FOREWORD

TOYOTA MOTOR CORPORATION

This **SUPPLEMENT** has been prepared to provide information covering general service repairs for the 1RZ,1RZ - E, 2RZ–FE, **3RZ – F and 3RZ – FE ENGINES** equipped on the **TOYOTA HILUX.**

Applicable models: **RZN**142, 144, 147, 148, 149, 154, 168, 169, 173, 174, 193 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.
S 1RZ, 2RZ, 2RZ–E Engine Repair Manual	RM167E
S 2RZ, 2RZ–E Engine Repair Manual Supplement **N/A FOR THE HILUX**	RM558E
S 3RZ–F, 3RZ–FE Engine Repair Manual	RM521E
S 1RZ–E Engine Repair Manual	RM467E
S 1RZ, 2RZ–E Repair Manual For Emission Control **N/A FOR THE HILUX**	ERM055E
S 3RZ–F Repair Manual For Emission Control **N/A FOR THE HILUX**	ERM103E

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.

First Printing: Aug. 18. 1997 01–970818–00

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.

S Must read this manual thoroughly. It is especially important to have good understanding all the contents written in the PRECAUTION of "IN" section.

S 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.

S If part replacement is necessary, must replace the part with the same part number or equivalent part. Do not replace it with inferior quality.

S It is important to note that this manual contains various "Cautions" and "Notices" that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these "Cautions" and "Notices" are not exhaustive, because it is important to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

MAIN INDEX: HILUX
SUPPLEMENT: ENGINE 3RZ-F & 3RZ-FE

August 1997

INTRODUCTION

CLICK HERE TO VIEW CHAPTER INDEX

HOW TO USE THIS MANUAL

GENERAL INFORMATION

IN02X-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-8

Be sure to read this before performing troubleshooting.

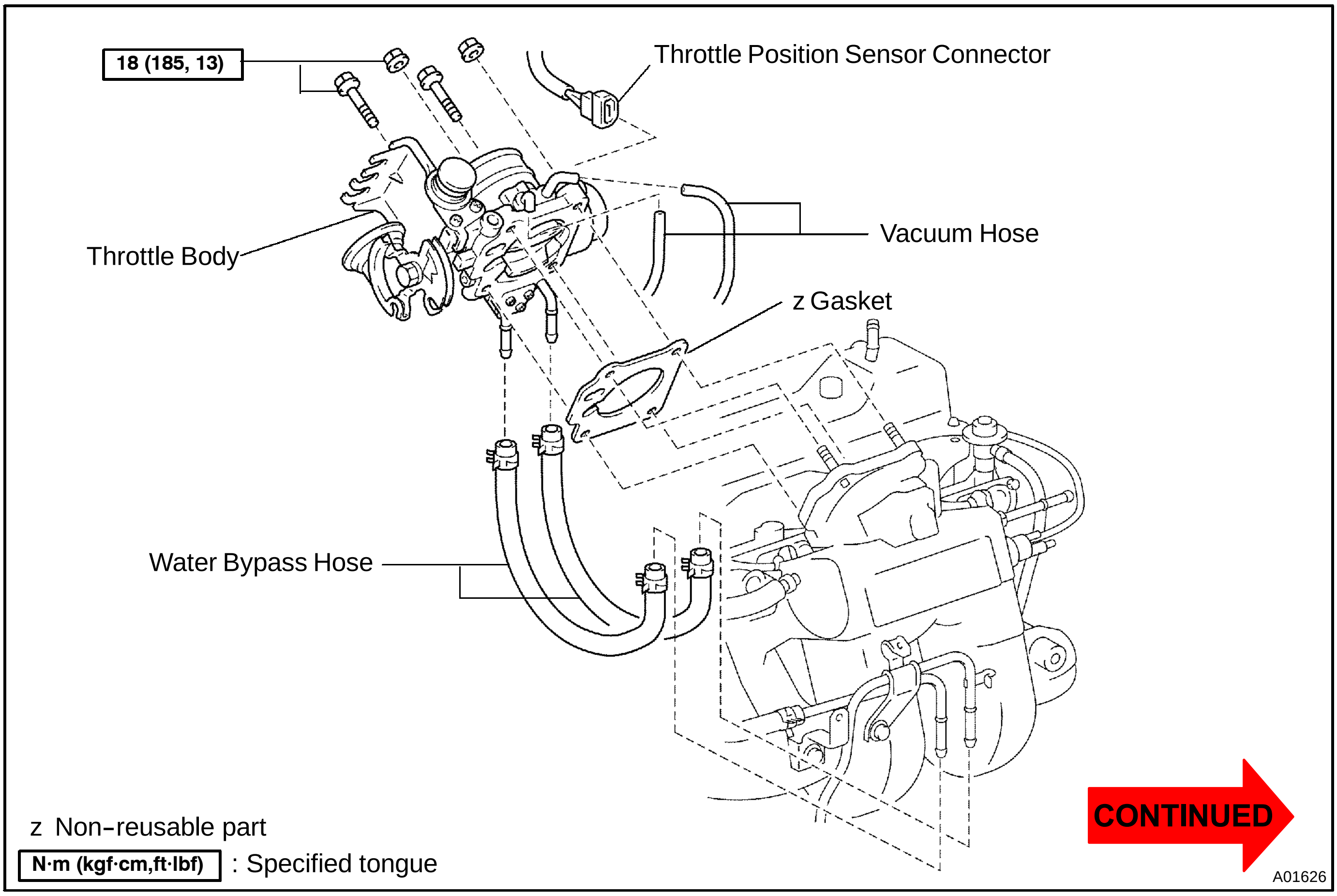
4. PREPARATION

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

5. REPAIR PROCEDURES

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

Example:



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

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

Example:

Task heading : what to do

Illustration:
what to do and where

21. CHECK PISTON STROKE OF OVERDRIVE BRAKE

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

SST 09350–30020 (09350–06120)

Set part No. *Component part No.*

Detailed text : how to do task

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

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

Specification

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

6. REFERENCES

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

7. SPECIFICATIONS

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

8. CAUTIONS, NOTICES, HINTS:

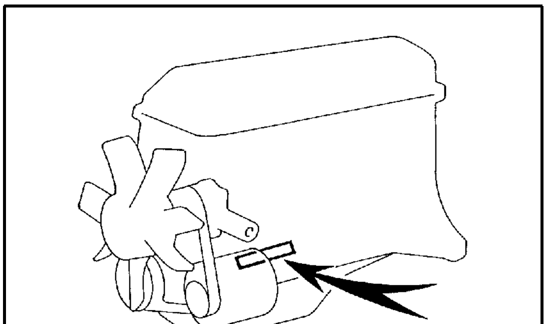
- CAUTIONS are presented in bold type, and indicate there is a possibility of injury to you or other people.
- NOTICES are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- HINTS are separated from the text but do not appear in bold. They provide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

9. SI UNIT

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

Example:

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



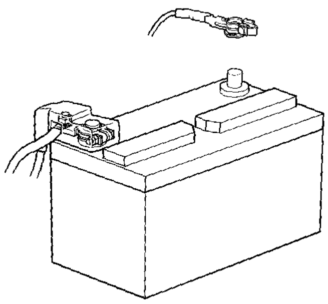
N17730

IDENTIFICATION INFORMATION

IN02Y-01

ENGINE SERIAL NUMBER

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



FI1066

REPAIR INSTRUCTIONS

GENERAL INFORMATION

IN02Z-01

BASIC REPAIR HINT

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

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

(c) Observe the following:

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

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

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

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

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

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

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

(e) Non–reusable parts

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

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

(f) Precoated parts

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

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

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

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

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

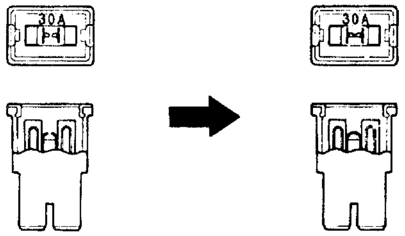
CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

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

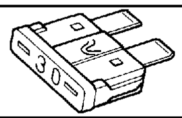
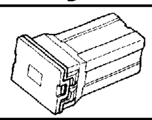
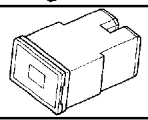
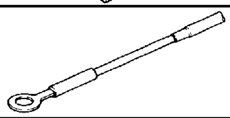
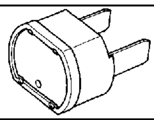
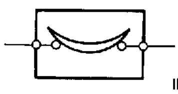
(i) Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found in the preparation part at the front of each section in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

Medium Current Fuse and High Current Fuse Equal Amperage Rating



BE1367

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

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

V00076

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

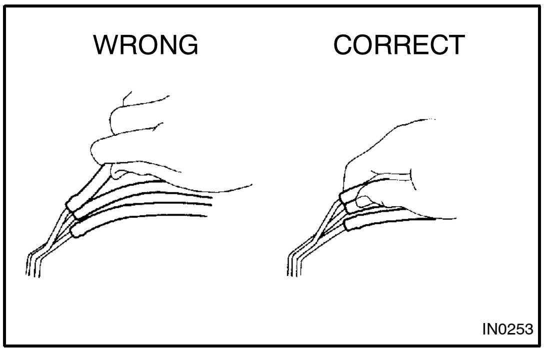
(1) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels at the opposite end in order to ensure safety.

