (See page IN–20).

Engine ECU Power Source Circuit

CIRCUIT DESCRIPTION

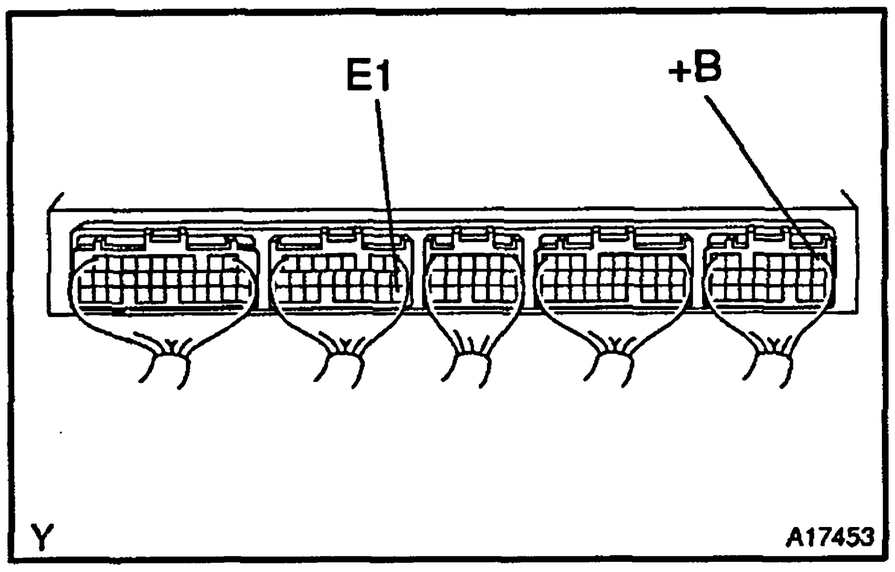
When the ignition switch is turned ON, battery positive voltage is applied to terminal IGSW of the engine ECU and the EFI main relay (Making: EFI) control circuit in the engine ECU sends a signal to terminal MREL of the engine ECU, switching on the EFI main relay. This signal causes the current to flow to the coil, closing the contacts of the EFI main relay and supplying power to terminals +B of the engine ECU.
If the ignition switch is turned OFF, the engine ECU continues to switch on the EFI main relay for maximum 2 seconds to perform the initial setting of the throttle body.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check +B voltage of engine ECU.**



PREPARATION:
(a) Remove the glove compartment door.
(b) Turn the ignition switch ON.
CHECK:
Measure the voltage between terminals +B and E1 of the engine ECU connector.
OK:
9 – 14 V

OK → **Proceed to next circuit inspection shown on Problem symptoms table (See page DI–21).**

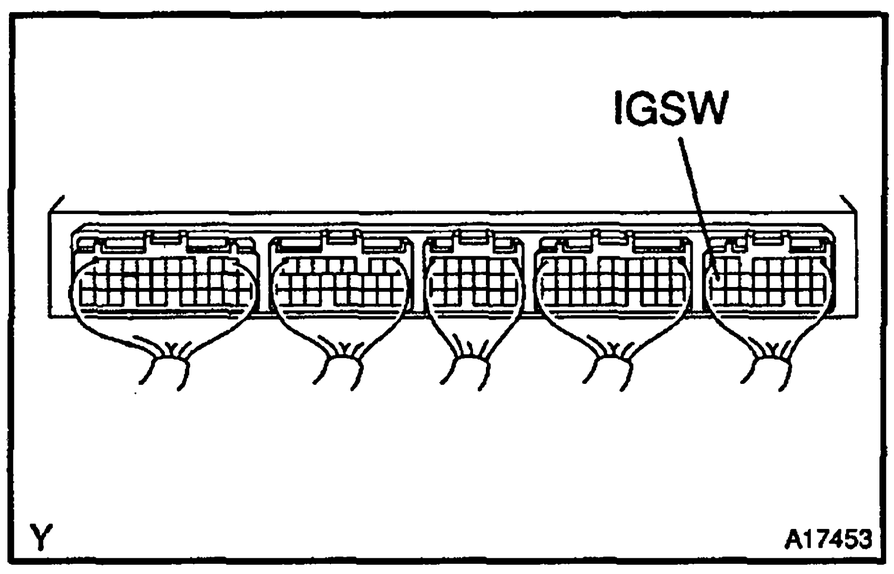
NG

2	**Check for open in harness and connector between terminal E1 of engine ECU and body ground (See page IN–20).**

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

OK

3	**Check IGSW voltage of engine ECU.**



PREPARATION:
Turn the ignition switch ON.
CHECK:
Measure the voltage between terminal IGSW of the engine ECU and the body ground.
OK:
9 – 14 V

OK → **Go to step 6.**

NG

4	**Check IGN fuse.**

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

OK

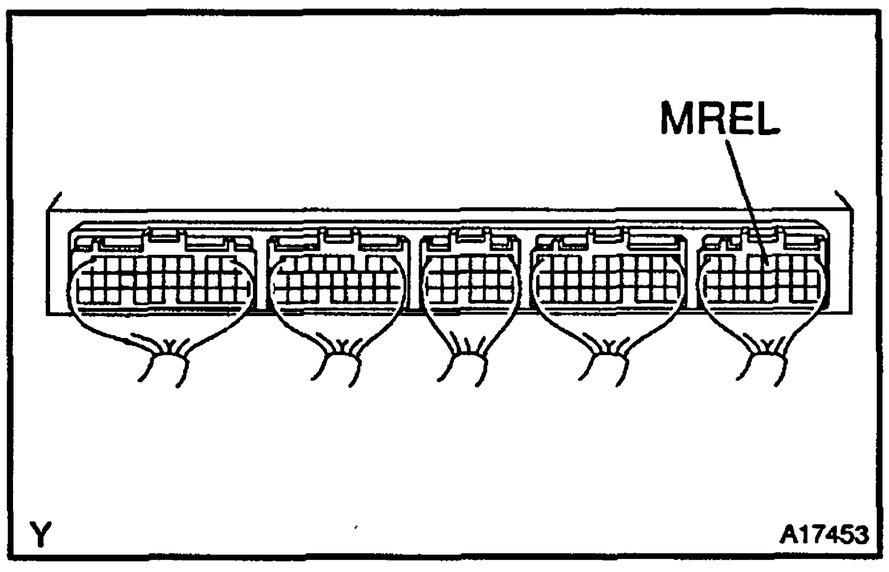
5	**Check ignition switch (See Pub. No. RM517E on page BE–6).**

NG → **Replace ignition switch.**

OK

Check and repair harness and connector between battery and ignition switch, ignition switch and engine ECU.

6	**Check MREL voltage of engine ECU.**



PREPARATION:
Turn the ignition switch ON.
CHECK:
Measure the voltage between terminal MREL of the engine ECU connector and the body ground.
OK:
9 – 14 V

NG → **Check and replace engine ECU (See page IN–20).**

OK

7	Check EFI fuse.

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

OK

8	Check EFI main relay (Marking: EFI).

NG → Replace EFI main relay (Marking: EFI).

OK

9	Check for open and short in harness and connector between terminal MREL of engine ECU and body ground (See page IN–20).

NG → Repair and replace harness or connector.

OK

Check and repair harness or connector between EFI fuse and battery.

DI9Q6–01

Back Up Power Source Circuit

CIRCUIT DESCRIPTION

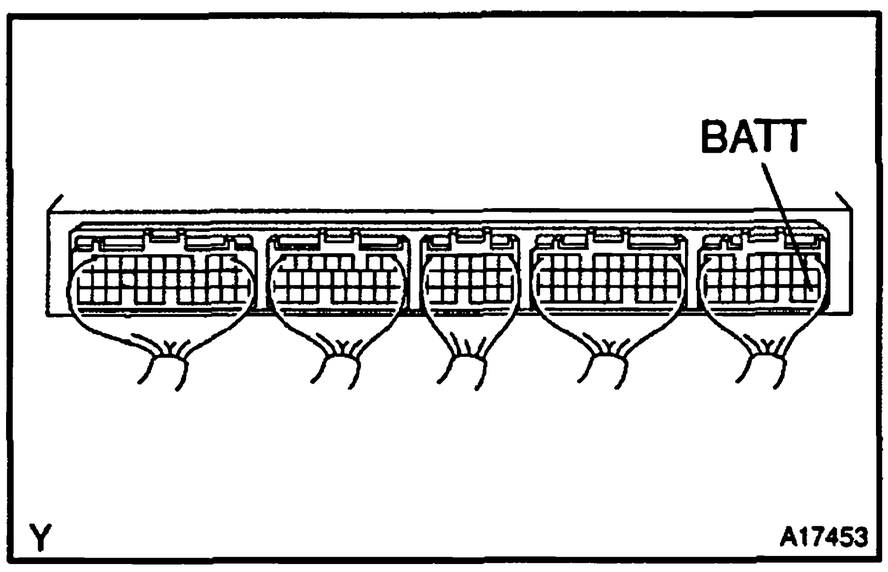
Battery positive voltage is supplied to terminal BATT of the engine ECU even when the ignition switch is OFF. This is for use by the DTC memory, air–fuel ratio adapting control value memory, etc.

WIRING DIAGRAM

Refer to DTC P1600/96 on page DI–114.

INSPECTION PROCEDURE

1	**Check BATT voltage of engine ECU.**



PREPARATION:
Remove the glove compartment door.

CHECK:
Measure the voltage between terminal BATT of the engine ECU connector and the body ground.

OK:
9 – 14 V

OK → **Check and replace engine ECU (See page IN–20).**

NG

2	**Check EFI fuse.**

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

OK

Check and repair harness or connector between battery, EFI fuse and engine ECU.

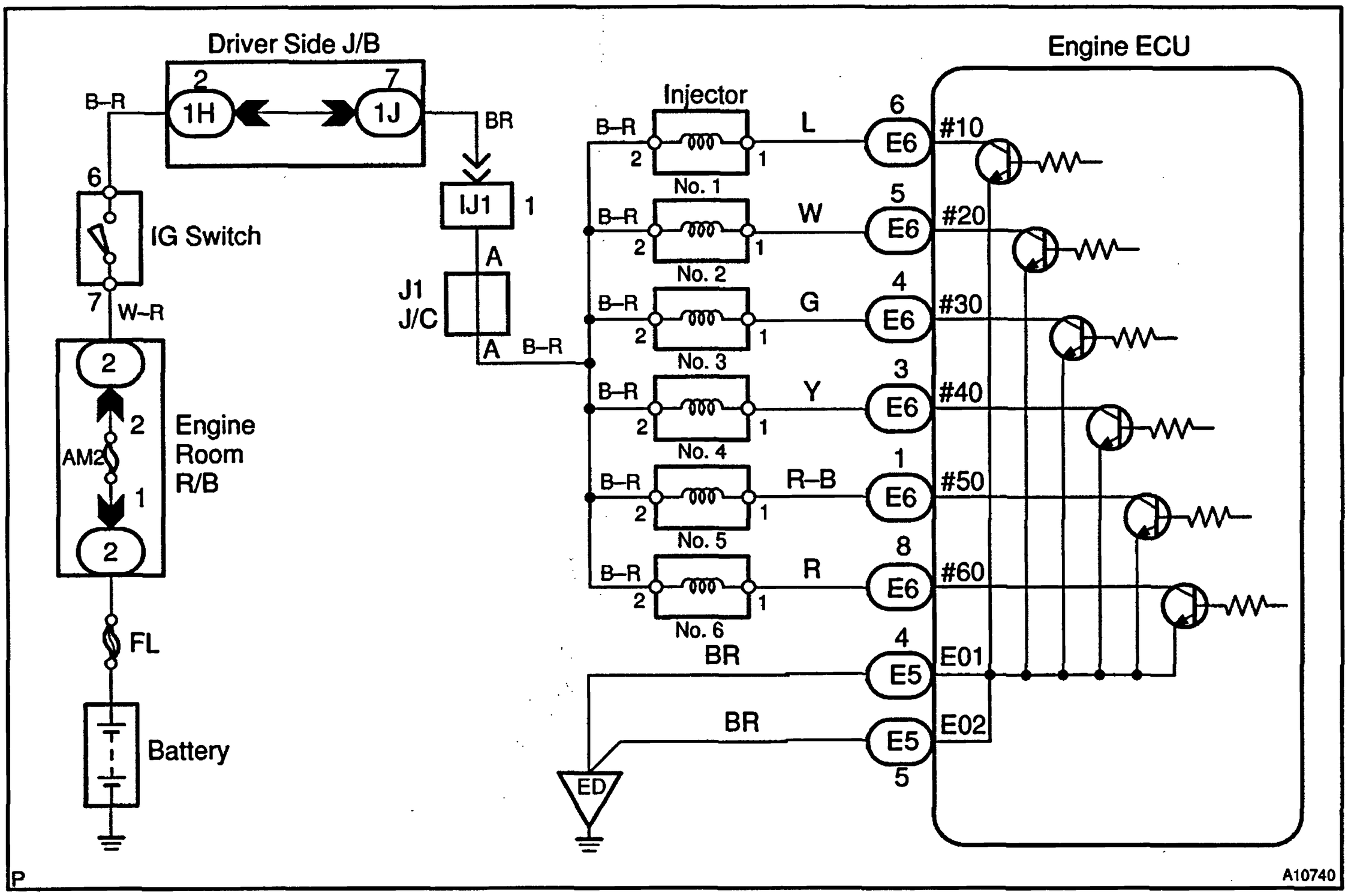
DI9Q7-01

Injector Circuit

CIRCUIT DESCRIPTION

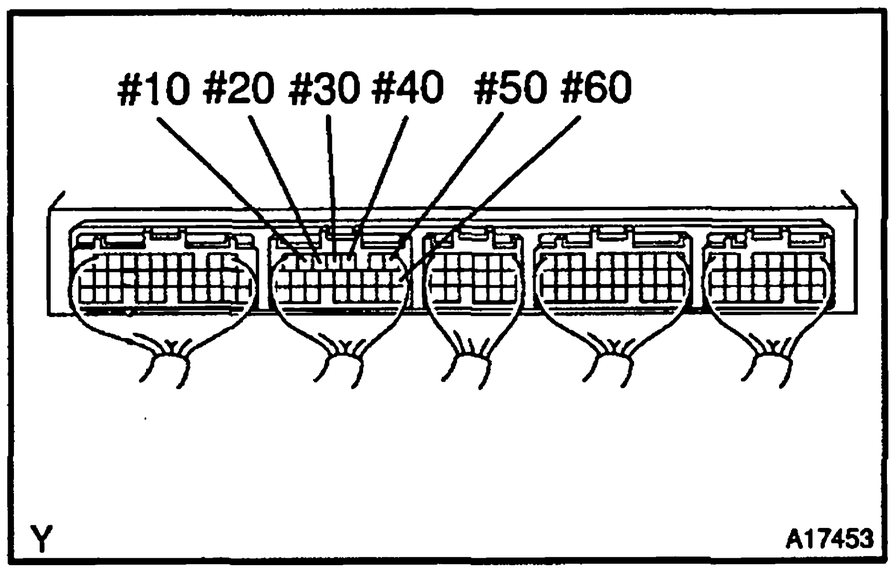
The injectors are provided to the intake manifold. They inject fuel into the cylinders based on the signals from the engine ECU.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check #10, #20, #30, #40, #50 and #60 voltage of engine ECU.**



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

Measure the voltage between terminals #10, #20, #30, #40, #50 and #60 of the engine ECU connector and the body ground.

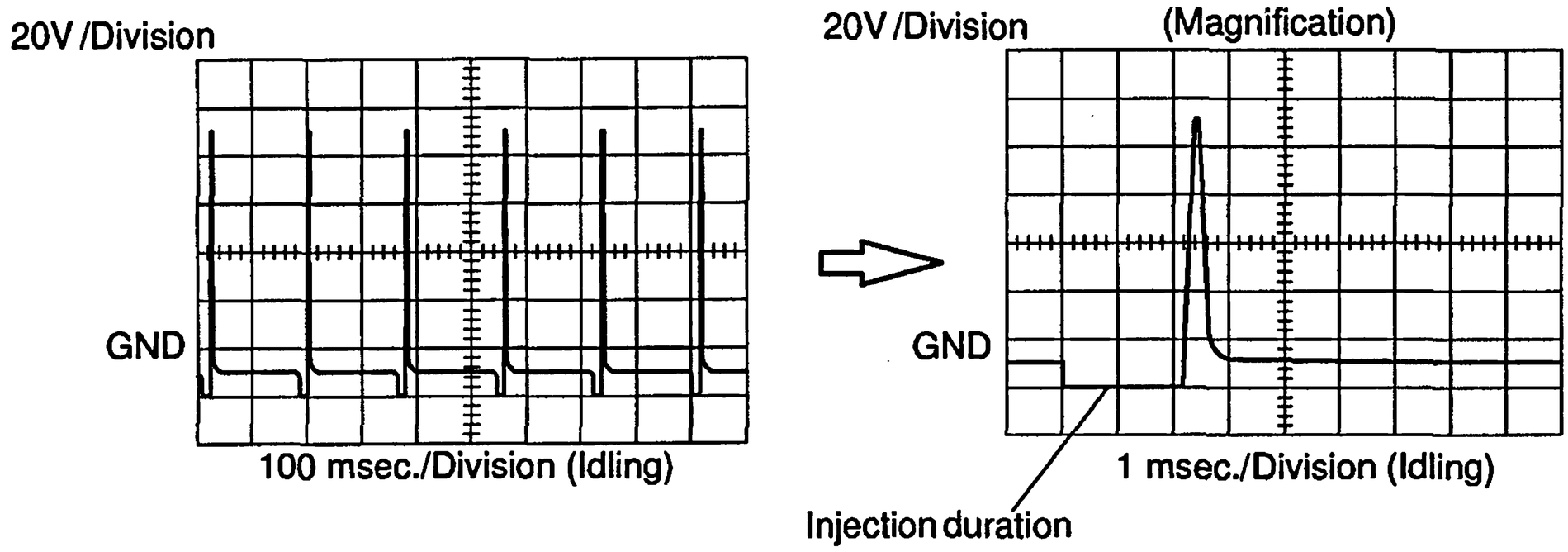
OK:

9 – 14 V

Reference INSPECTION USING OSCILLOSCOPE

With the engine idling, check the waveform between terminals #10 – #60 and E01 of the engine ECU connector.

Injector Signal Waveform



B05020 B05021 A05944

OK → **Go to step 4.**

NG

2	**Check AM2 fuse.**

NG → **Check for short in harness and all components connected to AM2 fuse.**

OK

3	**Check resistance of injectors (See Pub No. RM519E on page EG–140).**

NG → **Replace injector.**

OK

Check and repair harness and connector between engine ECU and battery.

4	Check for open in harness and connector between terminal E01 – E03 of engine ECU connector and body ground (See page IN–20).

NG → Repair or replace harness or connector.

OK

5	Check injector injection (See Pub No. RM519E on page EG–140).

OK → Proceed to next circuit inspection shown on problem symptoms table (See page DI–21).

NG

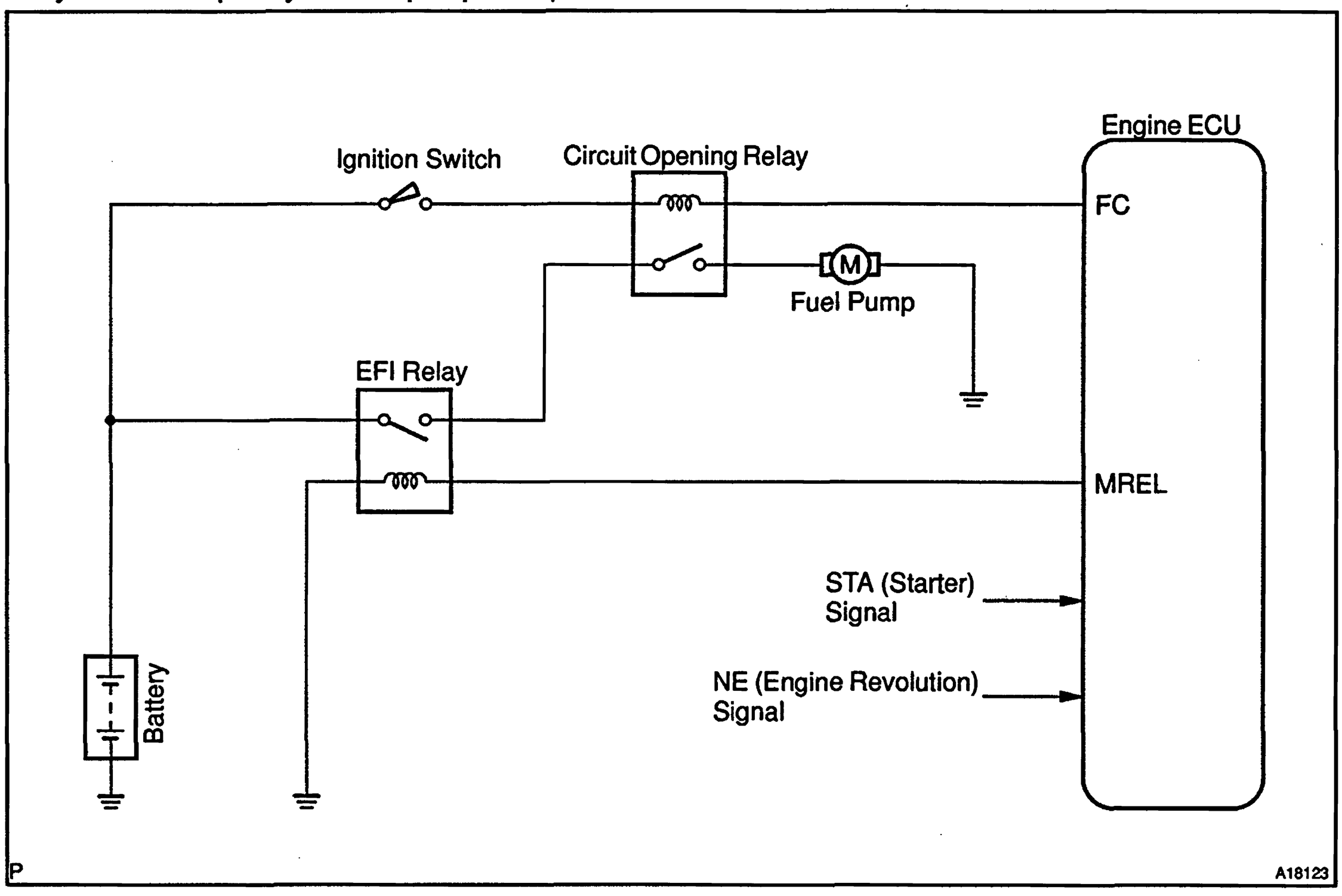
Replace injector(s).

DI9C6-01

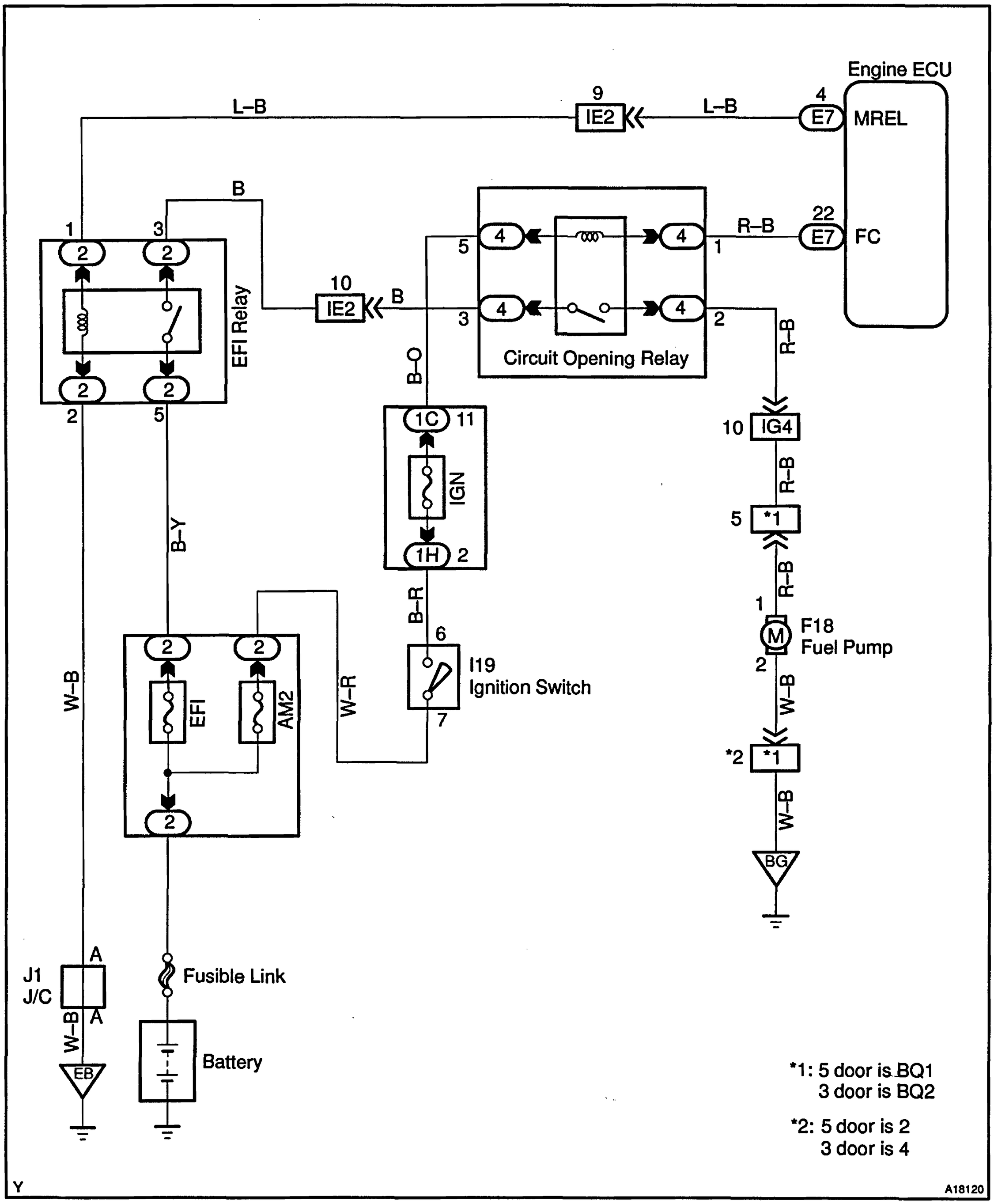
Fuel Pump Control Circuit

CIRCUIT DESCRIPTION

When the engine is cranked, a starter signal (STA) and an engine revolution signal (NE) is transmitted to the engine ECU. Input of these signals causes the engine ECU to operate the EFI relay and circuit opening relay and consequently the fuel pump will operate.



WIRING DIAGRAM



INSPECTION PROCEDURE

When using hand–held tester

1	Check fuel pump operation (See Page DI–4).

OK → Check for starter signal circuit (See page DI–120).

NG

2	Check for engine ECU power source circuit (See page DI–123).

NG → Repair or replace.

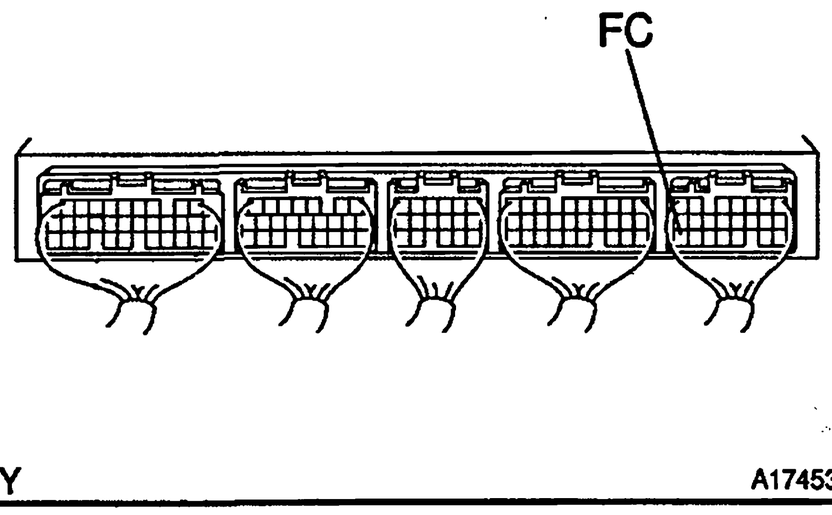
OK

3	Check circuit opening relay.

NG → Replace circuit opening relay.

OK

4	Check FC voltage of engine ECU.



PREPARATION:

(a) Remove the glove compartment door.

(b) Turn the ignition switch ON.

CHECK:

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

OK:

9 – 14 V

NG → **Check for open in harness and connector between EFI main relay and circuit opening relay, and circuit opening relay and engine ECU.**

OK ↓

5	Check fuel pump (See Pub. No. RM519E on page EG–132).

NG → **Repair or replace fuel pump.**

OK ↓

6	Check for open in harness and connector between circuit opening relay and fuel pump, and fuel pump and body ground (See page IN–20).

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

OK ↓

Check and replace engine ECU (See page IN–20).

When not using hand–held tester

1	Check operation of fuel pump (See page DI–4).

OK → Check for starter signal circuit (See page DI–120).

NG

2	Check for engine ECU power source circuit (See page DI–123).

NG → Repair or replace.

OK

3	Check circuit opening relay (See Pub. No. RM519E on page EG–154).

NG → Replace circuit opening relay.

OK

4	Check voltage between terminals FC of engine ECU connector and body ground.

NG → Check for open in harness and connector between EFI main relay and circuit opening relay, and circuit opening relay and engine ECU.

OK

5	Check fuel pump (See Pub. No. RM519E on page EG–132).

NG → Repair or replace fuel pump.

OK

6	Check for open in harness and connector between circuit opening relay and fuel pump, and fuel pump and body ground (See page IN–20).

NG → Repair or replace harness or connector.

OK

Check and replace engine ECU (See page IN–20).

EMISSION CONTROL

EC

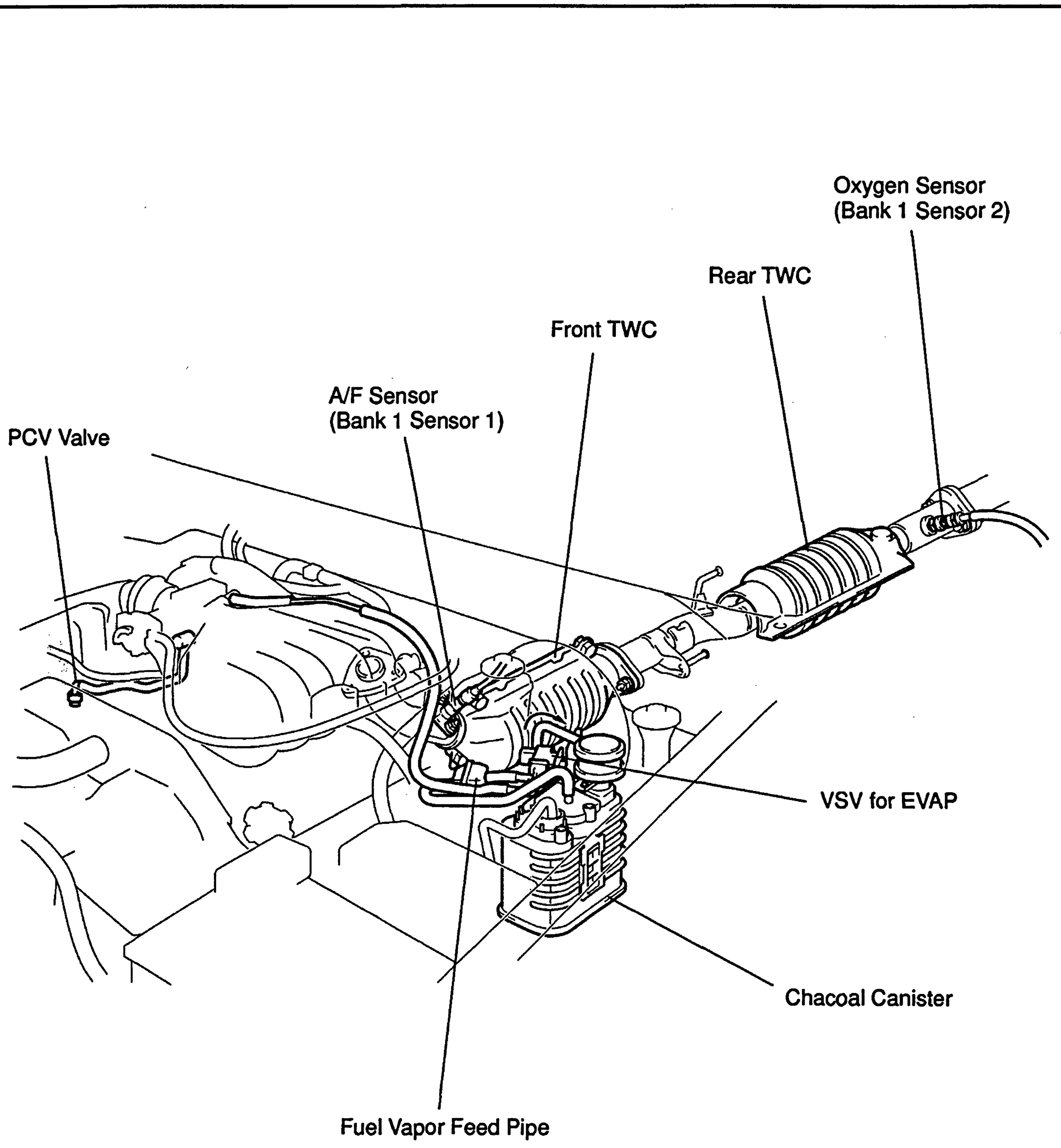
REFER TO 5VZ–FE ENGINE REPAIR MANUAL FOR EMISSION CONTROL (Pub. No. ERM120E)