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

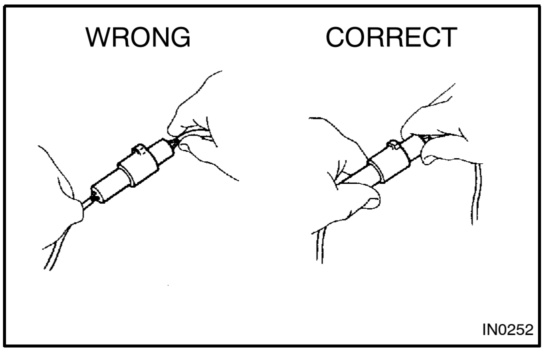
CONTINUED

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

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



IN0253



IN0252

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

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

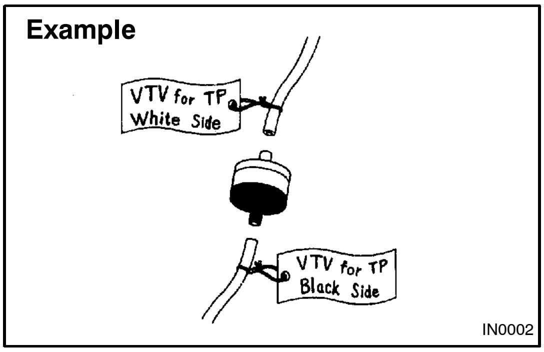
(4) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.

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

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

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

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



IN0002

(m) Tag hoses before disconnecting them:

(1) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.

(2) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

(n) Unless otherwise stated, all resistance is measured at an ambient temperature of 20°C (68°F). Because the resistance may be outside specifications if measured at high temperatures immediately after the vehicle has been running, measurements should be made when the engine has cooled down.

FOR ALL OF VEHICLES

IN030-01

PRECAUTION

1. FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

CAUTION:

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

(a) Use only unleaded gasoline
(b) Avoid prolonged idling
Avoid running the engine at idle speed for more than 20 minutes.
(c) Avoid spark jump test
(1) Perform spark jump test only when absolutely necessary. Perform this test as rapidly as possible.
(2) While testing, never race the engine.
(d) Avoid prolonged engine compression measurement
Engine compression tests must be done as rapidly as possible.
(e) Do not run engine when fuel tank is nearly empty
This may cause the engine to misfire and create an extra load on the converter.
(f) Avoid coasting with ignition turned off and prolonged braking
(g) Do not dispose of used catalyst along with parts contaminated with gasoline or oil

2. IF VEHICLE IS EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

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

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

3. FOR USING HAND–HELD TESTER

CAUTION:

Observe the following for safety reasons:

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

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

IN031–01

GENERAL INFORMATION

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

System	Page
Engine 1RZ–E: 2RZ–FE:, 3RZ–FE:	DI–1

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

INTRODUCTION – HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

CLICK HERE TO VIEW CHAPTER INDEX
3RZ-F,3RZ-FE Pages From Supplement
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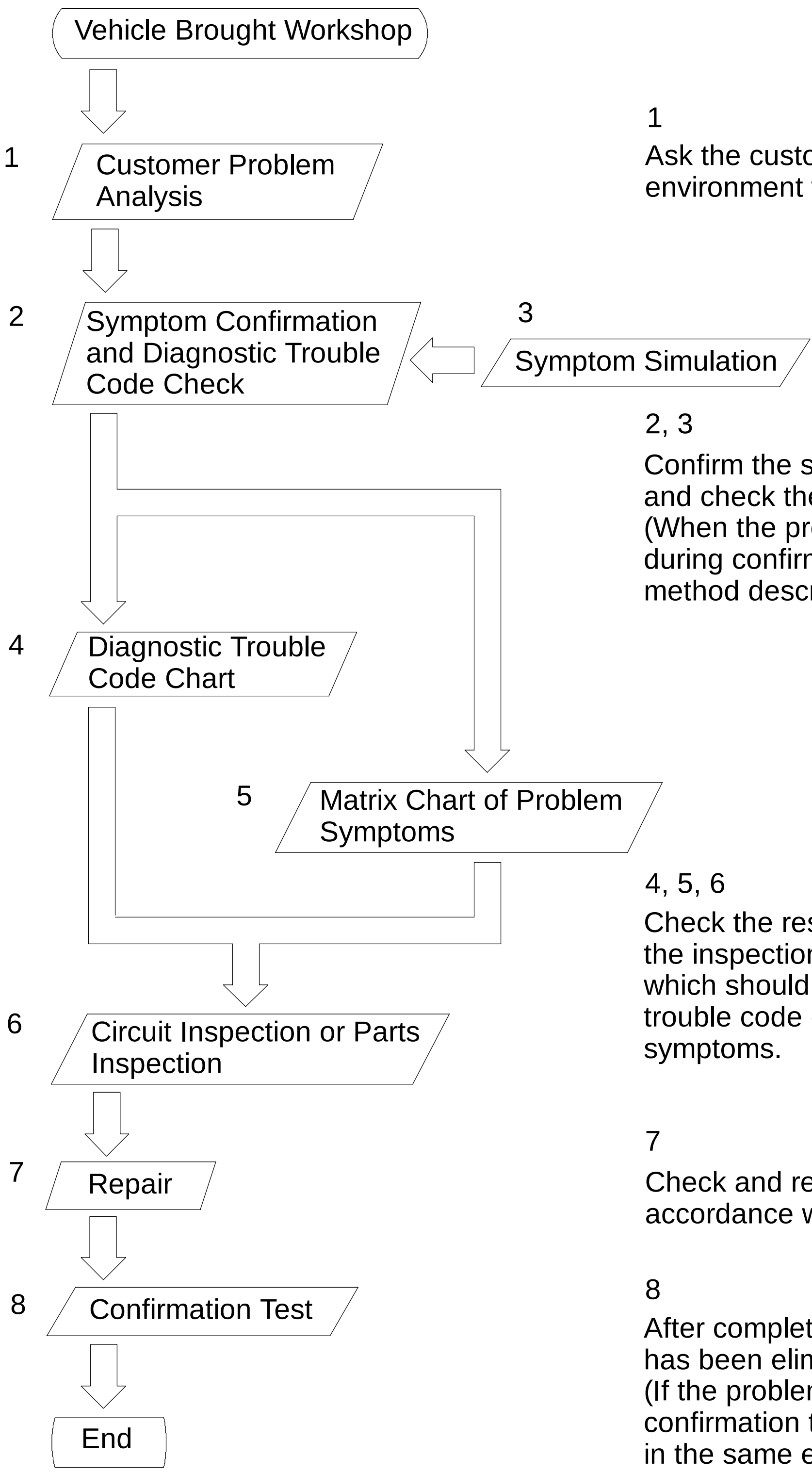
IN032-01

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 each section, showing the most effective methods for each circuit. Confirm the troubleshooting procedures first for the relevant circuit before beginning troubleshooting of that circuit.



1
Ask the customer about the conditions and the environment when the problem occurred.

2, 3
Confirm the symptoms and the problem conditions, and check the diagnostic trouble codes.
(When the problem symptoms do not appear during confirmation, use the symptom simulation method described later on.)

4, 5, 6
Check the results obtain in Step 2, then confirm the inspection procedure for the system or the part which should be checked using the diagnostic trouble code chart or the matrix chart of problem symptoms.

7
Check and repair the affected system or part in accordance with the instructions in Step 6.

8
After completing repairs, confirm that the problem has been eliminated.
(If the problem is not reproduced, perform the confirmation test under the same conditions and in the same environment as when it occurred for the first time.)

CONTINUED

1. CUSTOMER PROBLEM ANALYSIS

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

Important Point in the Problem Analysis:

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

Important Points in the Customer Problem Analysis

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

(Sample) Engine control system check sheet.