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

PARTS LAYOUT AND SCHEMATIC DRAWING

LOCATION

EC0LE-01



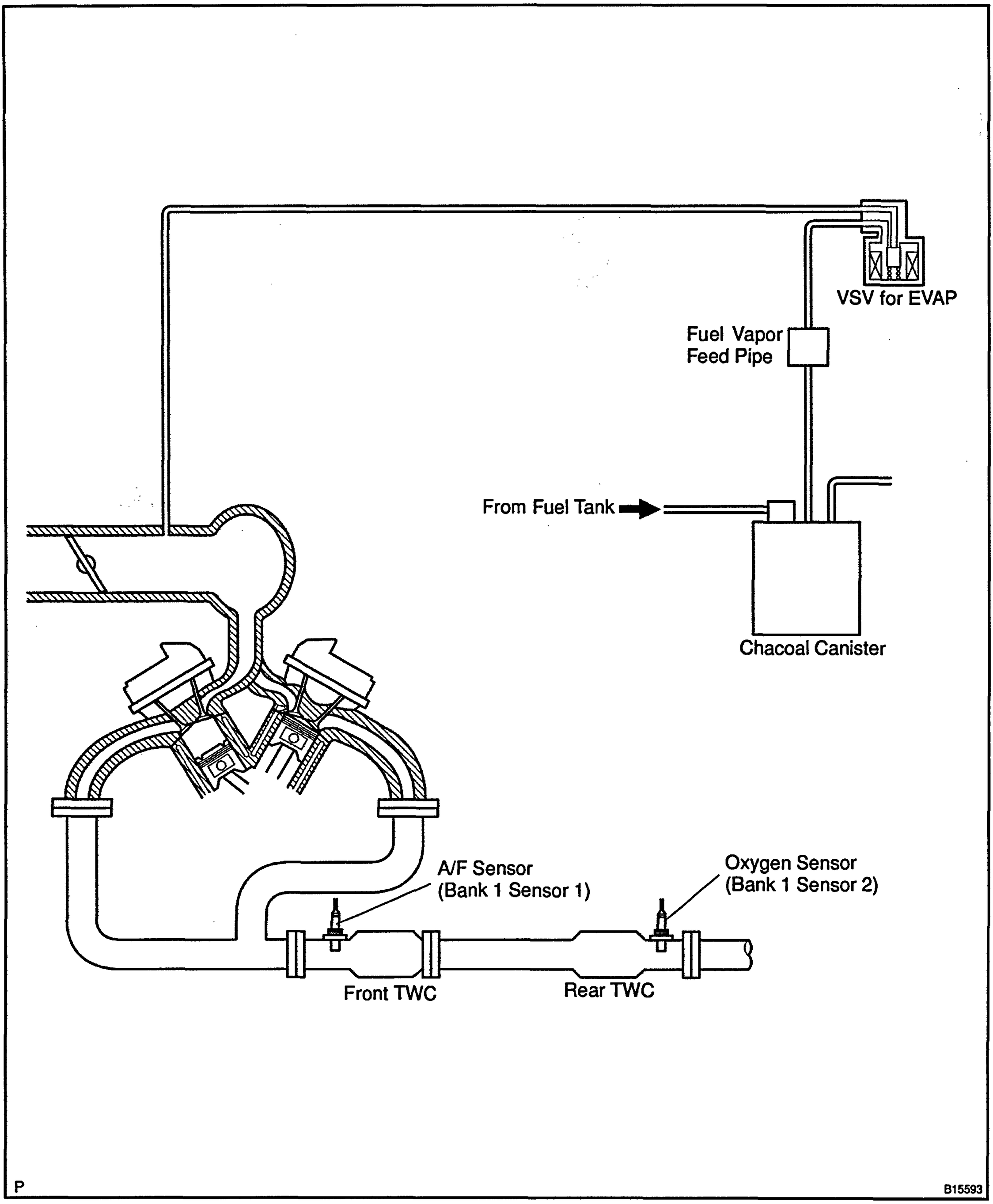
P

B15592

EC

EC0LF–01

DRAWING



P

B15593

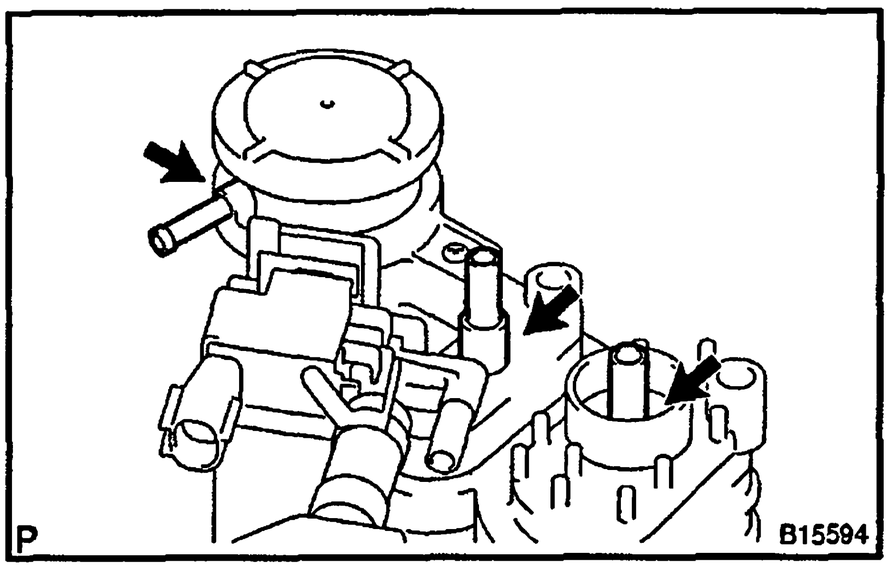
EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

EC0LG-01

INSPECTION

1. REMOVE CHARCOAL CANISTER ASSEMBLY

Disconnect the 2 hoses, and pull up the canister.

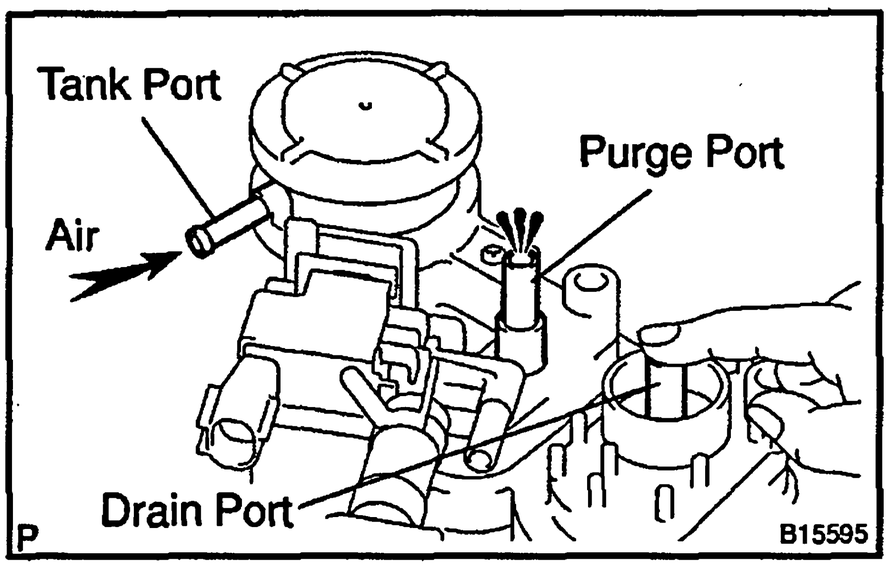


2. INSPECT CHARCOAL CANISTER

(a) Remove the charcoal canister cap.

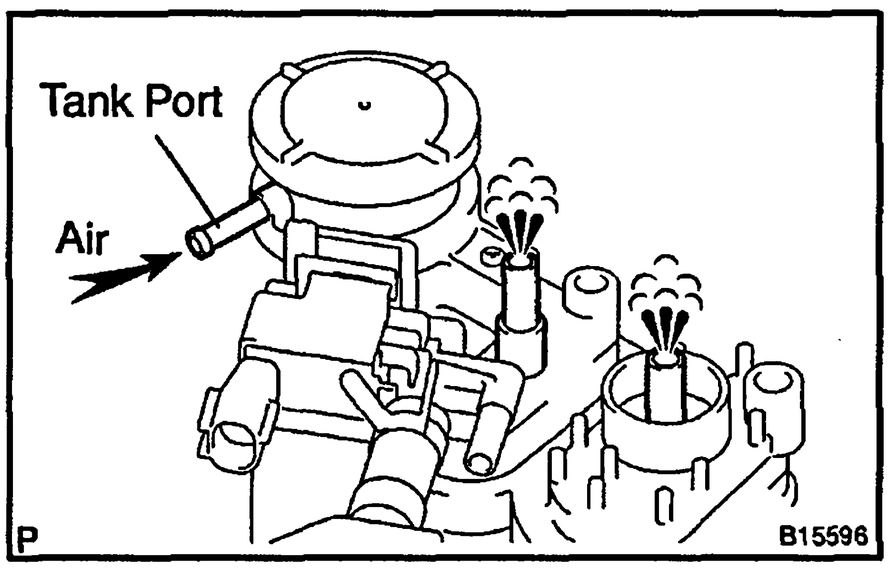
(1) Using a small screwdriver, remove the charcoal canister cap.

(b) Visually check the charcoal canister for cracks or damage.

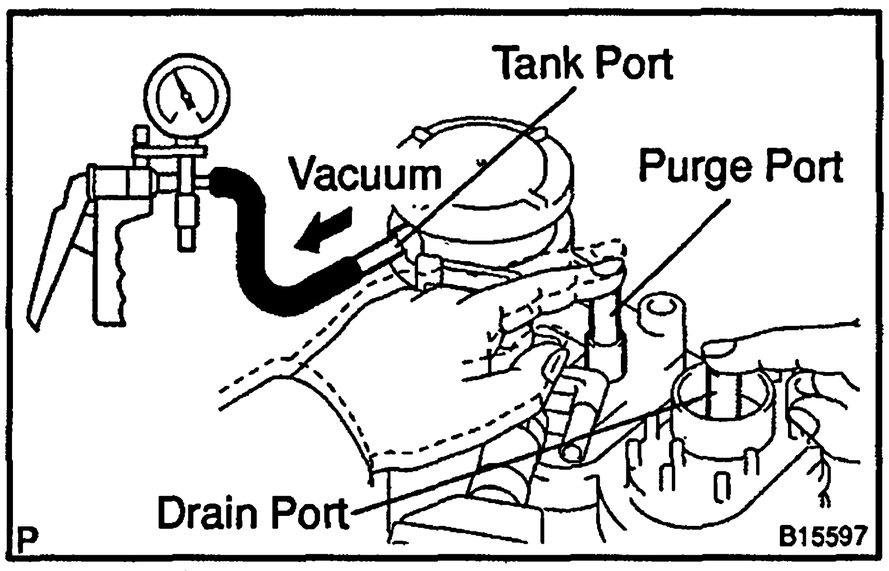


(c) Inspect the charcoal canister operation.

(1) While holding the drain port closed, blow air (4.71 kPa (48 gf/cm^2, 0.68 psi)), into the tank port and check that air flows from the purge port.

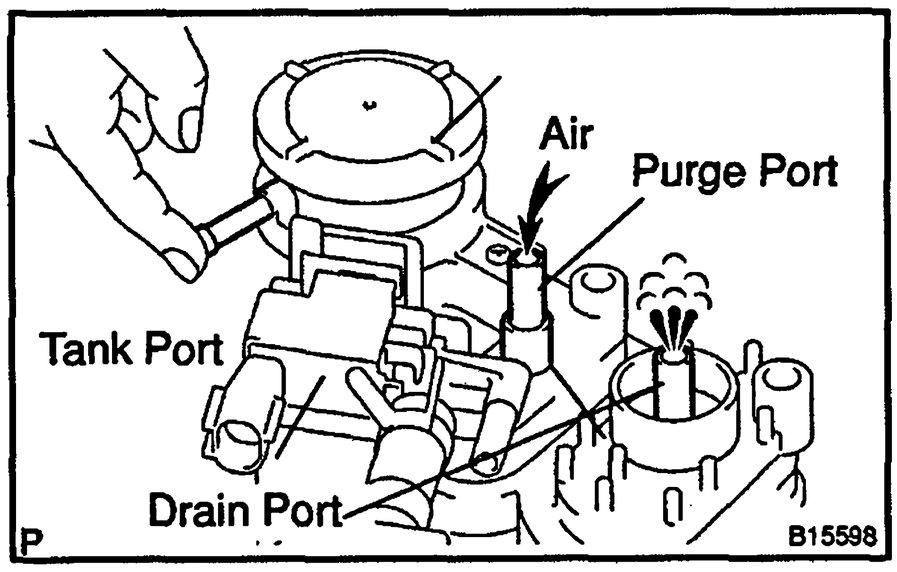


(2) Blow air (4.71 kPa (48 gf/cm^2, 0.68 psi)) into the tank port and check that air flows without resistance from the other port.



(3) Apply vacuum (1.96 kPa (20 gf/cm^2, 0.28 psi)) to the tank port, check that the vacuum does not decrease when the vacuum decreases when the purge port is released.

If a problem is found, replace the charcoal canister.



3. CLEAN FILTER IN CANISTER

Clean the filter by blowing 19.6 kPa (0.2 kgf/cm^2, 2.8 psi) of compressed air into purge port while holding the tank port closed.

NOTICE:

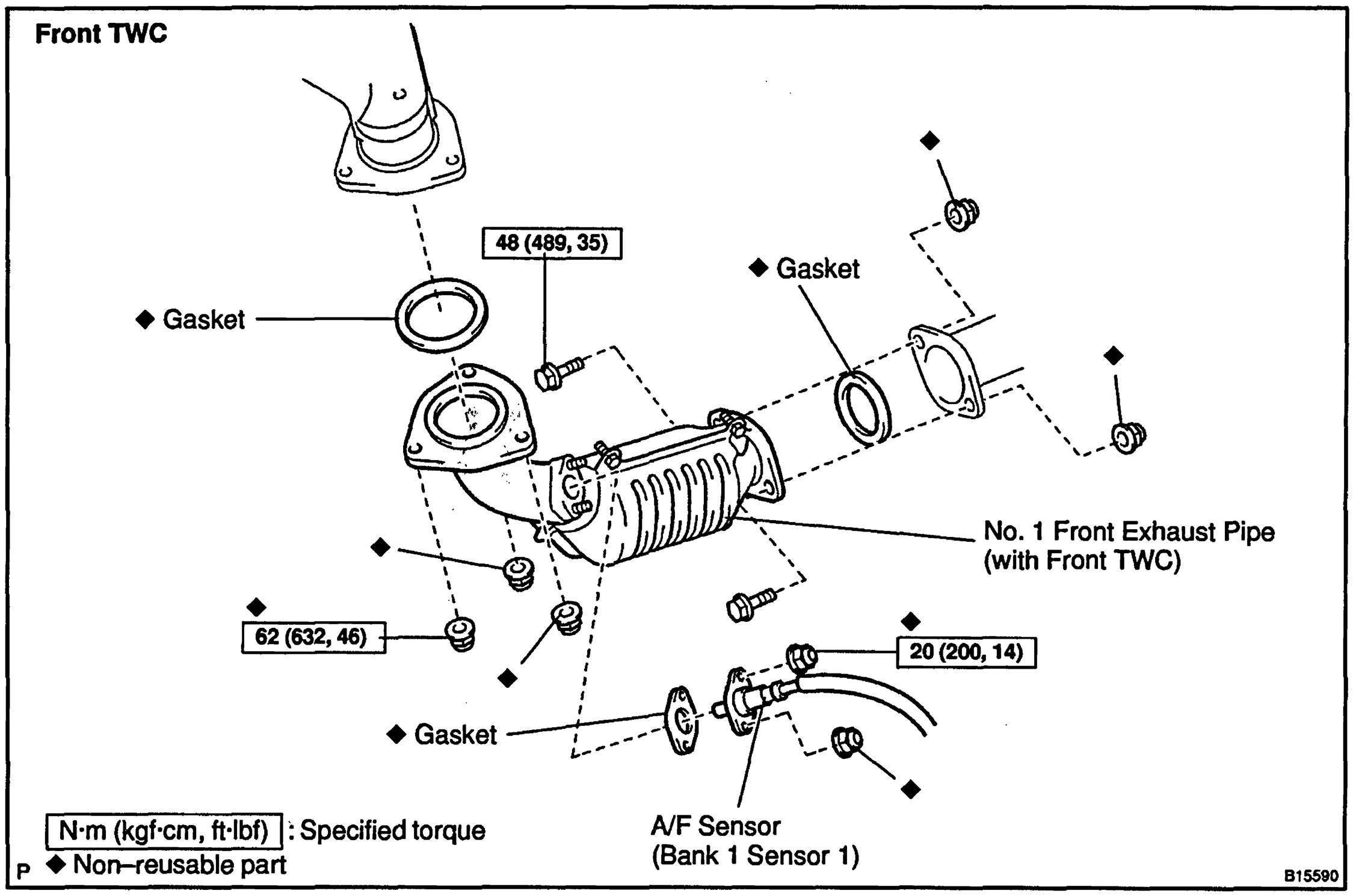
- **Do not attempt to wash the canister.**
- **No activated carbon should come out.**