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

Inspector's Name ______________________

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

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

...onstant ☐ **Sometimes (times per   day/month)**

CONTINUED

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2. SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE CHECK

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

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

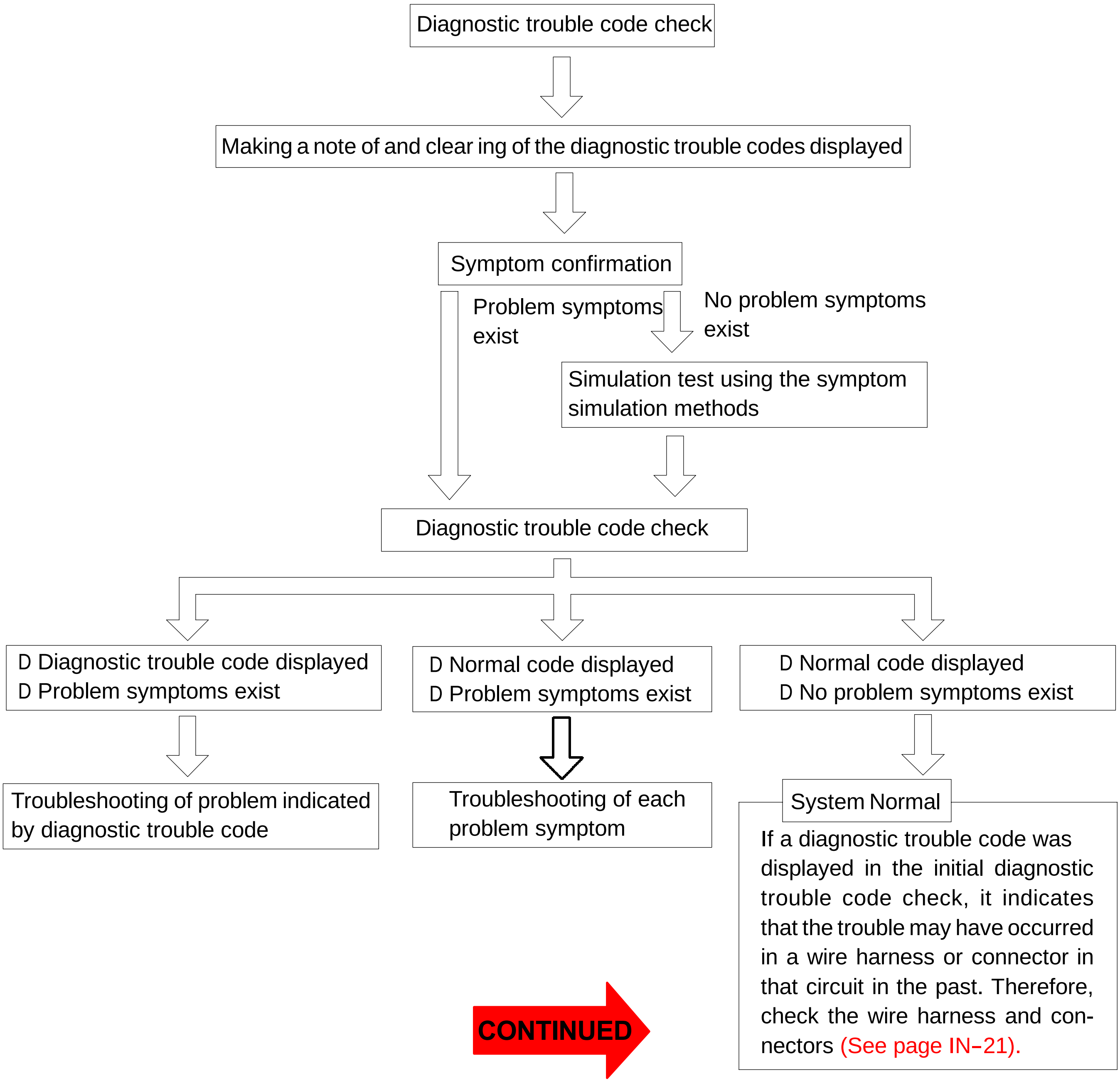
In diagnostic trouble code check, it is very important to determine whether the problem indicated by the diagnostic trouble code is still occurring or occurred in the past but returned to normal at present. In addition, it must be checked in the problem symptom check whether the malfunction indicated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

DIAGNOSTIC TROUBLE CODE CHECK PROCEDURE

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

CONTINUED

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



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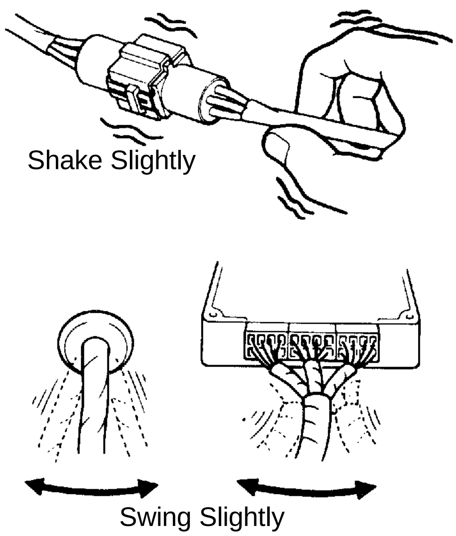
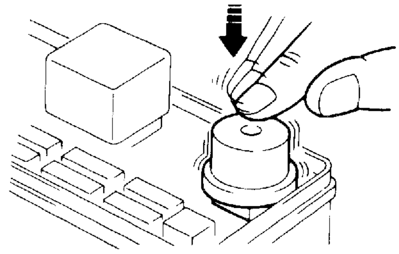
3. SYMPTOM SIMULATION

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

Important Points in the Symptom Simulation Test:

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

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

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CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX
3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

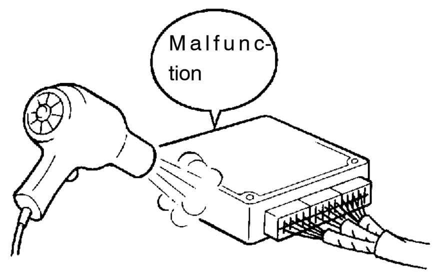
2 HEAT METHOD: When the problem seems to occur when the suspect area is heated.

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.

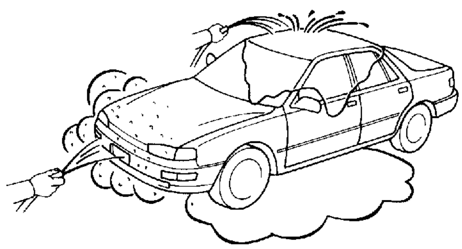
NOTICE:

(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)

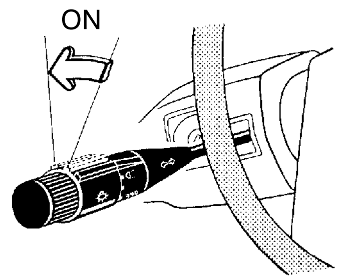
If a vehicle is subject to water leakage, the leaked water may contaminate the ECU. When testing a vehicle with a water leakage problem, special caution must be used.



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

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4. 1RZ–E: DIAGNOSTIC TROUBLE CODE CHART

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

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

D Trouble Area
Indicates the suspect area of the problem.

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

DTC CHART (SAE Controlled)

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

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

DTC No. (See page)	Detection Item	Trouble Area	*1 Check Engine Warning Light Nomal Mode/ Test Node	*Memory
12 (DI – 12)	NE Signal Circuit	D Open or short in NE circuit D IIA D Open or short in STA circuit D Engine ECU	ON / N.A	○
13 (DI – 28)	NE Signal Circuit	D Open or short in NE circuit D IIA D Engine ECU	ON / N.A	○
14 (DI – 31)	Ignition Signal Circuit	D Open or short in IGF or IGT circuit from IIA to engine ECU D Igniter D Engine ECU	ON / N.A	○
22 (DI – 32)	Water Temp. Sensor Circuit	D Open or short in water temp. sensor circuit D Water temp. sensor D Engine ECU	ON / N.A	○
		D Open or short intake air temp. sensor circuit D Intake air temp. sensor		

CONTINUED

5. 2RZ-FE:, 3RZ-FE: DIAGNOSTIC TROUBLE CODE CHART

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

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

D Trouble Area
Indicates the suspect area of the problem.

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

DTC CHART (SAE Controlled)

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

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

DTC No. (See page)	Detection Item	Trouble Area	CHK ENG *1	*Memory
P0100/31 (DI - 12)	Air Flow Circuit Malfunction	D Open or short in air flow meter circuit D Air flow meter D Engine ECU	○	○
P0110/24 (DI - 28)	Intake Air Temp. Circuit Malfunction	D Open or short in intake air temp. sensor circuit D Intake air temp. sensor D Engine ECU	-	○
P0115/22 (DI - 31)	Water Temp. Circuit Malfunction	D Open or short in water temp. sensor circuit D Water temp. sensor D Engine ECU	○	○
P0120/41 (DI - 32)	Throttle Position Sensor circuit Malfunction	D Open or short in throttle position sensor circuit D Throttle position sensor D Engine ECU	-	○
		D Open or short in Oxygen sensor circuit D Oxygen sensor		

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6. PROBLEM SYMPTOMS TABLE

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

HINT:

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

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

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

D Problem Symptom

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

PROBLEM SYMPTOMS TABLE

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

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7. 1RZ-FE: CIRCUIT INSPECTION

How to read and use each page is shown below.

D Diagnostic Trouble Code No. and Detection Item

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

DTC	43	Starter Signal Circuit

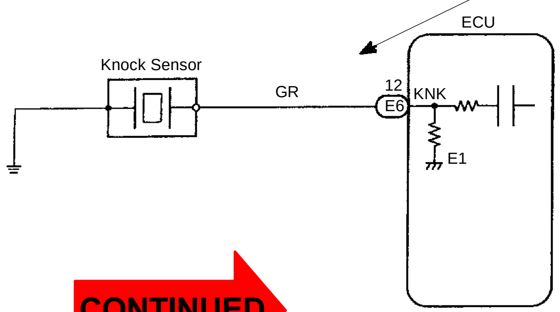
CIRCUIT DESCRIPTION

When the engine is cranked, the intake air flow is slow, so fuel vaporization is poor. A rich mixture is these fore necessary in order to achieve good startability. While the engine is being cranked, the battery positive voltage is applied to terminal STA of the ECU.

DTC No.	Detection Item	Trouble Area
43	No starter signal to ECU	D Open or short in signal circuit D engine ECU

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

WIRING DIAGRAM



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

CONTINUED

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8. 2RZ–FE:, 3RZ–FE: CIRCUIT INSPECTION

How to read and use each page is shown below.

D Diagnostic Trouble Code No. and Detection Item

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

DTC	P0325/52	Knock Sensor Circuit Malfunction

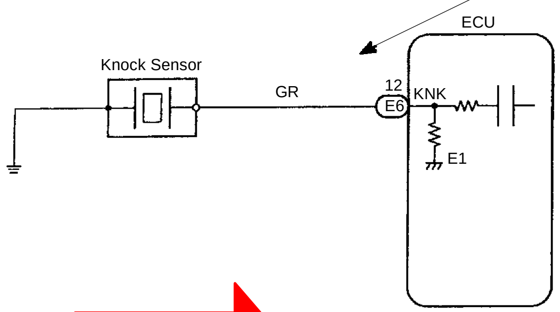
CIRCUIT DESCRIPTION

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	D Open or short in knock sensor circuit D Knock sensor (Looseness) D Engine ECU

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

WIRING DIAGRAM



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

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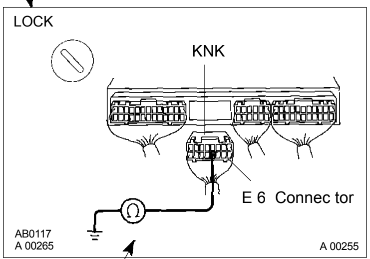
D Indicates the position of the ignition switch during the check.

LOCK
Ignition Switch LOCK (OFF)
START
Ignition Switch START
ON
Ignition Switch ON
ACC
Ignition Switch ACC

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

INSPECTION PROCEDURE

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



PREPARATION:
(a) Remove the glove compartment (See page F I -- 37).
(b) Disconnect the E 6 connector of ECM.

CHECK:
Measure resistance between terminal K N K of E C U connector and body ground.

OK:
Resistance: 1M. or higher

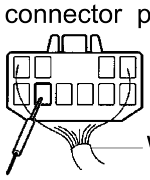
OK → Go to step 3.

NG

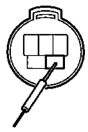
2	Check knock sensor (See page F I -- 34).

OK → Replace knock sensor.

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

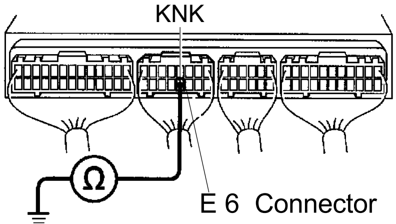


Check from the connector back side. (with harness)

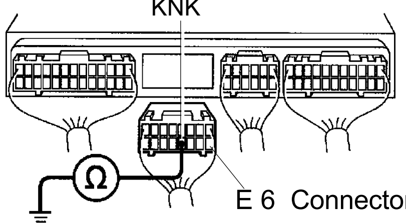


Check from the connector front side. (without harness)
In this case, care must be taken not to bend the terminals.

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



Connector being checked is connected.



Connector being checked is disconnected.

V 08425

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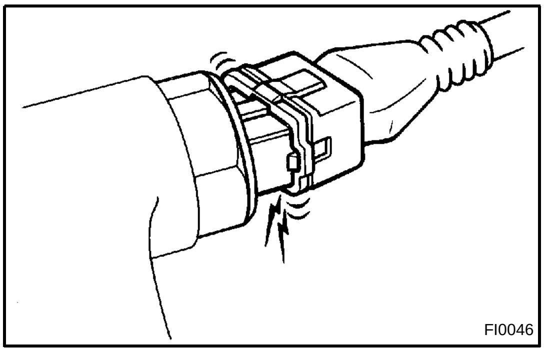
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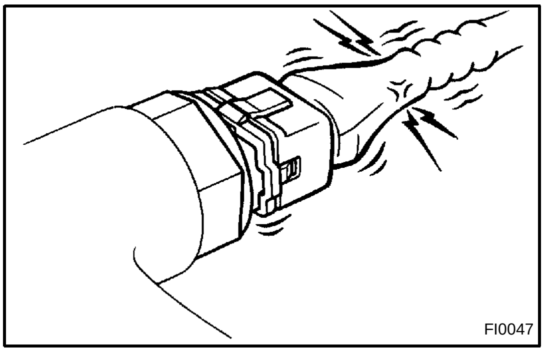
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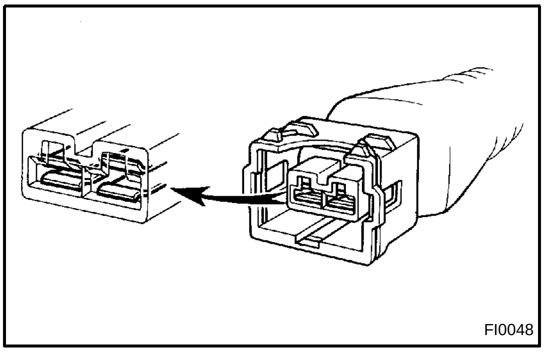
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HOW TO USE THE DIAGNOSTIC CHART AND INSPECTION PROCEDURE

1. CONNECTOR CONNECTION AND TERMINAL INSPECTION

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

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

SHORT CIRCUIT:
This could be due to a short circuit between the wire harness and the body ground or to a short inside the switch etc.
HINT:
When there is a short between the wire harness and body ground, check thoroughly whether the wire harness is caught in the body or is clamped properly.

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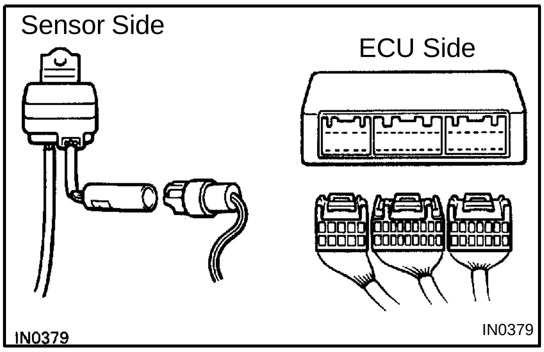
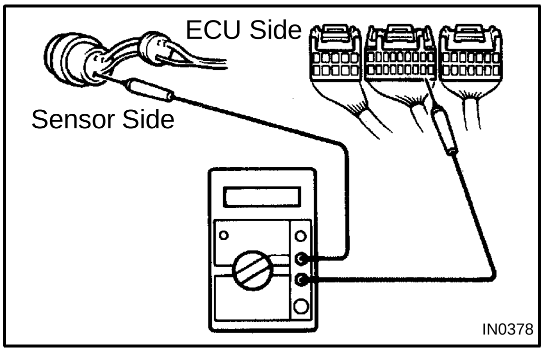




2. CONTINUITY CHECK (OPEN CIRCUIT CHECK)

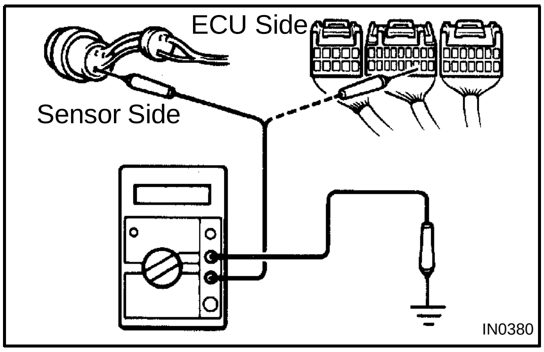
(a) Disconnect the connectors at both ECU and sensor sides.