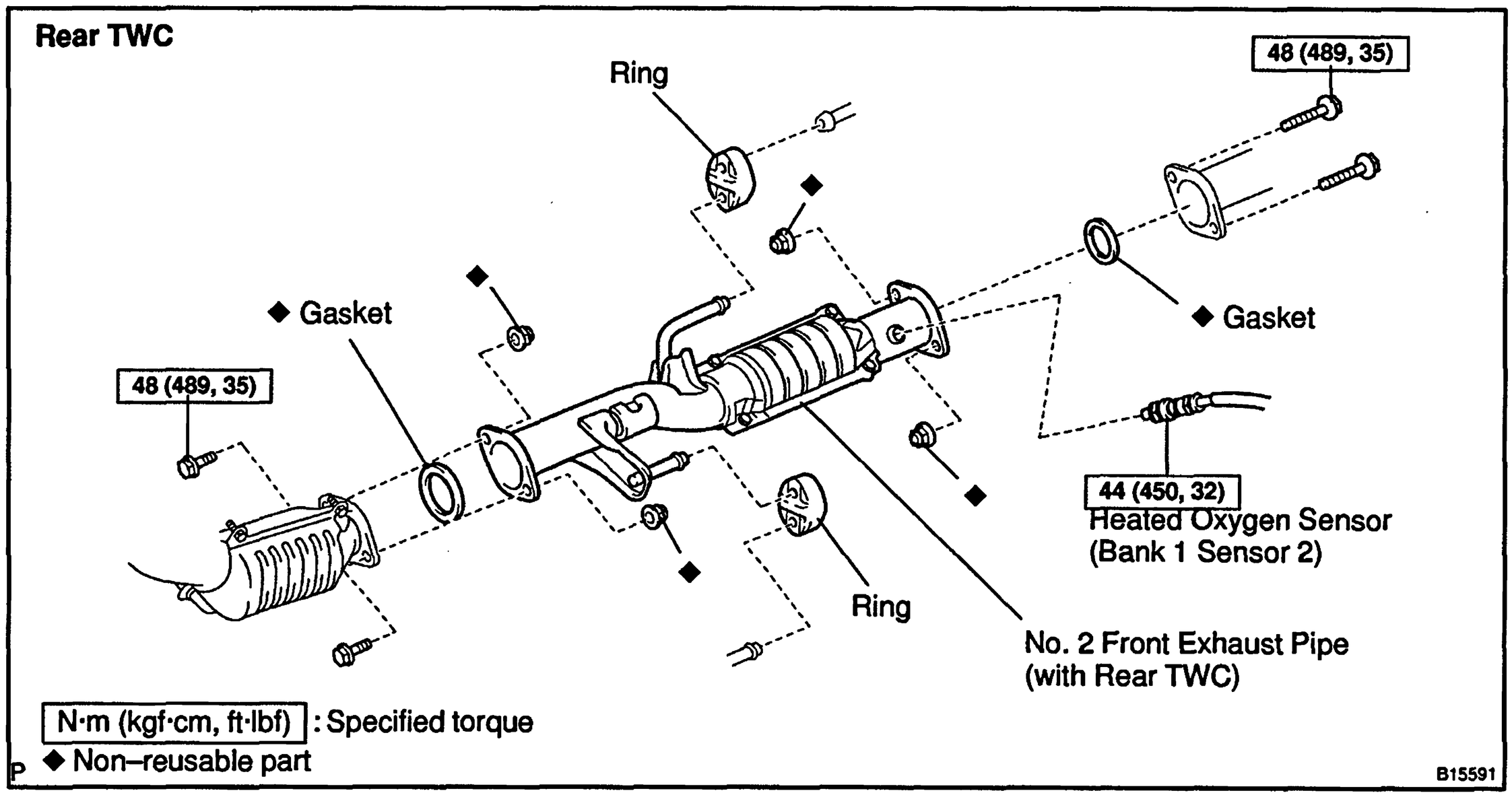
4. REINSTALL CHARCOAL CANISTER

THREE–WAY CATALYTIC CONVERTER (TWC) SYSTEM

COMPONENTS

EC0LH–01



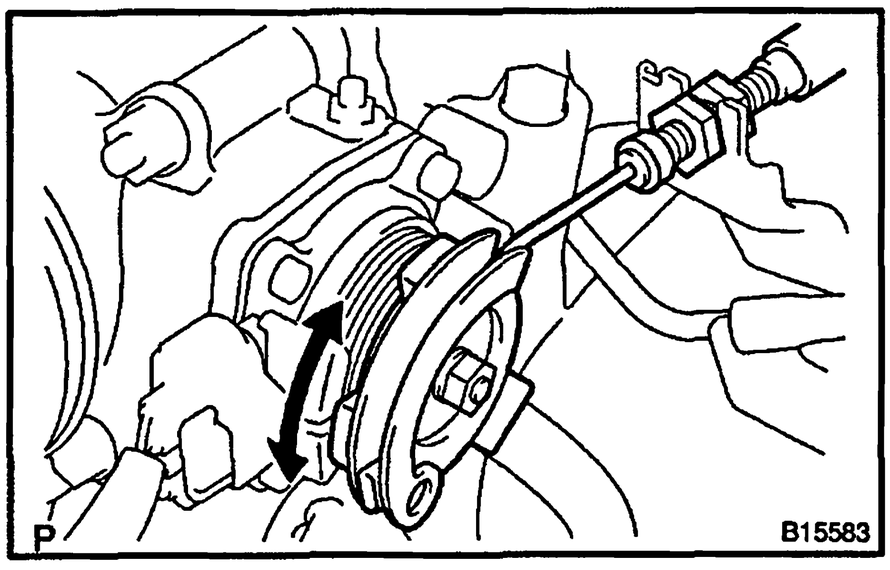


ELECTRONIC FUEL INJECTION

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
5VZ–FE Engine Repair Manual	RM519E
5VZ–FE Engine Repair Manual Supplement (Jun., 1999)	RM703E

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



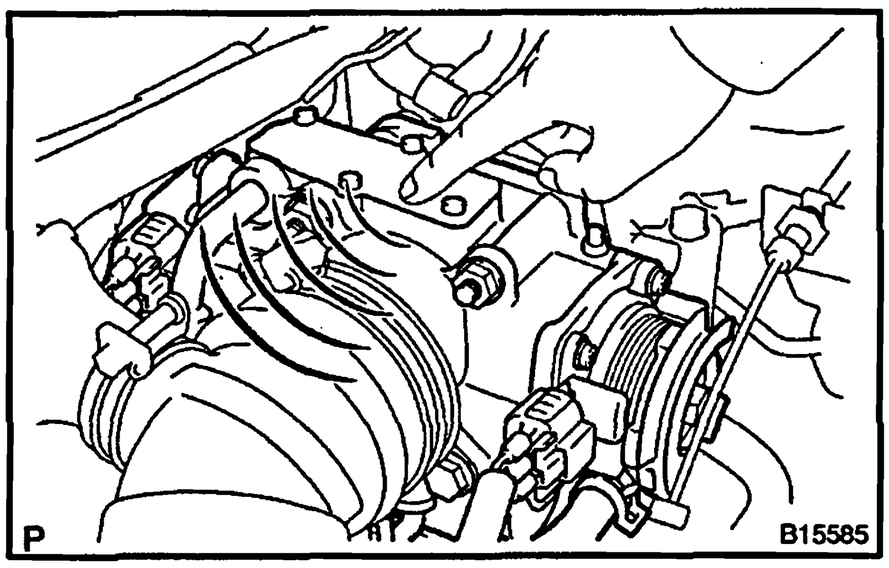
THROTTLE BODY

ON–VEHICLE INSPECTION

SF029–05

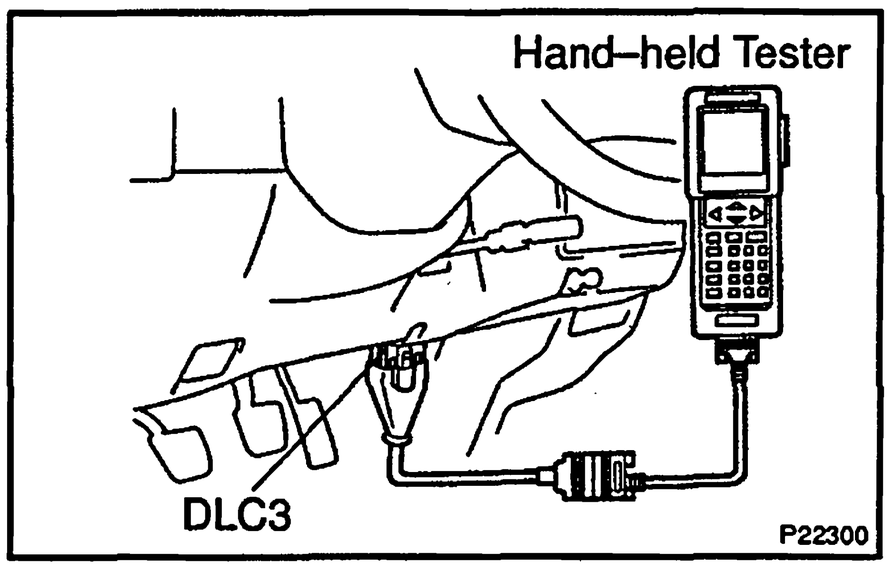
1. INSPECT SYSTEM OPERATION

(a) Check that the throttle linkage moves smoothly.



(b) Inspect the throttle control motor for operating sound.
  (1) Turn the ignition switch ON.
  (2) When turning the accelerator pedal position sensor lever, check the running sound of the motor. Also, check that there is no friction sound.

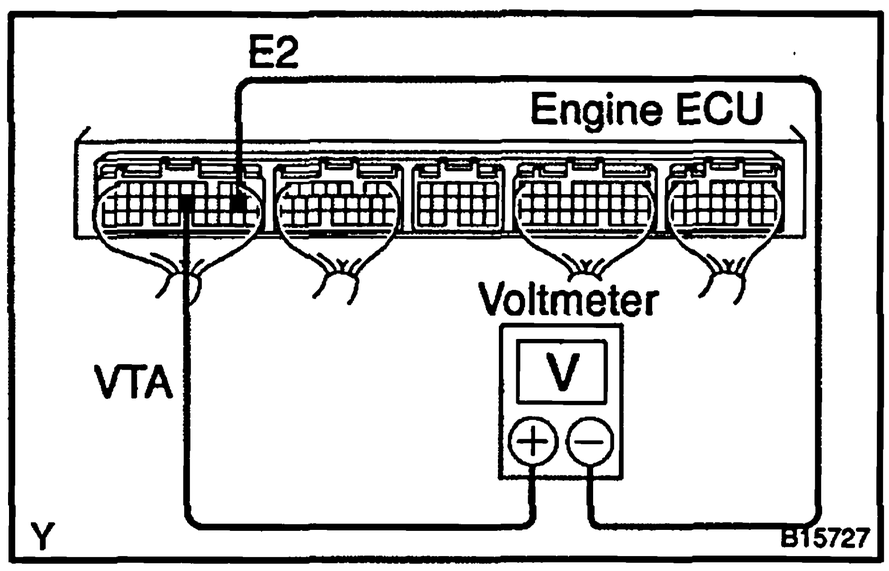
If operation is not as specified, check the throttle control motor (See step 2), wiring and engine ECU.



(c) Inspect the accelerator pedal position sensor.
  (1) Connect the hand–held tester to the DLC3.
  (2) Check that the MIL does not light up.
  (3) When turning the accelerator pedal position sensor lever to the full–open position, check that the throttle valve opening percentage (THROTTLE POS) of the CURRENT DATA showns the standard value.

Standard throttle valve opening percentage:
60 % or more

If operation is not as specified, check that the accelerator pedal position sensor (See step 4), wiring and engine ECU.



If you have no hand–held tester, measure the voltage between terminals VTA and E2 of the engine ECU connector.

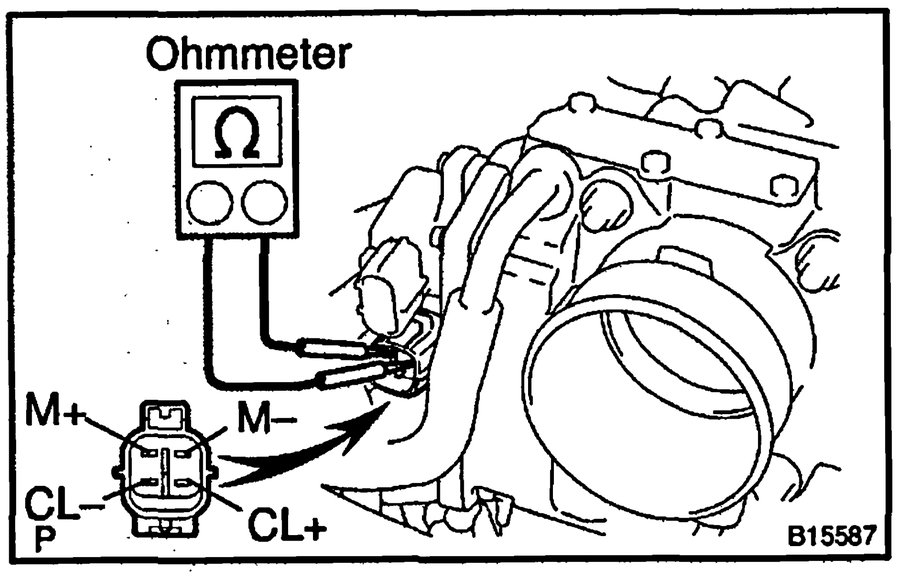
(d) Inspect the idle speed.
  (1) Start the engine and check that the MIL does not light up.
  (2) Allow the engine to warm up to normal operating temperature.
  (3) Turn the A/C compressor ON to OFF, and check the idle speed.

Idle speed (Transmission in neutral): 700 ± 50 rpm

NOTICE:

Perform inspection under condition without electrical load.

(e) After checking the above (b) to (d), perform the driving test and check that there is no sense of incongruity.



2. INSPECT THROTTLE CONTROL MOTOR

(a) Disconnect the throttle control motor connector.

(b) Using an ohmmeter, measure the motor resistance between terminals M+ and M–.

Motor resistance: 0.3 – 100 Ω at 20°C (68°F)

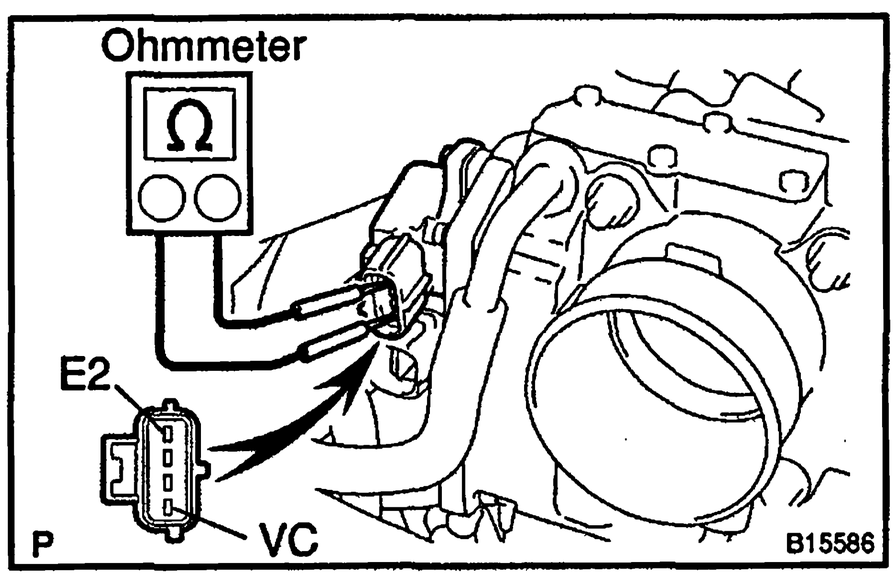
If the resistance is not as specified, replace the throttle body (See page FI–4).

(c) Using an ohmmeter, measure the clutch resistance between terminals CL+ and CL–.

Clutch resistance: 4.2 – 5.2 Ω at 20°C (68°F)

If the resistance is not as specified, replace the throttle body (See page FI–4).

(d) Reconnect the throttle control motor connector.



3. INSPECT THROTTLE POSITION SENSOR

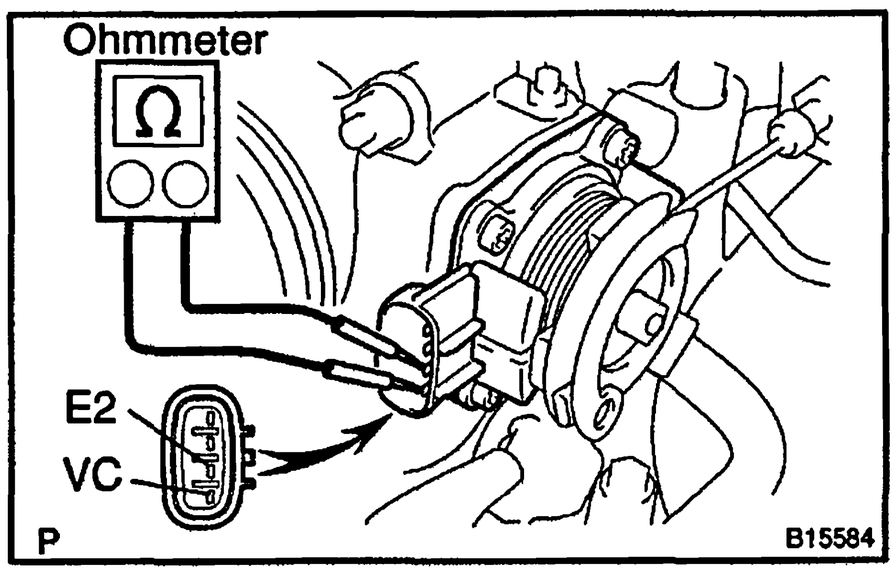
(a) Disconnect the throttle position sensor connector.

(b) Using an ohmmeter, measure the resistance between terminals VC and E2.

Resistance: 1.2 – 3.2 kΩ at 20°C (68°F)

If the resistance is not as specified, replace the throttle body (See page FI–4).

(c) Reconnect the throttle position sensor connector.



4. INSPECT ACCELERATOR PEDAL POSITION SENSOR

(a) Disconnect the pedal position sensor connector.

(b) Using an ohmmeter, measure the resistance between terminals VC and E2.

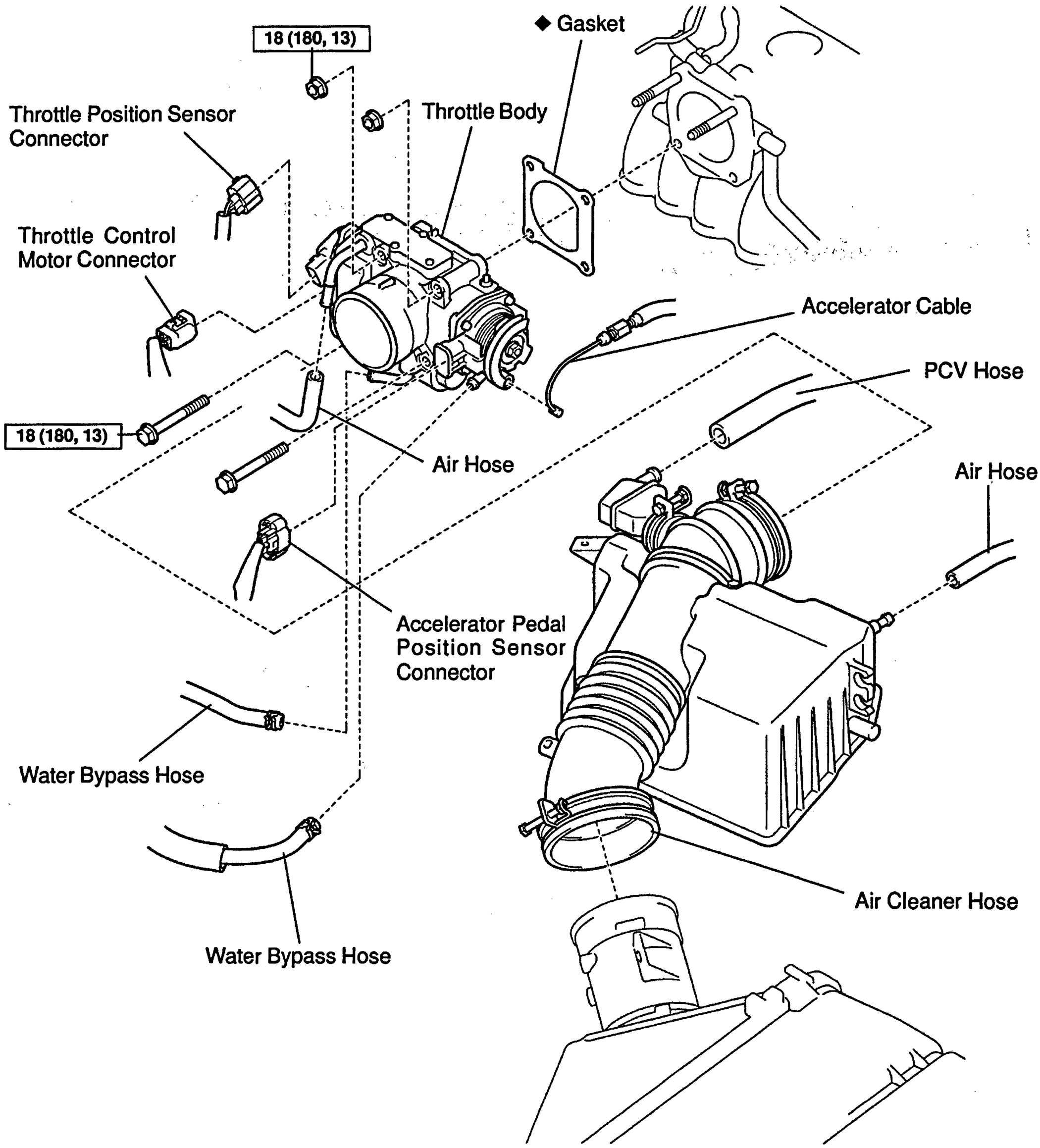
Resistance: 1.2 – 3.2 kΩ at 20°C (68°F)

If the resistance is not as specified, replace the throttle body (See page FI–4).