(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)

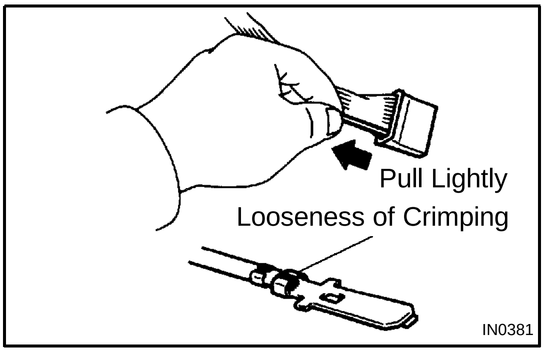
(a) Disconnect the connectors at both ends.

(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.

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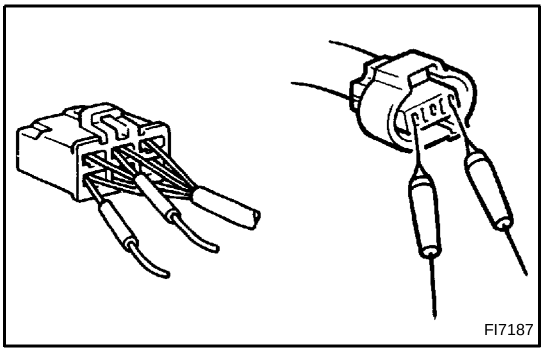
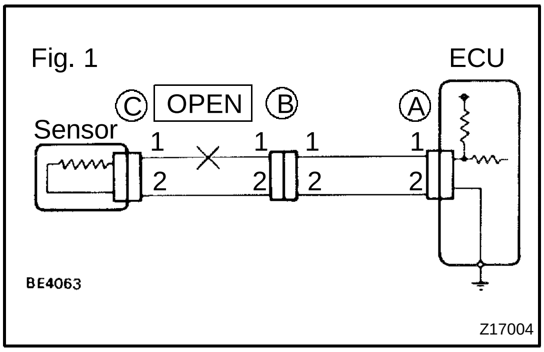


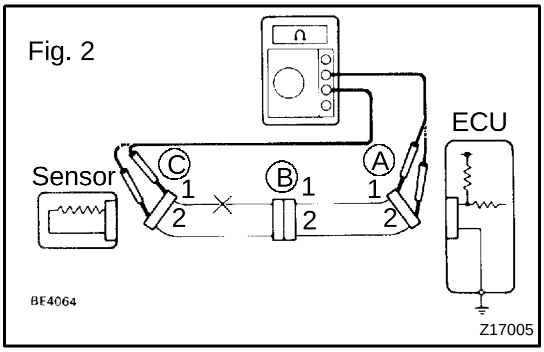
5. CONNECTOR HANDLING

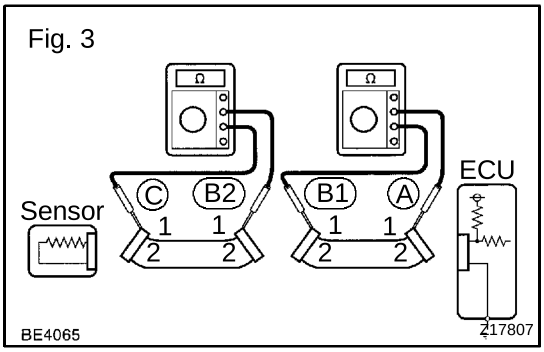
When inserting tester probes into a connector, insert them from the rear of the connector. When necessary, use mini test leads. For water resistant connectors which cannot be accessed from behind, take good care not to deform the connector terminals.



6. CHECK OPEN CIRCUIT

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





(a) Check the continuity.

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

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

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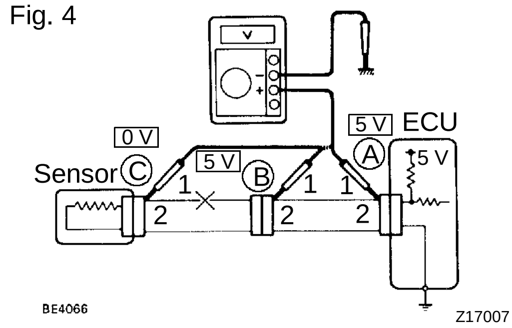
Fig. 4



(b) Check the voltage.

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

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

If the results are:

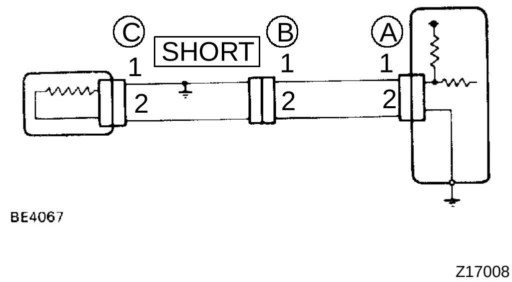
5V: Between Terminal 1 of connector ”A” and Body Ground

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

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

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

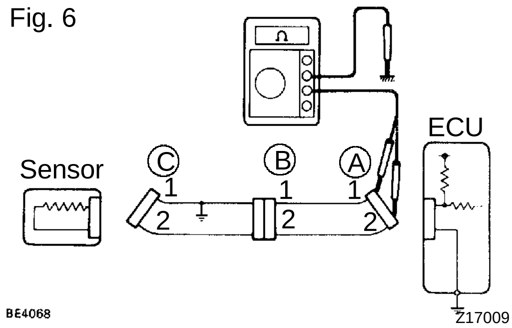
Fig. 5



7. CHECK SHORT CIRCUIT

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

Fig. 6



Check the continuity with ground.

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

In the case of Fig.6

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

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

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

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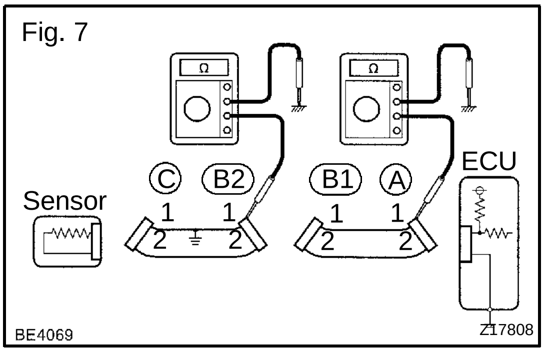
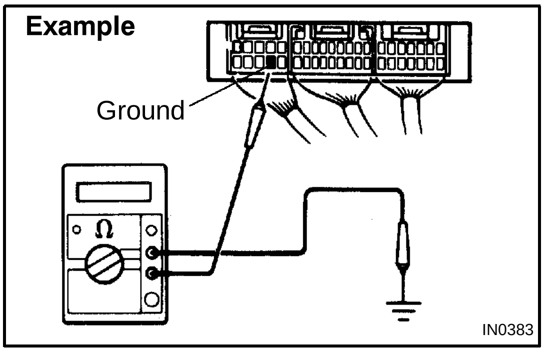


(2) Disconnect connector "B" and measure the resistance between terminal 1 of connector "A" and body ground, and terminal 1 of connector "B2" and body ground.
Between terminal 1 of connector "A" and body ground → No continuity
Between terminal 1 of connector "B2" and body ground → Continuity (short)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