(c) Reconnect the pedal position sensor connector.

SF02A–06

COMPONENTS



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

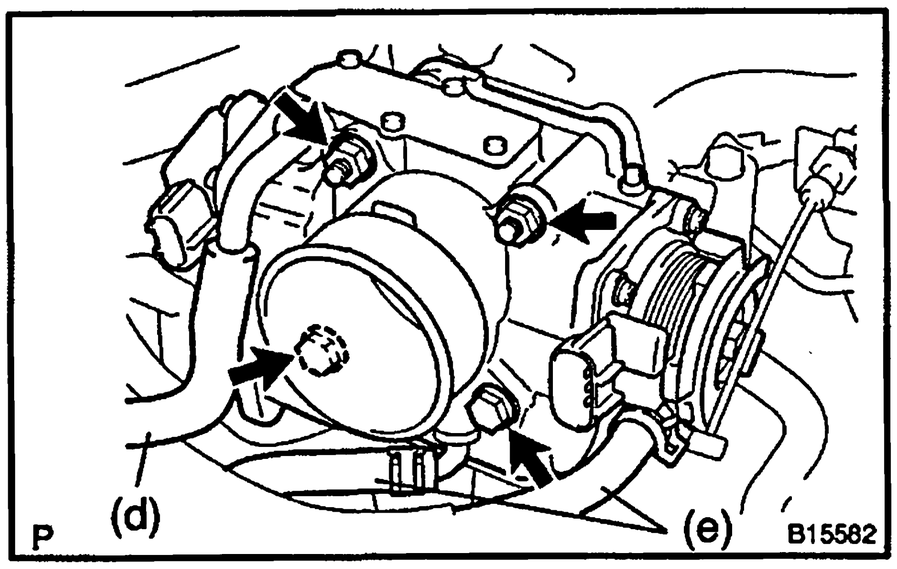
◆ Non–reusable part

B15599

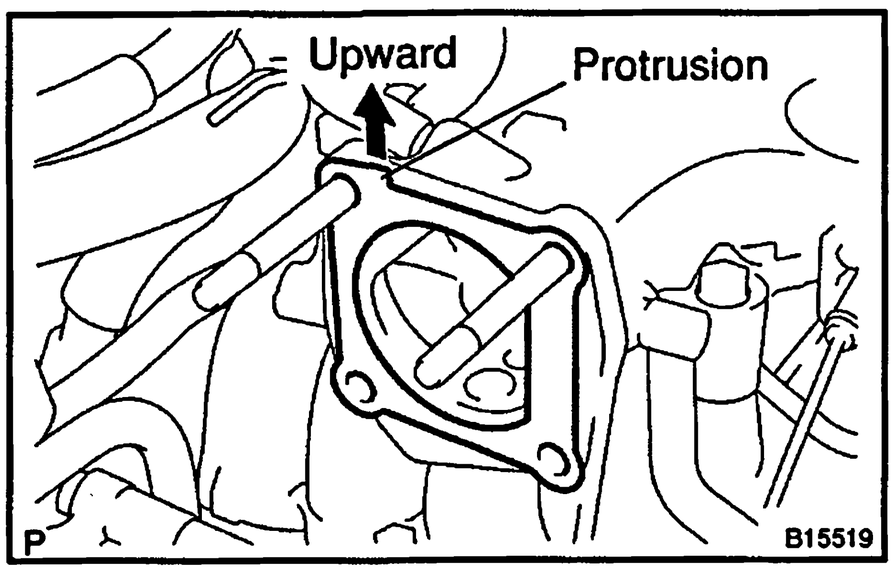
FI02E-01

REPLACEMENT

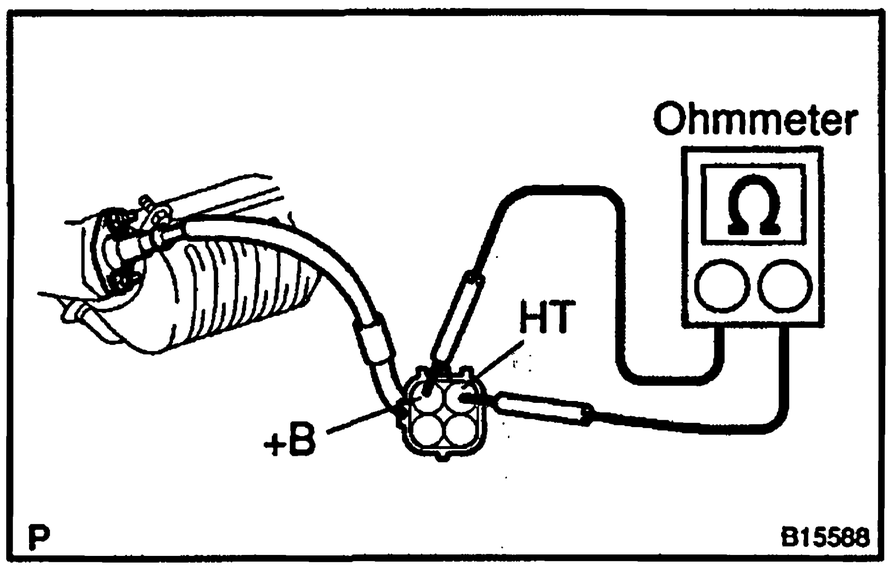
1. DRAIN ENGINE COOLANT
2. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY
3. REMOVE AIR CLEANER HOSE



4. REMOVE THROTTLE BODY
(a) Disconnect the throttle position sensor connector.
(b) Disconnect the throttle control motor connector.
(c) Disconnect the accelerator pedal position sensor connector.
(d) Disconnect the air hose.
(e) Disconnect the 2 water bypass hoses.
(f) Remove the 2 bolts, 2 nuts, throttle body and gasket.



5. REINSTALL THROTTLE BODY
(a) Place a new gasket on the air intake chamber facing the protrusion upward.
(b) Install the throttle body with the 2 bolts and 2 nuts.
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)
(c) Connect the throttle position sensor connector.
(d) Connect the throttle control motor connector.
(e) Connect the accelerator pedal position sensor connector.
(f) Connect the air hose.
(g) Connect the 2 water bypass hoses.
6. RECONNECT ACCELERATOR CABLE TO THROTTLE BODY
7. REINSTALL AIR CLEANER HOSE
8. REFILL WITH ENGINE COOLANT
9. START ENGINE AND CHECK FOR COOLANT LEAKS



AIR–FUEL RATIO (A/F) SENSOR (Bank 1 Sensor 1)

FI0ZF–01

INSPECTION

INSPECT HEATER RESISTANCE OF A/F SENSOR

(a) Disconnect the A/F sensor connector.

(b) Using an ohmmeter, measure the resistance between terminals +B and HT.

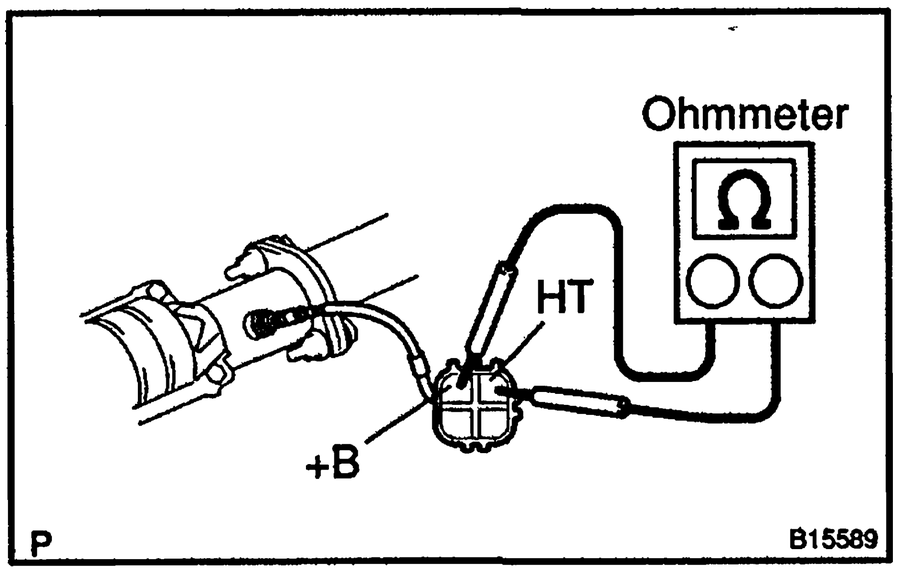
Resistance:

20°C (68°F)	0.8 – 1.4 Ω
800°C (1,472°F)	1.8 – 3.2 Ω

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

Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

(c) Reconnect the A/F sensor connector.



OXYGEN SENSOR (Bank 1 Sensor 2)

F10ZG-01

INSPECTION

INSPECT HEATER RESISTANCE OF OXYGEN SENSOR

(a) Disconnect the oxygen sensor connector.

(b) Using an ohmmeter, measure the resistance between terminals +B and HT.

Resistance:

20°C (68°F)	11 – 16 Ω
800°C (1,472°F)	23 – 32 Ω

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

Torque: 44 N·m (450 kgf·cm, 32 ft·lbf)

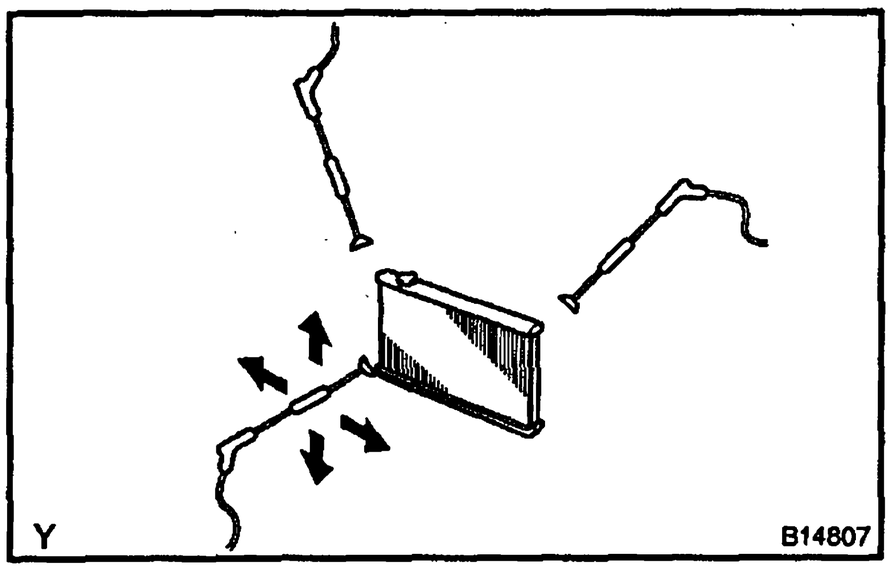
(c) Reconnect the oxygen sensor connector.

COOLING

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	
5VZ–FE Engine Repair Manual	RM519E
5VZ–FE Engine Repair Manual Supplement (Jun., 1999)	RM703E

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



RADIATOR

CO1BB-02

ON–VEHICLE CLEANING

INSPECT FINS BLOCKAGE

If fins are clogged, wash them with water or a steam cleaner and dry with compressed air.

NOTICE:

- **If the distance between the steam cleaner and the core is too close, there is a possibility of damaging the fin, so keep the following injection distance.**

Ingection Pressure	Ingection Distance
2,942 – 4,903 kpa (30 – 80 kgf·cm^2, 427 – 711 psi)	300 mm (11.811 in)
4,903 – 7,845 kpa (50 – 80 kgf·cm^2, 711 – 1,138 psi)	500 mm (19.685 in)

- **If the fins are bent, stralghten them with a screwdriver or pliers.**
- **Never apply water directly onto the electronic components.**

CO1BC-01

ON–VEHICLE INSPECTION

1. REMOVE RADIATOR CAP

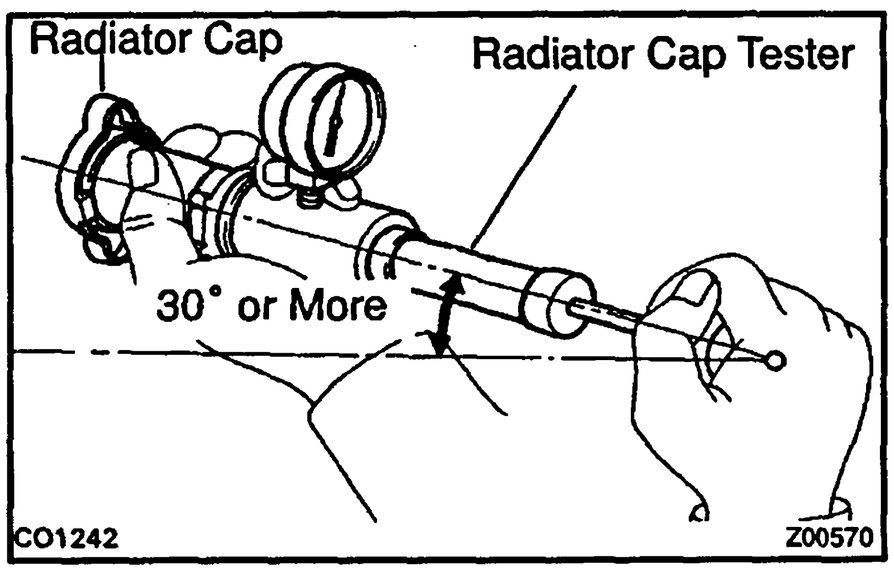
CAUTION:

To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

2. INSPECT RADIATOR CAP

NOTICE:

- **If the radiator cap has contaminations, always rinse it with water.**
- **Before using a radiator cap tester, wet the relief valve and pressure valve with engine coolant or water.**
- **When performing steps (a) and (b) below, keep the radiator cap tester at an angle of over 30° above the horizontal.**



(a) Using a radiator cap tester, slowly pump the tester and check that air is coming from the vacuum valve.
Pump speed: 1 push/(3 seconds or more)

NOTICE:

Push the pump at a constant speed.

If air is not coming from the vacuum valve, replace the radiator cap.

(b) Pump the radiator cap tester, and measure the relief valve opening pressure.
Pump speed: 1 push within 1 second

NOTICE:

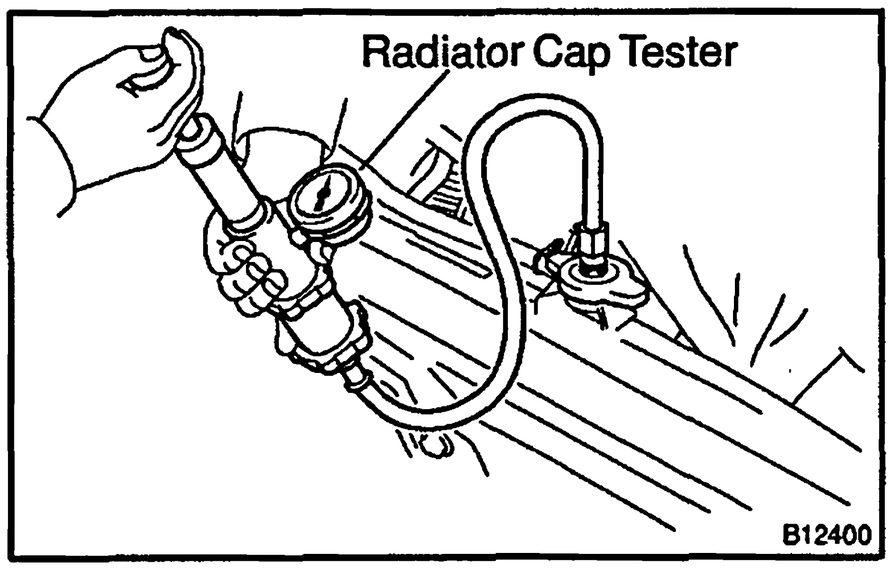
This pump speed is for the first pump only (in order to close the vacuum valve). After this, the pump speed can be reduced.

Standard opening pressure:
74 – 103 kPa (0.75 – 1.05 kgf/cm^2, 10.7 – 14.9 psi)
Minimum opening pressure:
59 kPa (0.6 kgf/cm^2, 8.5 psi)

HINT:

Use the tester's maximum reading as the opening pressure.

If the opening pressure is less than minimum, replace the radiator cap.