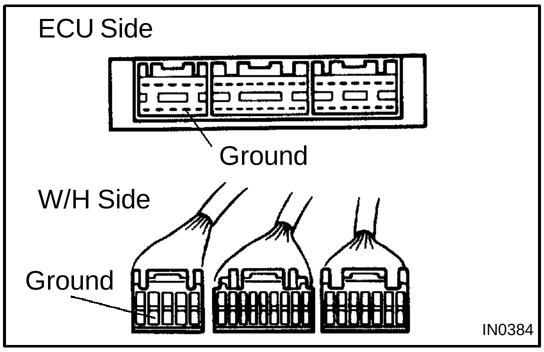
8. CHECK AND REPLACE ECU

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



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

Resistance: 1 Ω or less



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

TERMS

ABBREVIATIONS USED IN THIS MANUAL

IN034–01

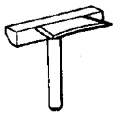
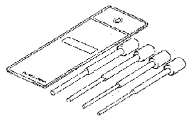
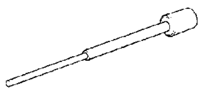
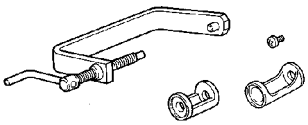
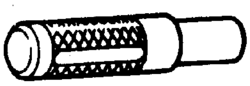
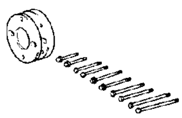
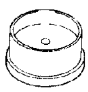
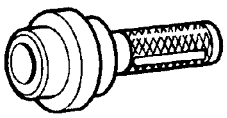
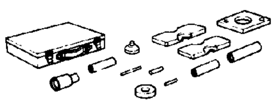
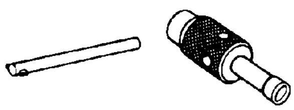
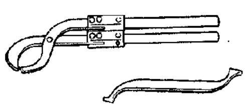
Abbreviations	Meaning
A/C	Air Conditioner
A/T	Automatic Transmission
BTDC	Before Top Dead Center
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
EGR	Exhaust Gas Recirculation
EVAP	Evaporative Emission Control
FIPG	Formed In Place Gasket
FL	Fusible Link
M/T	Manual Transmission
IG	Ignition
IIA	Integrated Ignition Assembly
ISC	Idle Speed Control
J/B	Junction Block
O/S	Oversize
PCV	Positive Crankcase Ventilation
SSM	Special Service Materials
SST	Special Service Tools
SW	Switch
TDC	Top Dead Center
TWC	Three – Way Catalyst
VSV	Vacuum Switching valve
w/	With
w/ o	Without
2WD	Two Wheel Drive Vehicles (4 x 2)
4WD	Four Wheel Drive Vehicles (4 x 4)

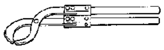
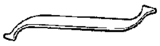
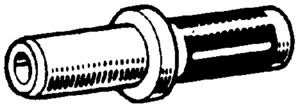
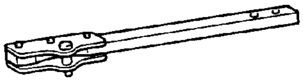
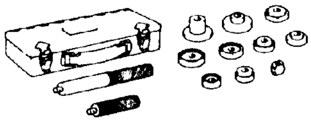
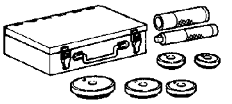
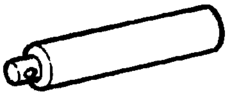
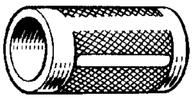
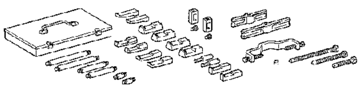
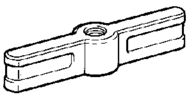
PREPARATION

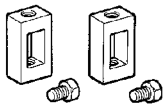
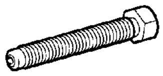
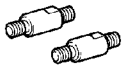
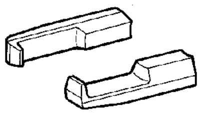
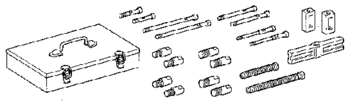
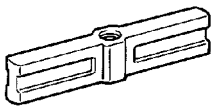
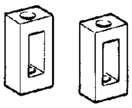
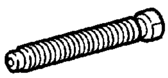
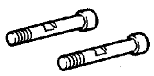
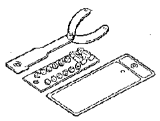
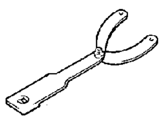
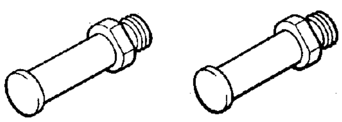
ENGINE MECHANICAL

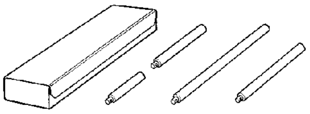
SST (Special Service Tools)

PP0L2-01

	09032-00100	Oil Pan Seal Cutter	
	09201-10000	Valve Guide Bushing Remover & Replacer Set	
	(09201-01060)	Valve Guide Bushing Remover & Replacer 6	
	09202-70020	Valve Spring Compressor	
	09207-76010	Rocker Arm Bushing	
	09213-54015	Crankshaft Pulley Holding Tool	
	09223-15030	Oil Seal & Bearing Replacer	Crankshaft rear oil seal
	09223-50010	Crankshaft Front oil Seal Replacer	
	09236-00101	Water Pump Overhaul Tool Set	
	(09236-15010)	Bearing Stay	Valve stem oil seal
	09243-00020	Idle Adjusting Screw Wrench	
	09248-55040	Valve Clearance Adjust Tool Set	CONTINUED

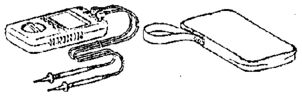
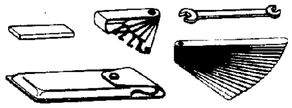
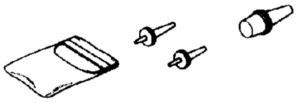
	(09248-05410)	Valve Lifter Press	
	(09248-05420)	Valve Lifter Stopper	
	09325-20010	Transmission Oil Plug	
	09330-00021	Companion Flange Holding Tool	Crankshaft pulley
	09550-10012	Replacer Set "B"	
	(09252-10010)	No. 1 Replacer Handle-	Valve guide busing
	09608-30012	Front Hub & Drive Pinion Bearing Tool Set-	
	(09951-07100)	Handle 100	Crankshaft rear oil seal
	09636-20010	Upper Ball Joint Dust Cover Replacer	Crankshaft timing gear
	09816-30010	Oil Pressure Switch Socket	Knock sensor
	09843-18020	Diagnosis Check Wire	
	09950-40010	Puller B Set	
	(09951-04010)	Hanger 150	CONTINUED

	(09952-04010)	Slide Arm	
	(09953-04010)	Center Bolt 100	
	(09954-04010)	Arm 25	
	(09955-04060)	Claw No.6	
	09950-50010	Puller C Set	
	(09951-05010)	Hanger 150	
	(09952-05010)	Slide Arm	
	(09953-05010)	Center Bolt 100	
	(09954-05020)	Claw No.2	
	09960-10010	Variable Pin Wrench Set	
	(09962-01000)	Variable Pin Wrench Arm Assy	
	(09963-00500)	Pin 5	
	(09963-01000)	Pin 10	CONTINUED

	09950-70010 Handle Set	
	(09951-07150) Handle 150	CONTINUED

PP0L3-01

RECOMMENDED TOOLS

	09082-00040	TOYOTA Electrical Tester.	
	09200-00010	Engine Adjust Kit .	
	09258-00030	Hose Plug Set .	Plug for the vacuum hose, fuel hose etc.

CONTINUED

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EQUIPMENT

Caliper gauge	
CO/HC meter	
Compression gauge	
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Dye penetrant	
Engine tune-up tester	
Heater	
Magnetic finger	
Micrometer	
OBD II scan tool	Engine speed
Piston ring compressor	
Piston ring expander	
Plastigage	
Precision straight edge	
Soft brush	
Spring tester	Valve spring
Steel square	Valve spring
Thermometer	
Torque wrench	
V-block	
Valve seat cutter	
Vernier calipers	
Tachometer	

CONTINUED

PP0L5-01

SSM (Service Special Materials)

08826-00080	Seal Packing Black or equivalent (FIPG)	Over space between cylinder head and timing chain cover Semi-circular plug Oil pan, Rear oil seal retaine
08833-00070	Adhesive 1324, THREE BOND 1324 or equivalent	Spark plug tube Drive plate bolt
08833-00080	Adhesive 1344 THREE BOND 1344 LOCTITE 242 or equivalent	Oil pressure switch

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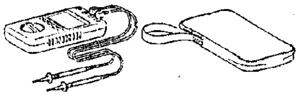
EMISSION CONTROL

RECOMMENDED TOOLS

PP0L6-01

	09082-00040	TOYOTA Electrical Tester.	

PP0L7-01

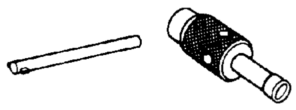
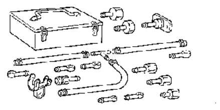
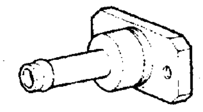
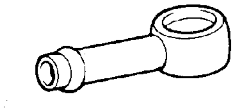
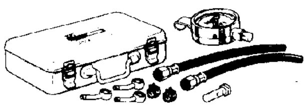
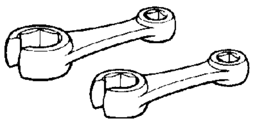
EQUIPMENT

OBD II scan tool	Engine speed
Torque wrench	
Vacuum gauge	

ELECTRONIC FUEL INJECTION

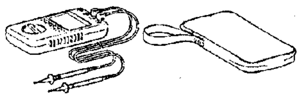
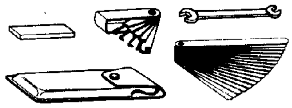
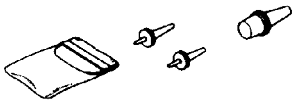
PP0L8–01

SST (Special Service Tools)

	09243–00020	Idle Adjusting Screw Wrench	
	09268–41046	Injection Measuring Tool Set	
	(09268–41091)	NO.7 Union	
	(90405–09015)	No.1 Union	
	09268–45012	EFI Fuel Pressure Gauge	
	09631–22020	Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09816–30010	Oil Pressure Switch Socket	Knock sensor
	09842–30070	Wiring ”F” EFI Inspection	
	09843–18020	Diagnosis Check Wire	

PP0L9-01

RECOMMENDED TOOLS

	09082–00040	TOYOTA Electrical Tester.	
	09200–00010	Engine Adjust Kit .	
	09258–00030	Hose Plug Set .	Plug for vacuum hose, fuel hose etc.

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PP0LA-01

EQUIPMENT

Carburetor cleaner	Throttle body
Graduated cylinder	Injector
Heater	
Ohmmeter	
Soft brush	Throttle body
Sound scope	Injector
Thermometer	
Tachometer	
Torque wrench	

COOLING

EQUIPMENT

PP0LB-01

Heater	Thermostat
Radiator cap tester	
Thermometer	Thermostat
Torque wrench	

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PP0LC-01

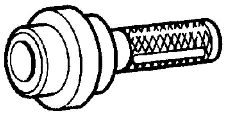
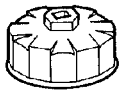
COOLANT

Item	Capacity	Classification
1RZ-E:	7.8 liters (8.2 US qts, 6.9 Imp. qts)	Ethylene-glycol base
1RZ:		
w/ Heater	7.8 liters (8.2 US qts, 6.9 Imp. qts)	
w/o Heater	7.3 liters (7.7 US qts, 6.4 Imp. qts)	
2RZ-FE:		
w/ Heater	7.4 liters (7.8 US qts, 6.5 Imp. qts)	
w/o Heater	6.9 liters (7.3 US qts, 6.1 Imp. qts)	
3RZ-F:		
w/ Heater	7.7 liters (8.1 US qts, 6.8 Imp. qts)	
W/o Heater	7.2 liters (7.6 US qts, 6.3 Imp. qts)	
3RZ-FE:	7.7 liters (8.1 US qts, 6.8 Imp. qts)	

LUBRICATION

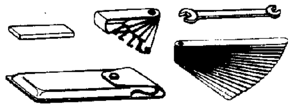
SST (Special Service Tools)

PP0LD-01

	09223-50010	Crankshaft Front oil Seal Replacer	
	09228-07501	Oil Filter Wrench	
	09816-30010	Oil Pressure Switch Socket	

PP0LE-01

RECOMMENDED TOOLS

	09200-00010	Engine Adjust Kit .	

PP0LF-01

EQUIPMENT

Oil pressure gauge	
Precision straight edge	Oil pump
Torque wrench	

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PP0LG-01

LUBRICANT

Item	Capacity	Classification
Engine oil		API grade SH, Energy-Conserving II or SJ Energy-Conserving or ILSAC multigrade engine oil. Recommended viscosity is as shown in the illustration.
2WD		
Dry fill	5.1 liters (5.4 US qts, 4.5 lmp. qts)	
Drain and refill		
w/ Oil filter change	4.7 liters (5.0 US qts, 4.1 lmp. qts)	
w/o Oil filter change	4.0 liters (4.2 US qts, 3.5 lmp. qts)	
4WD		
Dry fill	6.3 liters (6.7 US qts, 5.5 lmp. qts)	
Drain and refill		
w/ Oil filter change	6.0 liters (6.3 US qts, 5.3 lmp. qts)	
w/o Oil filter change	5.3 liters (5.6 US qts, 4.7 lmp. qts)	

PP0LH-01

SSM (Service Special Materials)

08833-00080	Adhesive 1344 THREE BOND 1344 LOCTITE 242 or equivalent	Oil pressure switch

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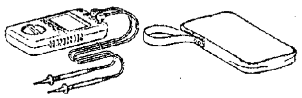
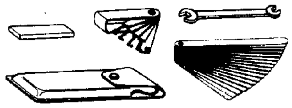
IGNITION

RECOMMENDED TOOLS

PP0LI-01

	09082-00040	TOYOTA Electrical Tester.	
	09200-00010	Engine Adjust Kit .	

PP0LJ-01

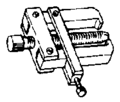
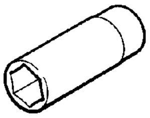
EQUIPMENT

Spark plug cleaner	
Torque wrench	
Ohmmeter	

STARTING

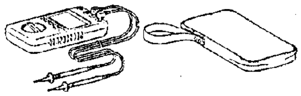
SST (Special Service Tools)

PP0LK-01

	09286-46011	Injection Pump Spline Shaft Puller	Armature bearing
	09810-38140	Starter Magnet Switch Nut Wrench 14	Terminal nut
	09820-00030	Alternator Rear Bearing Replacer	Armature rear bearing

PP0LL-01

RECOMMENDED TOOLS

	09082-00040	TOYOTA Electrical Tester.	

PP0LM-01

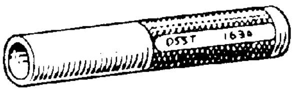
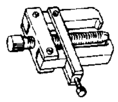
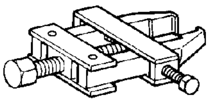
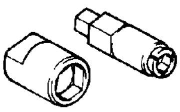
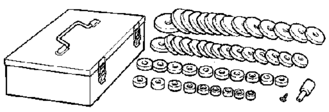
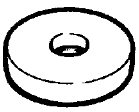
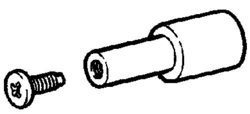
EQUIPMENT

Dial indicator	Commutator
Magnetic finger	Steel ball
Pull scale	Brush spring
Sandpaper	Commutator
Torque wrench	
V-block	Commutator
Vernier calipers	Commutator, Brush
Press	Magnetic switch terminal kit

CHARGING

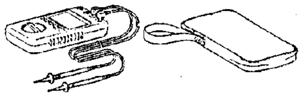
PP0LN-01

SST (Special Service Tools)

	09285-76010	Injection Pump Camshaft Bearing Cone Replacer	Rotor rear bearing cover
	09286-46011	Injection Pump Spline Shaft Puller	Rectifier end frame
	09820-00021	Alternator Rear Bearing Puller	
	09820-00030	Alternator Rear Bearing Replacer	Rotor rear bearing
	09820-63010	Alternator Pulley Set Nut Wrench Set	
	09950-60010	Replacer Set	Rotor front bearing
	(09951-00260)	Replacer 26	
	(09951-00500)	Replacer 50	
	(09952-06010)	Adapter	

PP0LO-01

RECOMMENDED TOOLS

	09082-00040 TOYOTA Electrical Tester.	

PP0LP-01

EQUIPMENT

Ammeter(A)	
Battery specific gravity gauge	
Belt tension gauge	
Torque wrench	
Vernier calipers	Rotor (Slip ring), Brush

SERVICE SPECIFICATIONS

STANDARD BOLT

HOW TO DETERMINE BOLT STRENGTH

SS00F-03

	Mark	Class
Hexagon head bolt	Bolt head No. 4–	4T
	5–	5T
	6–	6T
	7–	7T
	8–	8T
	9–	9T
	10–	10T
	11–	11T
	No mark	4T
Hexagon flange bolt w/ washer hexagon bolt	No mark	4T
Hexagon head bolt	2 Protruding lines	5T
Hexagon flange bolt w/ washer hexagon bolt	2 Protruding lines	6T
Hexagon head bolt	3 Protruding lines	7T
Hexagon head bolt	4 Protruding lines	8T

	Mark	Class
Hexagon flange bolt w/ washer hexagon bolt	4 Protruding lines	9T
Hexagon flange bolt w/ washer hexagon bolt	5 Protruding lines	10T
Hexagon flange bolt w/ washer hexagon bolt	6 Protruding lines	11T
Stud bolt	No mark	4T
	Grooved	6T
Welded bolt		4T

V06821

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3RZ-F,3RZ-FE Pages From Supplement
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SS00G-03

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

V00079

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3RZ-F,3RZ-FE Pages From Supplement
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ENGINE MECHANICAL