3. INSPECT COOLING SYSTEM FOR LEAKS

NOTICE:

Clean the radiator cap housing before install the radiator cap tester.

(a) Fill the radiator with coolant and attach a radiator cap tester.

(b) Warm up the engine.

(c) Pump it to 118 kPa (1.2 kgf/cm^2, 17.1 psi), and check that the pressure does not drop.

If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and head.

4. REINSTALL RADIATOR CAP

NOTICE:

- **Clean the radiator cap housing before install the radiator cap.**
- **If the radiator cap has contaminations, always rinse it with water.**

CHARGING

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	
5VZ–FE Engine Repair Manual	RM519E
5VZ–FE Engine Repair Manual Supplement (Jun., 1999)	RM703E

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

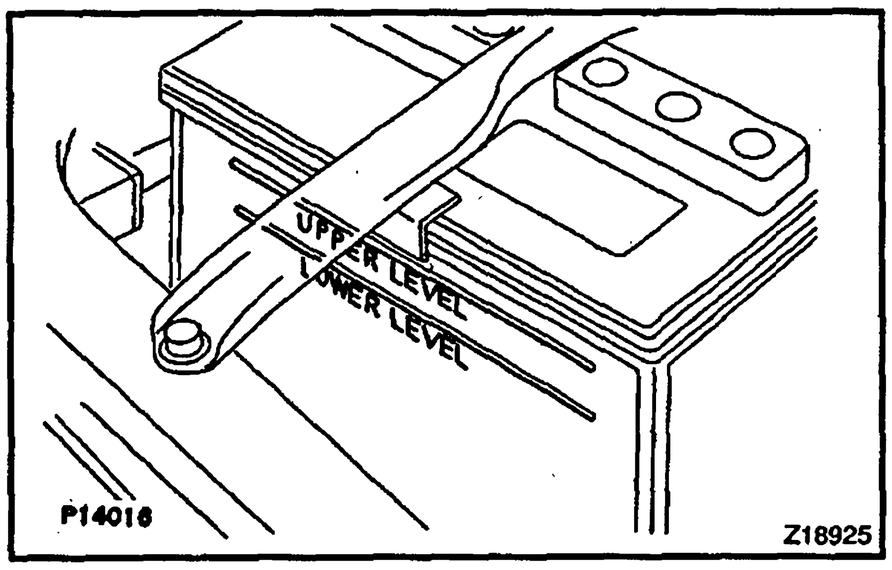
CHARGING SYSTEM

ON–VEHICLE INSPECTION

CH0KF–01

CAUTION:

- **Check that the battery cables are connected to the correct terminals.**
- **Disconnect the battery cables when the battery is given a quick charge.**
- **Do not perform tests with a high voltage insulation resistance tester.**
- **Never disconnect the battery while the engine is running.**



1. CHECK BATTERY ELECTROLYTE LEVEL

Check the electrolyte quantity of each cell.

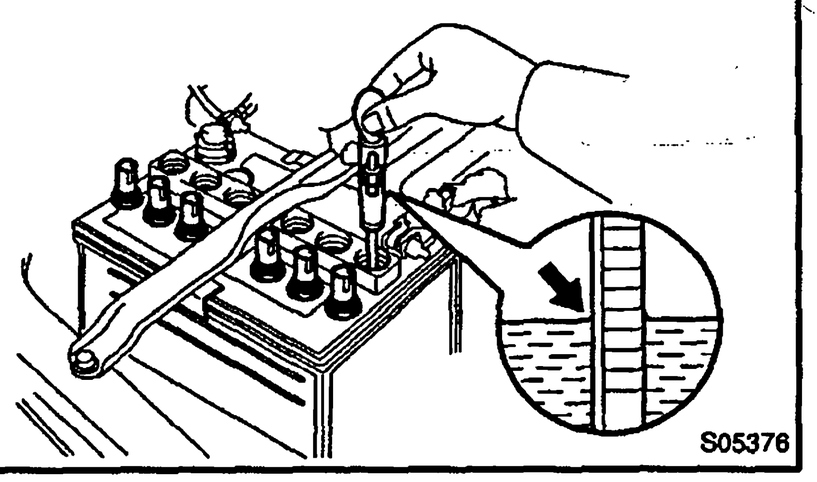
(Maintenance–Free Battery)

If under the lower level, replace the battery (or add distilled water if possible) and check the charging system.

(Except Maintenance–Free Battery)

If under the lower level, add distilled water.

Except Maintenance–Free Battery

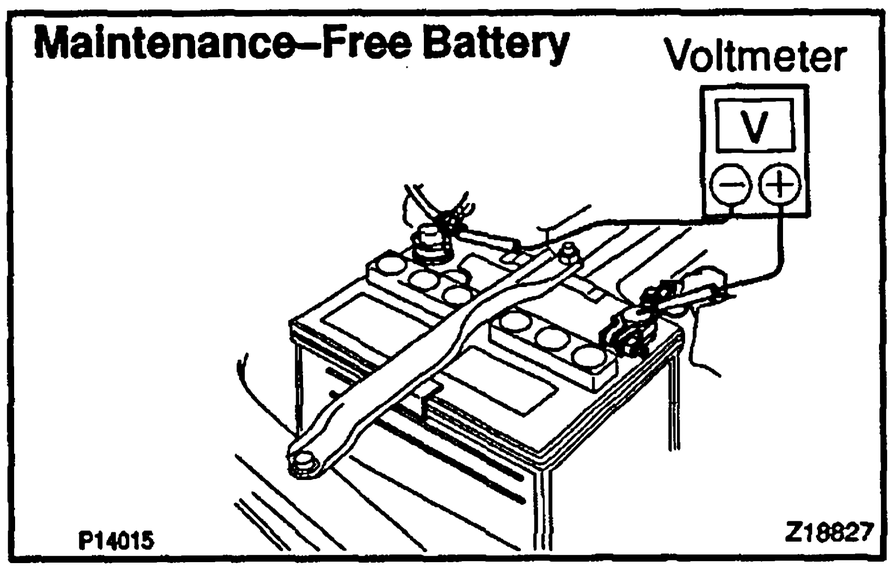


2. (Except Maintenance–Battery)
CHECK BATTERY SPECIFIC GRAVITY

Check the specific gravity of each cell.

Standard specific gravity: At 20°C (68°F): 1.25 – 1.29

If the specific gravity is less than specification, charge the battery.



3. (Maintenance–Free Battery)
CHECK BATTERY BOLTAGE

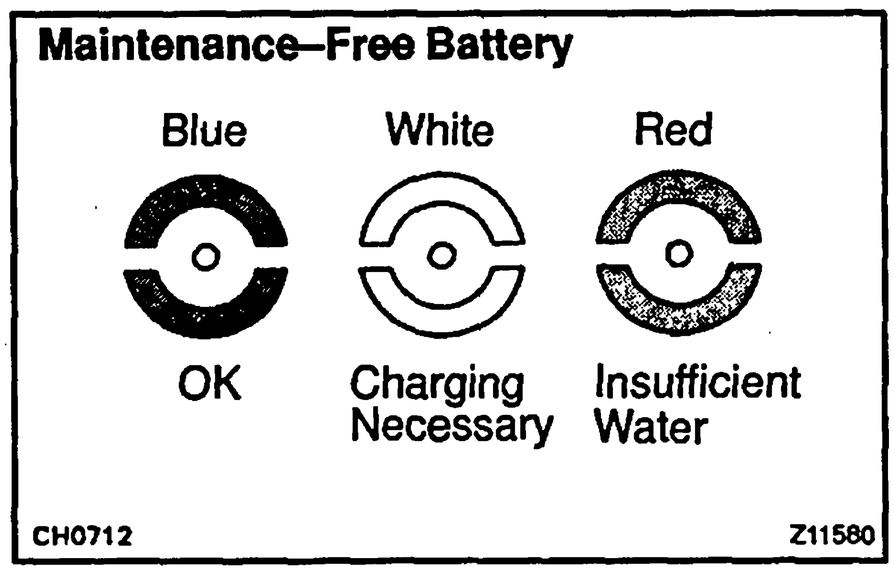
Measure the battery voltage between the negative (–) and positive (+) terminals of the battery.

Standard voltage: At 20°C (68°F): 12.7 – 12.9 V

HINT:

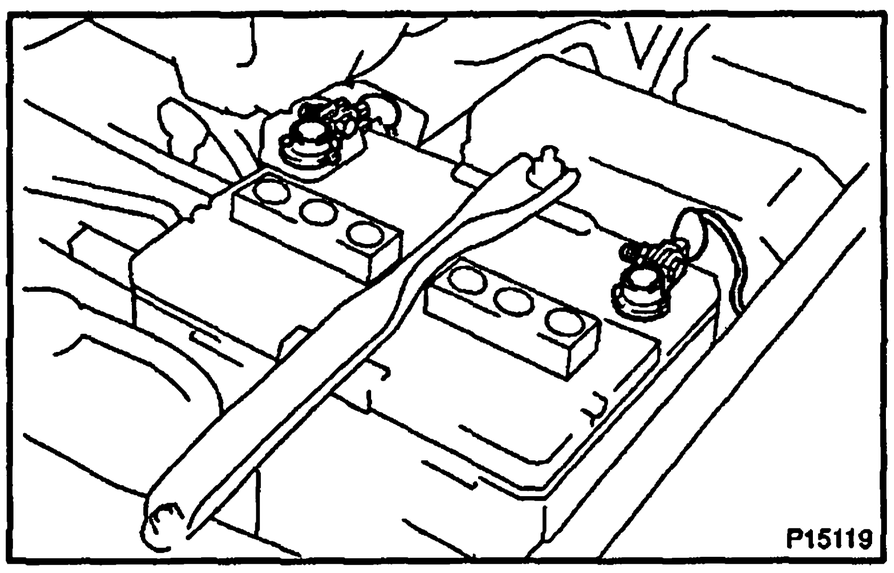
- Before measuring the voltage, turn the ignition switch OFF and turn off the electrical systems (headlight, blower motor, rear defogger etc.) for 60 secondsto remove the surface charge.
- When measuring the voltage, however, turn the ignition switch OFF and turn off the electrical systems.

If the voltage is less than the specification, charge the battery.



HINT:

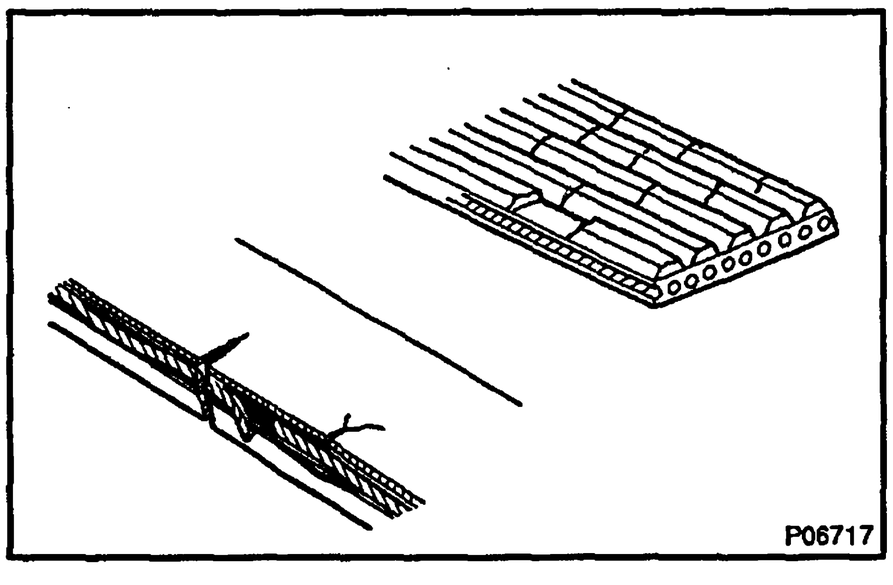
Check the indicator as shown in the illustration.



4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

(a) Check that the battery terminals are not loose or corroded.

(b) Check the fusible link and fuses for continuity.

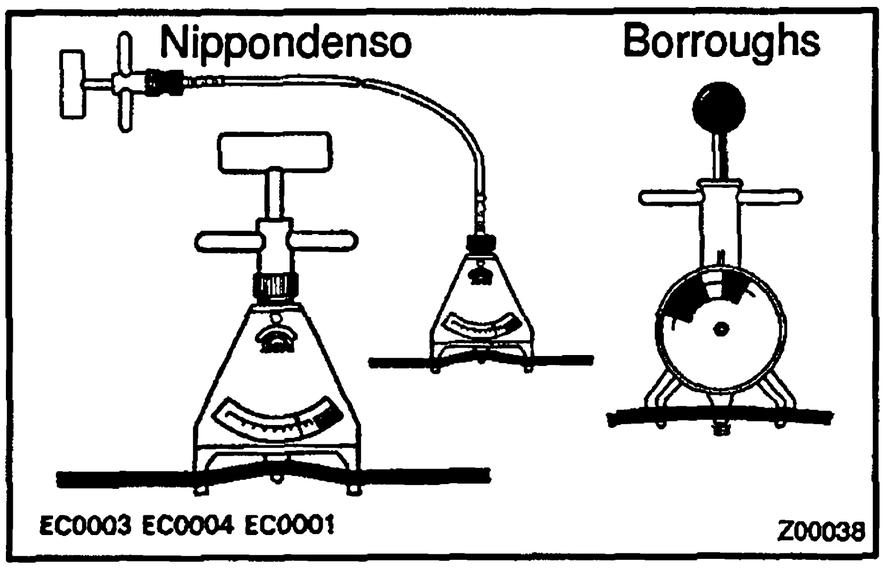


5. INSPECT DRIVE BELT

(a) Visually check the belt for excessive wear, frayed cords etc.

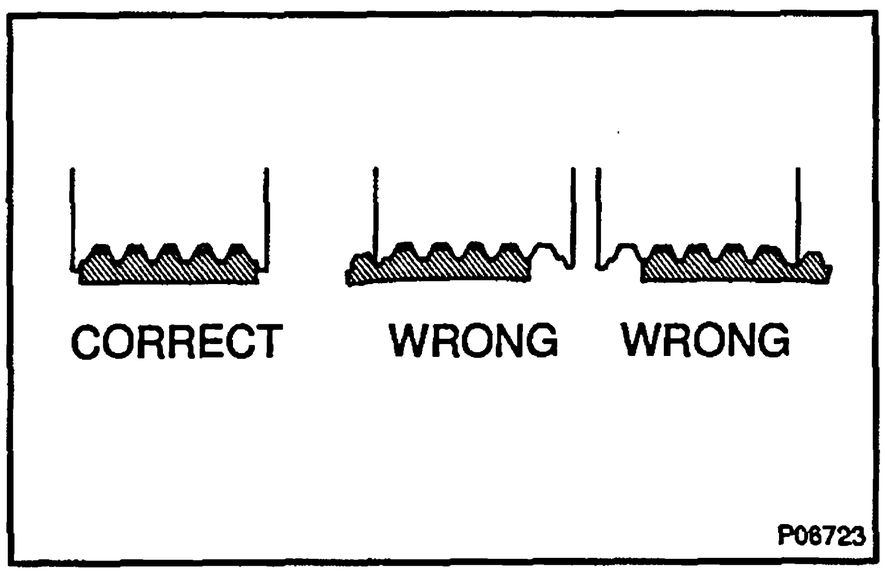
HINT:

Cracks on the ribbed side of the belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



(b) Using a belt tension gauge, check the drive belt tension.
Belt tension gauge:
Nippondenso BTG 20 (95506–00020) or
Borroughs No. BT–33–73F
Drive belt tension:
New belt: 160 ± 20 lbf
Used belt: 100 ± 20 lbf

If necessary, adjust the drive belt tension.



HINT:

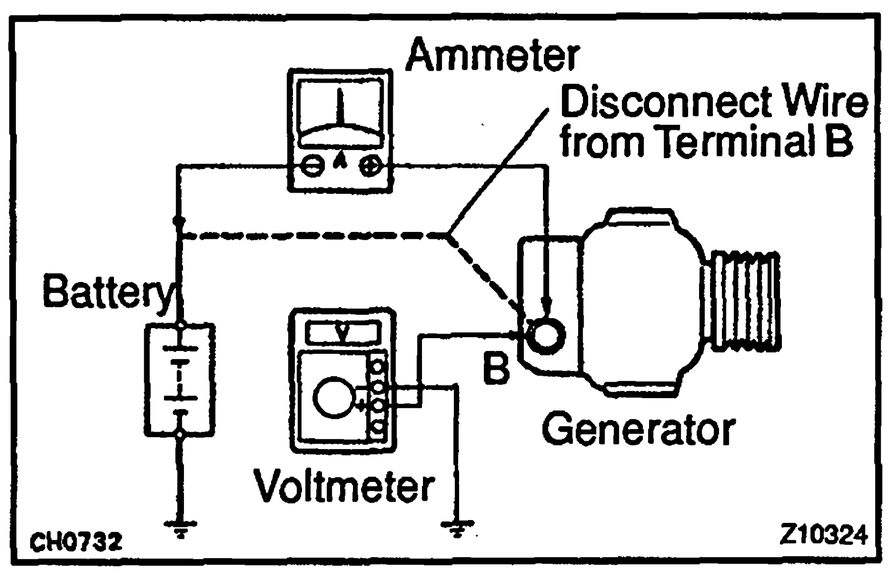
- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the drive belt, check that it fits properly in the ribbed grooves. Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- After installing a new belt, run the engine for approx. 5 minutes and then recheck the tension.

6. INSPECT FUSES FOR CONTINUITY

- ENGINE 10A
- CHARGE 7.5A
- IGN 7.5A

7. VISUALLY CHECK GENERATOR WIRING AND LISTEN FOR ABNORMAL NOISES

(a) Check that the wiring is in good condition.
(b) Check that there is no abnormal noise from the generator while the engine is running.



8. CHECK CHARGING CIRCUIT WITHOUT LOAD

HINT:
If a battery/generator tester is available, connect the tester to the charging circuit according to the manufactuer's instructions.

(a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:
- Disconnect the wire from terminal B of the generator and connect the wire to the negative (–) terminal of the ammeter.
- Connect the test lead from the positive (+) terminal of the ammeter to terminal B of the generator.
- Connect the positive (+) lead of the voltmeter to terminal B of the generator.
- Ground the negative (–) lead of the voltmeter.

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(b) Check the charging circuit as follows:
With the engine running from idling to 2,000 rpm, check the reading on the ammeter and voltmeter.
Standard amperage: 10 A or less
Standard voltage:
At 25 °C (77 °F): 13.7 – 14.7 V
At 115 °C (239 °F): 13.2 – 14.0 V

If the voltage reading is greater than the standard voltage, check the voltage regulator.

9. INSPECT CHARGING CIRCUIT WITH LOAD

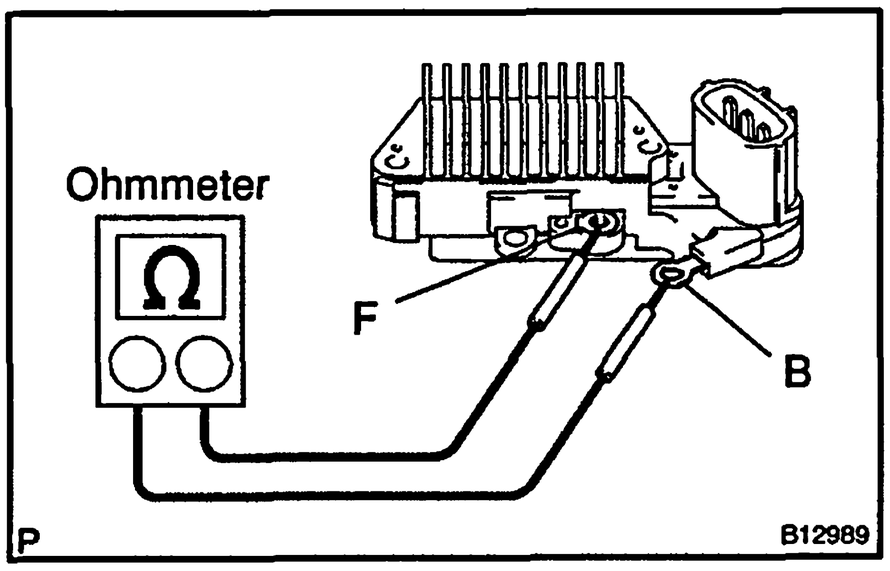
(a) With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater fan control switch to HI.

(b) Check the reading on the ammeter.
Standard amperage: 30 A or more

If the ammeter reading is less than 30 A, repair the generator.

HINT:

If the battery is fully charged, the indication will sometimes be less than 30 A.



ALTERNATOR

CH0KG-03

INSPECTION

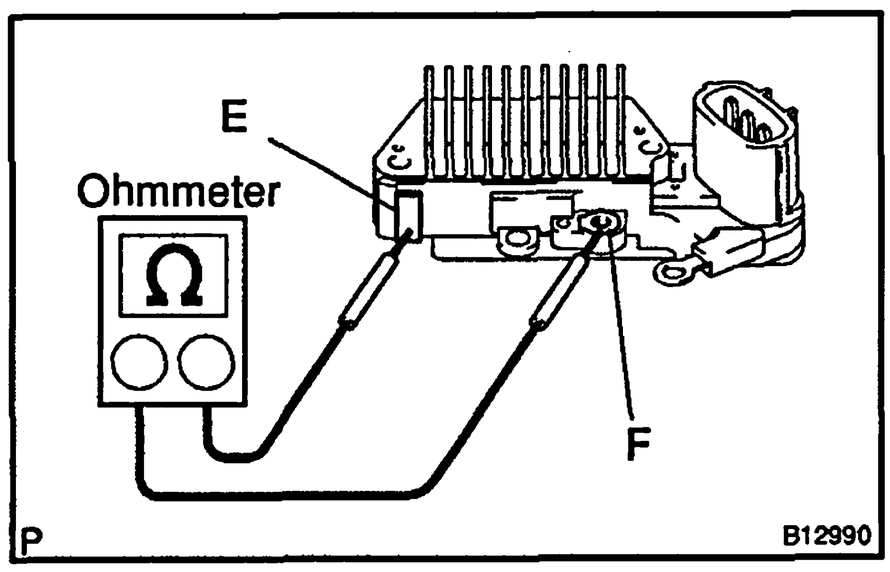
1. INSPECT VOLTAGE REGULATOR

(a) Using an ohmmeter, check the continuity between terminals F and B.

Standard:

When the positive and negative poles between terminals F and B are exchanged, there is continuity in one way but no continuity in another way.

If the continuity is not as specified, replace the regulator.

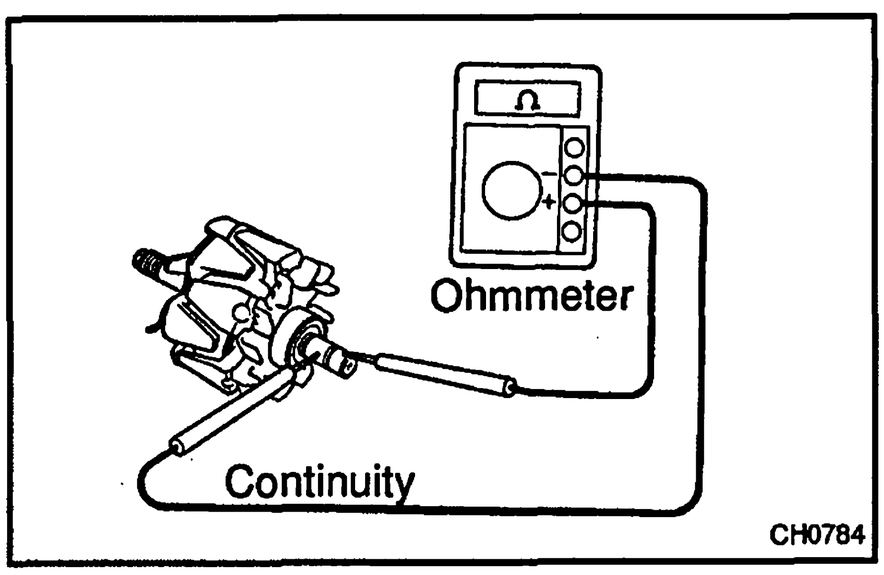


(b) Using an ohmmeter, check the continuity between terminals F and E.

Standard:

When the positive and negative poles between terminals F and E are exchanged, there is continuity in one way but no continuity in another way.

If the continuity is not as specified, replace the voltage regulator.

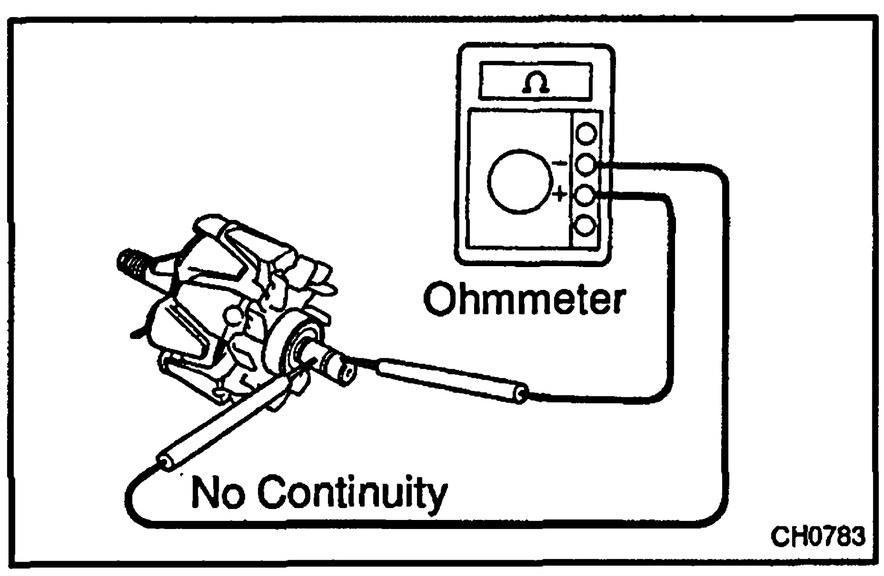


2. INSPECT ROTOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the slip rings.

Standard resistance: At 20°C (68°F): 2.1 – 2.5 Ω

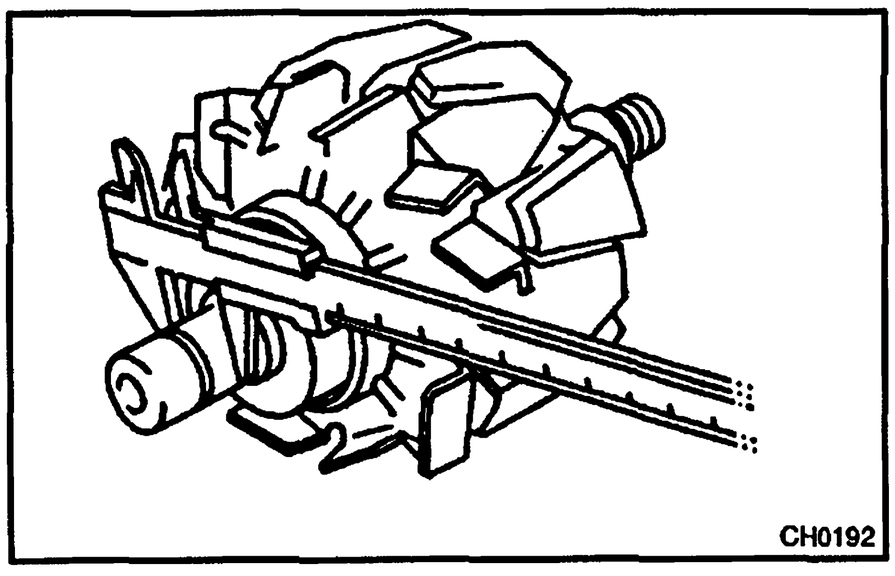
If there is no continuity, replace the rotor.



3. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and rotor.

If there is continuity, replace the rotor.



4. INSPECT SLIP RINGS

(a) Check that the slip rings are not rough or scored.

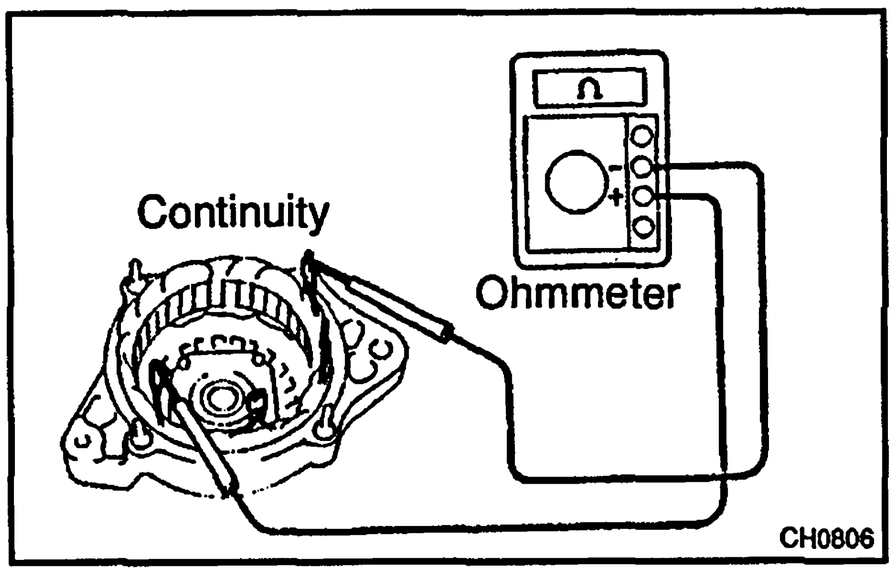
If rough or scored, replace the rotor.

(b) Using vernier calipers, measure the slip ring diameters.

Standard diameter: 14.2 – 14.4 mm (0.559 – 0.567 in.)

Minimum diameter: 12.8 mm (0.504 in.)

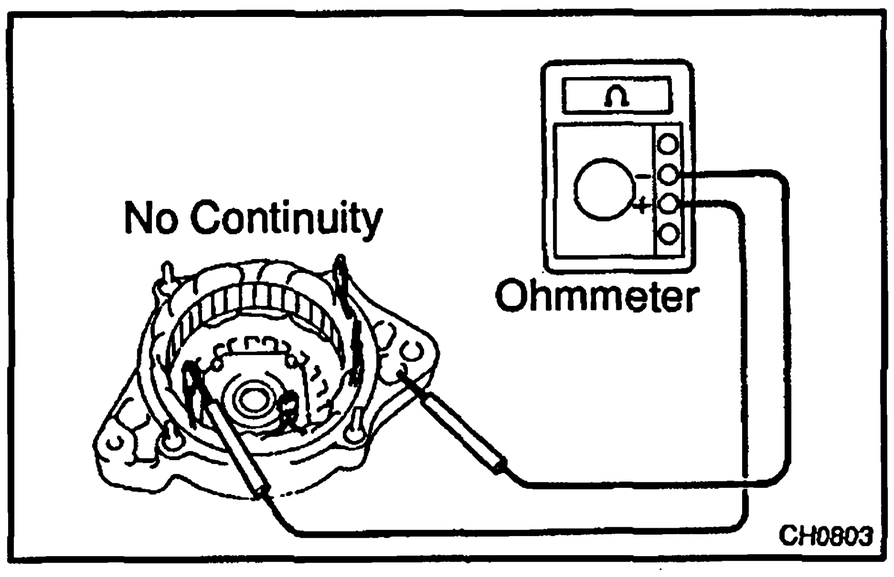
If the diameter is less than the minimum, replace the rotor.



5. INSPECT STATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the coil leads.

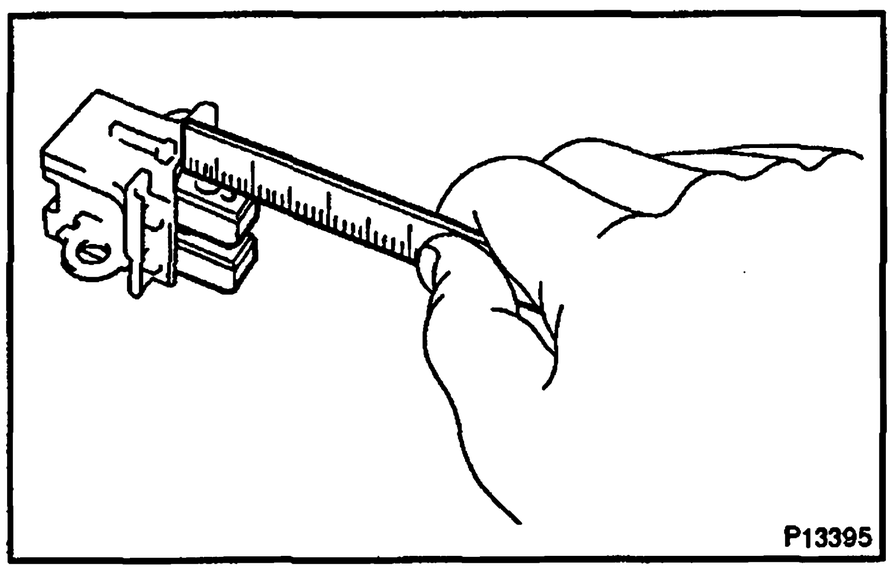
If there is no continuity, replace the drive end frame assembly.



6. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil leads and drive end frame.

If there is continuity, replace the drive end frame assembly.



7. INSPECT EXPOSED BRUSH LENGTH

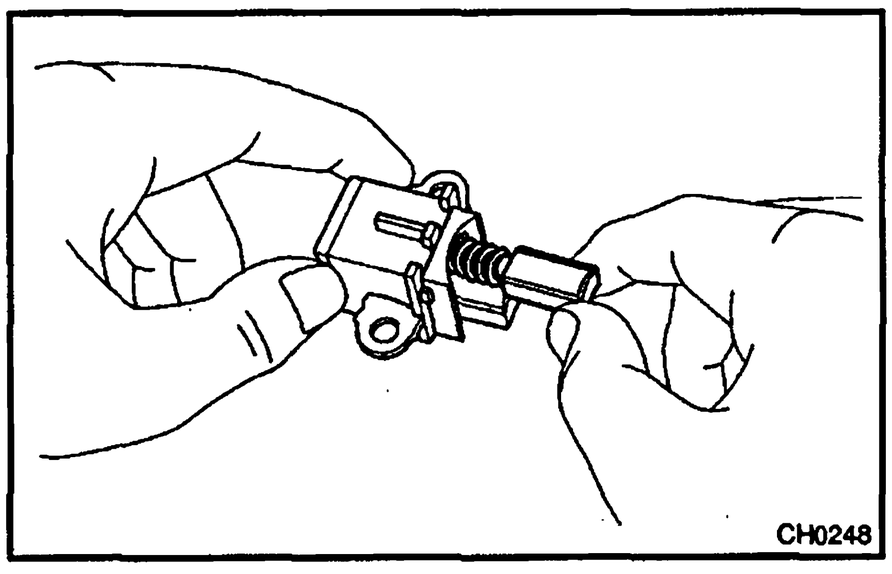
Using a scale, measure the exposed brush length.

Standard exposed length:

9.5 – 11.5 mm (0.374 – 0.452 in.)

Minimum exposed length: 1.5 mm (0.059 in.)

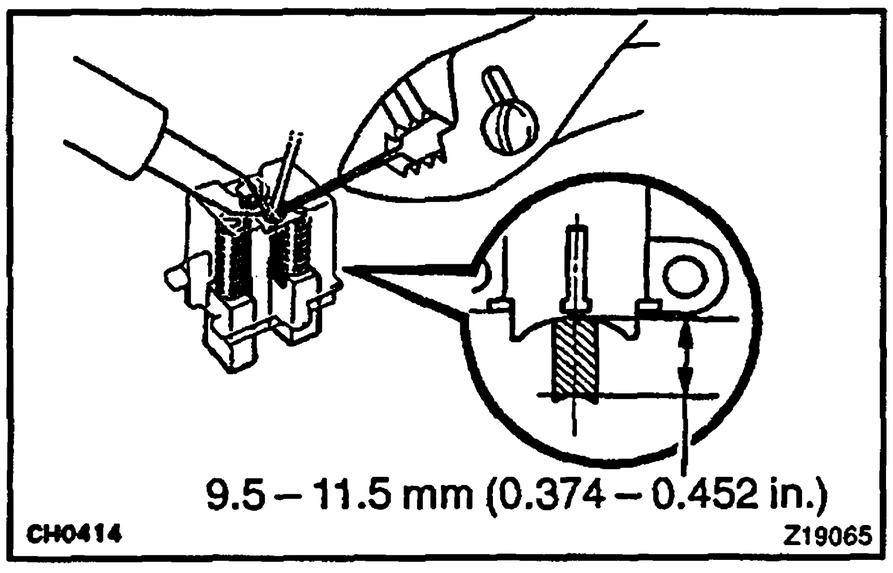
If the exposed length is less than the minimum, replace the brushes.



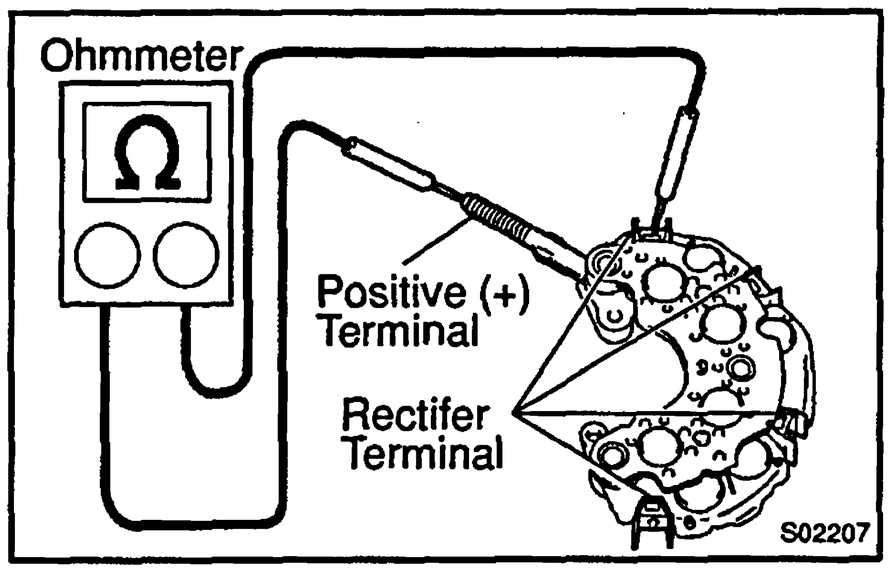
8. IF NECESSARY, REPLACE BRUSHES

(a) Unsolder and remove the brush and spring.

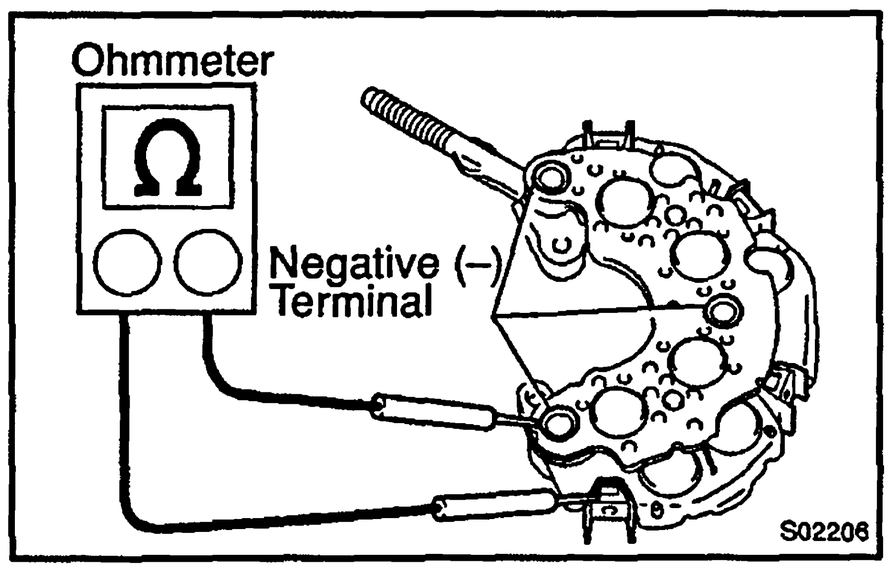
(b) Run the wire of the brush through the hole in the brush holder, and insert the spring and brush into the brush holder.



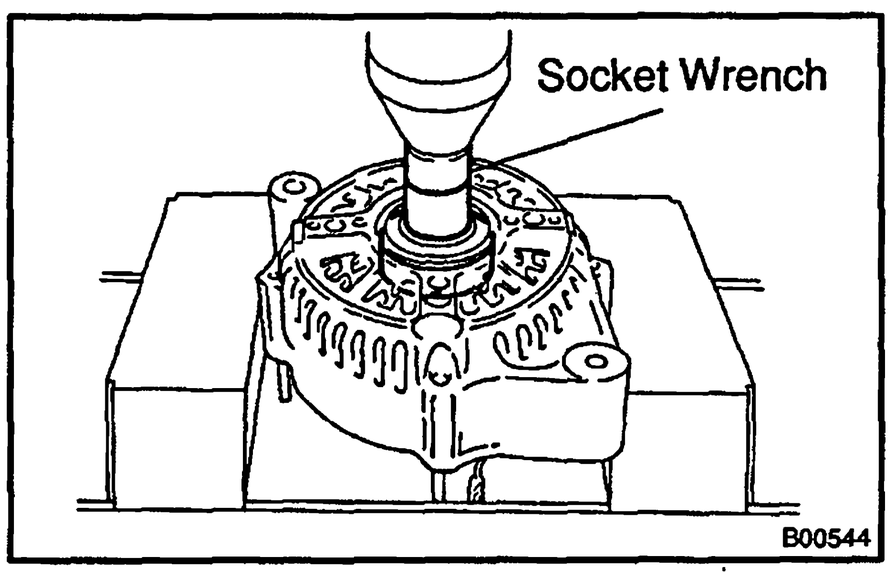
(c) Solder the brush wire to the brush holder at the exposed length.
Exposed length: 9.5 – 11.5 mm (0.374 – 0.452 in.)
(d) Check that the brush moves smoothly in the brush holder.
(e) Cut off the excess wire.
(f) Apply insulation paint to the soldered point.



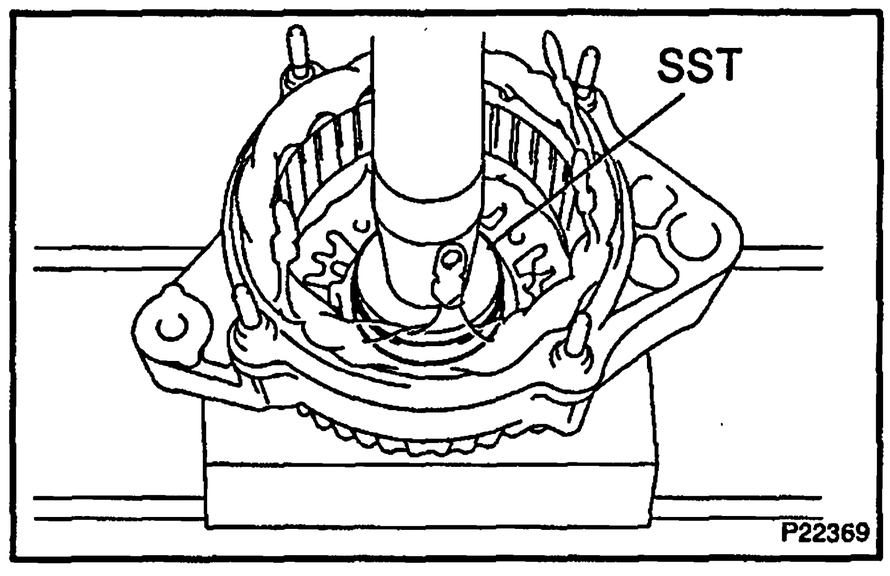
9. INSPECT POSITIVE RECTIFIER
(a) Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.
(b) Reverse the polarity of the tester probes and repeat step (a).
(c) Check that one shows continuity and the other shows no continuity.
If continuity is not as specified, replace the rectifier holder.



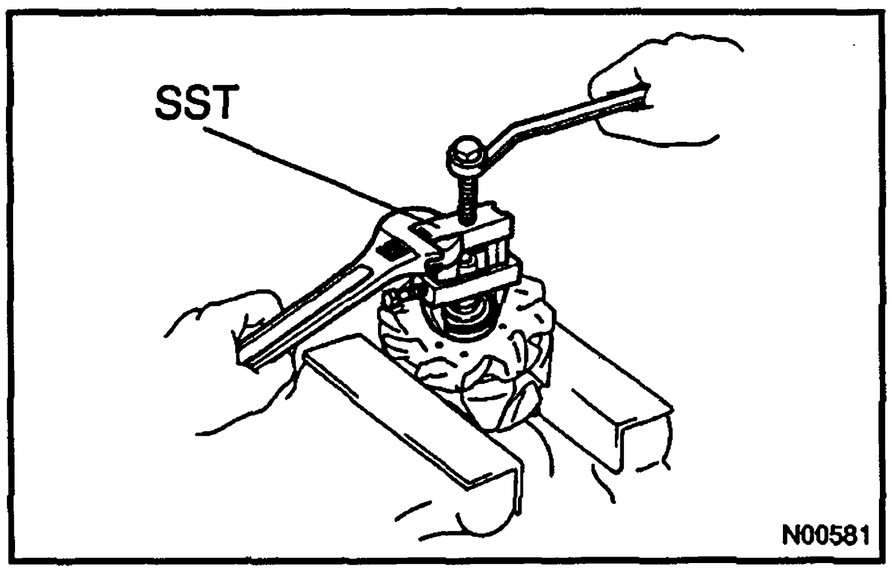
10. INSPECT NEGATIVE RECTIFIER
(a) Using an ohmmeter, connect one tester probe to each negative (–) terminal and the other to each rectifier terminal.
(b) Reverse the polarity of the tester probes and repeat step (a).
(c) Check that one shows continuity and the other shows no continuity.
If continuity is not as specified, replace the rectifier holder.



11. INSPECT FRONT BEARING
Check that the bearing is not rough or worn.
12. IF NECESSARY, REPLACE FRONT BEARING
(a) Remove the 4 screws and bearing retainer.
(b) Using a press and socket wrench, press out the front bearing.



(c) Using SST and a press, press the front bearing into the drive end frame.
SST 09950–60010 (09951–00500)
(d) Install the bearing retainer with the 4 screws.



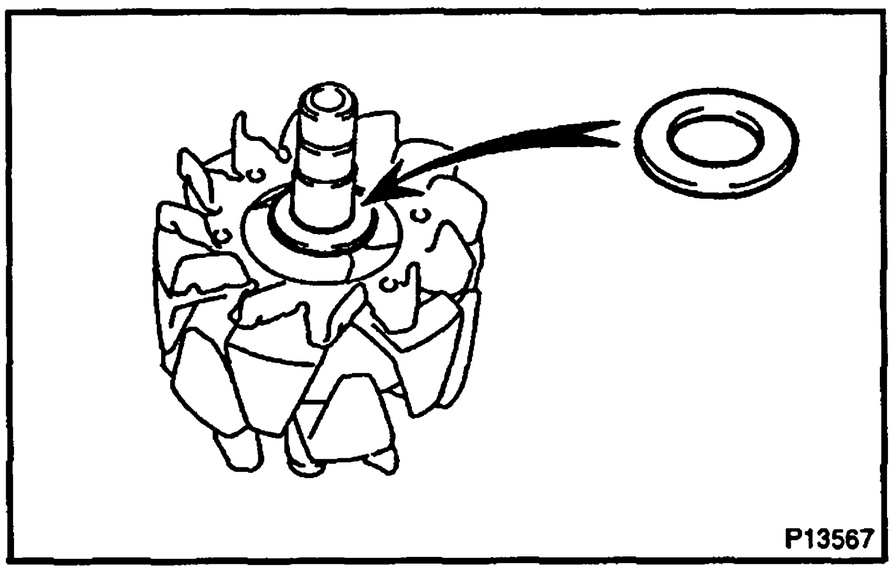
13. INSPECT REAR BEARING

Check that the bearing is not rough or worn.

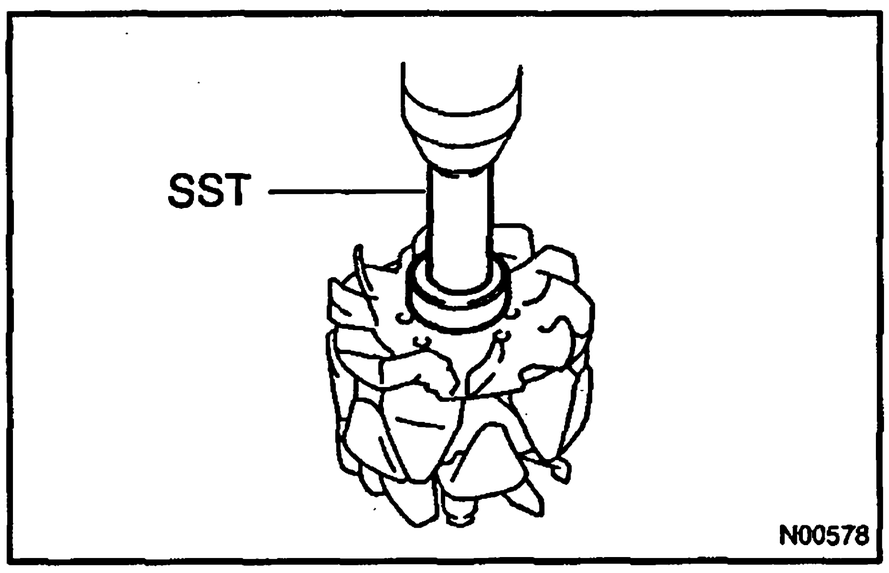
14. IF NECESSARY, REPLACE REAR BEARING

(a) Using SST, remove the bearing cover and bearing.
SST 09820–00021

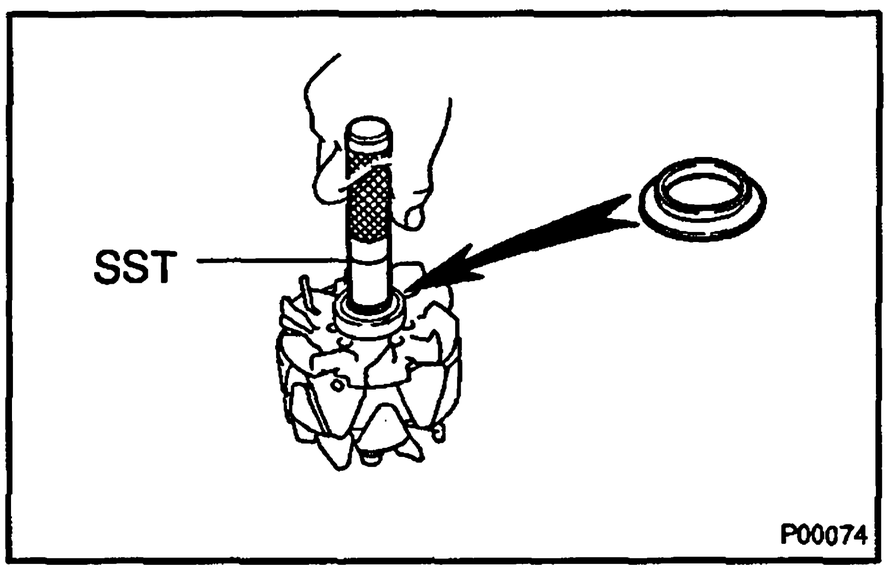
(b) Remove the bearing cover (inside).



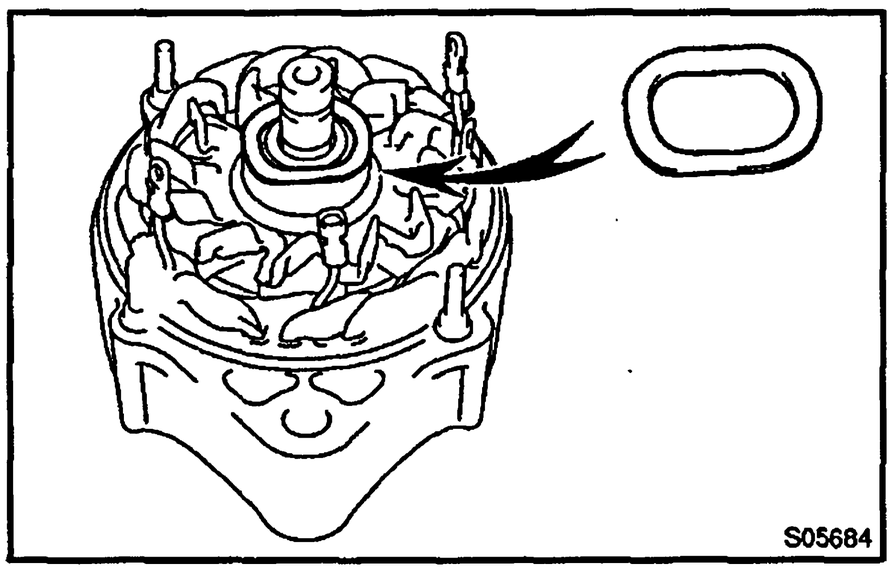
(c) Place the bearing cover (inside) on the rotor.



(d) Using SST and a press, press in a new bearing and the bearing cover.
SST 09820–00031



(e) Using SST, push in the bearing cover (outside).
SST 09285–76010



(f) Place the generator washer on the rotor.

ALPHABETICAL INDEX

A

C

D

E

F

G

H

O

P

R

S

T