SERVICE DATA

SS0B1-01

Idle CO	Concentration	1RZ:, 1RZ-E: 3RZ-F:, 3RZ-FE:	1.5 ± 0.5 % 1.5 ± 0.5 %
Idle CO/HC	Concentration	2RZ-FE:	0 – 0.5 %
Compression pressure	at 250 rpm Difference of pressure between each cylinder	STD 1RZ:, 1RZ-E: 2RZ:, 3RZ-FE: 3RZ-F: Minimum	1,230 kPa (12.5 kgf/cm², 178 psi) or more 1,230 kPa (12.5 kgf/cm², 178 psi) or more 1,127 kPa (11.5 kgf/cm², 168 psi) or more 880 kPa (9.0 kgf/cm², 127 psi) 98 kPa (1.0 kgf/cm², 14 psi) or less
Valve Clearance	at cold Intake Exhaust	1RZ:, 1RZ-E: 2RZ-FE:, 3RZ-F:, 3RZ-FE:	0.20 – 0.30 mm (0.008 – 0.012 in.) 0.15 – 0.25 mm (0.006 – 0.010 in.) 0.25 – 0.35 mm (0.010 – 0.014 in.)
Ignition timing		1RZ:, 3RZ-F: 1RZ-E:, 2RE-FE:, 3RE-FE:	5° BTDC@ Max. 850 rpm 5° BTDC@ idle w/ Terminals TE1 and E1 of check Connector connected
Idle speed		1RZ:, 1RZ-E:, 3RZ-F: 2RZ-FE:, 3RZ-FE:	700 – 800 rpm 750 – 850 rpm 650 – 750 rpm
Cylinder head (1RZ:, 1RZ-E:)	Warpage Cylinder block side Manifold side Valve seat Refacing angle Contacting angle Contacting width Cylinder head bolt thread outside diameter	 Maximum Maximum Intake Exhaust STD Minimum	 0.15 mm (0.0059 in.) 0.20 mm (0.0079 in.) 30°, 45°, 60° 45° 1.0 – 1.4 mm (0.039 – 0.055 in.) 10.760 – 10.970 mm (0.4236 – 0.4319 in.) 10.40 mm (0.4094 in.)
Cylinder head (2RZ-FE:, 3RZ-F:, 3RZ-FE:)	Warpage Cylinder block side Manifold side Valve seat Refacing angle Contacting angle Contacting width Cylinder head bolt outside diameter	 Maximum Maximum Intake Exhaust STD Minimum	 0.05 mm (0.0020 in.) 0.10 mm (0.0390 in.) 30°, 45°, 60° 45° 60° 45° 0.9 – 1.9 mm (0.035 – 0.075 in.) 10.76 – 10.97 mm (0.4236 – 0.4319 in.) 10.40 mm (0.4094 in.)
Valve guide bushing (1RZ:, 1RZ-E:)	Inside diameter Outside diameter (for repair part)	 STD O/S 0.05	8.010 – 8.030 mm (0.3154 – 0.3161 in.) 13.040 – 13.051 mm (0.5134 – 0.5138 in.) 13.090 – 13.101 mm (0.5154 – 0.5158 in.)
Valve guide bushing (2RZ-FE:, 3RZ-F:, 3RZ-FE:)	Inside diameter Outside diameter (for repair part) Protrusion height Replacing temperature (Cylinder head side)	 STD O/S 0.05	6.010 – 6.030 mm (0.2366 – 0.2374 in.) 11.000 – 11.027 mm (0.4331 – 0.4341 in.) 11.050 – 11.077 mm (0.4350 – 0.4361 in.) 8.2 – 8.6 mm (0.323 – 0.339 in.) 80 – 100°C (176 – 212°F)

CONTINUED

Valve (1RZ:, 1RZ-E:)	Valve overall length	STD Intake	101.70 - 102.30 mm(4.0039 - 4.0278 in.)
		Exhaust	102.05 - 102.45 mm (4.0177 - 4.0335 in.)
		Minimum intake	101.50 mm (3.9961 in.)
		Exhaust	101.75 mm (4.0059 in.)
	Valve face angle		44.5°
	Stem diameter	Intake	7.970 - 7.985 mm (0.3138 - 0.3144 in.)
		Exhaust	7.965 - 7.980 mm (0.3136 - 0.3142 in.)
	Stem oil clearance	STD Intake	0.025 - 0.060 mm (0.0010 - 0.0024 in.)
		Exhaust	0.030 - 0.065 mm (0.0012 - 0.0026 in.)
		Maximum Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	STD Intake	1.00 - 1.40 mm (0.0394 - 0.0551 in.)
		Exhaust	1.30 - 1.70 mm (0.0512 - 0.0669 in.)
		Minimum Intake	0.70 mm (0.0276 in.)
		Exhaust	1.00 mm (0.0394 in.)
Valve (2RZ-FE:)	Valve overall length	STD Intake	103.45 mm (4.0728 in.)
		Exhaust	103.60 mm (4.0787 in.)
		Minimum Intake	102.95 mm (4.0531 in.)
		Exhaust	103.10 mm (4.0590 in.)
	Valve face angle		44.5°
	Stem diameter	Intake	5.970 - 5.985 (0.2350 - 0.2356 in.)
		Exhaust	5.965 - 5.980 (0.2348 - 0.2354 in.)
	Stem oil clearance	STD Intake	0.025- -0.060 mm(0.0010- -0.0024 in.)
		Exhaust	0.030 - 0.065 mm (0.0012 - 0.0026 in.)
		Maximum Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	STD	1.0 mm (0.039 in.)
		Minimum	0.5 mm (0.020 in.)
Valve (3RZ-F:, 3RZ-FE:)	Valve overall length	3RZ-F: STD Intake	103.95 mm (4.0925 in.)
		Exhaust	103.90 mm (4.0905 in.)
		3RZ-FE: STD Intake	103.45 mm (4.0728 in.)
		Exhaust	103.60 mm (4.0787 in.)
		3RZ-F: Minimum Intake	103.45 mm (4.0728 in.)
		Exhaust	103.45 mm (4.0728 in.)
		3RZ-FE: Minimum Intake	102.95 mm (4.0531 in.)
		Exhaust	103.10 mm (4.0590 in.)
	Valve face angle		44.5°
	Stem diameter	Intake	5.970 - 5.985 mm (0.2350 - 0.2356 in.)
		Exhaust	5.965 - 5.980 mm (0.2348 - 0.2354 in.)
	Stem oil clearance	STD Intake	0.025 - 0.060 mm (0.0010 - 0.0024 in.)
		Exhaust	0.030 - 0.065 mm (0.0012 - 0.0026 in.)
		Maximum Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	3RZ-F: STD Intake	1.5 mm (0.0591 in.)
		Exhaust	1.3 mm (0.0512 in.)
		Minimum Intake	1.0 mm (0.039 in.)
		Exhaust	0.8 mm (0.031 in.)
		3RZ-FE: STD	1.0 mm (0.039 in.)
		Minimum	0.5 mm (0.020 in.)
Valve spring (1RZ:, 1RZ-E:)	Deviation	Maximum	2.0 mm (0.079 in.)
	Free length		47.70 mm (1.8779 in.)
	Installed tension	at 40.30 mm(1.5866 in.)	252 - 278 N (25.7 - 28.4 kgf, 56.7 - 62.6 lbf)
Valve spring (2RZ-FE,: 3RZ-F:, 3RZ-FE:)	Deviation	Maximum	2.0 mm (0.079 in.)
	Free length		47.70 mm (1.878 in.)
	Installed tension	at 40.3 mm (1.586 in.)	162 - 190 N (16.5 - 19.4 kgf, 36.4 - 42.8 lbf)

CONTINUED

Camshaft (1RZ:, 1RZ-E:)	Thrust clearance	STD	0.080 - 0.155 mm (0.0031 - 0.0061 in.)
		Maximum	0.25 mm (0.0098 in.)
	Journal oil clearance	STD	0.0025 - 0.066 mm (0.0010 - 0.0026 in.)
		Maximum	0.10 mm (0.0039 in.)
	Journal diameter		33.959 - 33.975 mm (1.3370 - 1.3376 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Cam lobe height	STD	47.840 - 47.940 mm (1.8835 - 1.8874 in.)
		Minimum	47.44 mm (1.8677 in.)
Camshaft (2RZ-FE:, 3RZ-F:, 3RZ-FE:)	Thrust clearance	STD	0.040 - 0.095 mm (0.0016 - 0.0037 in.)
		Maximum	0.12 mm (0.0047 in.)
	Journal oil clearance	STD	0.025 - 0.062 mm (0.0010 - 0.0024 in.)
		Maximum	0.08 mm (0.0031 in.)
	Journal diameter		26.959 - 26.975 mm (1.0614 - 1.0620 in.)
	Circle runout	Maximum	0.06 mm (0.0024 in.)
	Cam lobe height	Intake	45.31 - 45.41 mm (1.7839 - 1.7878 in.)
		Exhaust	45.06 - 45.16 mm (1.7740 - 1.7779 in.)
	Camshaft gear backlash	STD	0.020 - 0.200 mm (0.0008 - 0.0079 in.)
		Maximum	0.30 mm (0.0188 in.)
	Camshaft gear spring end free distance		22.5 - 22.9 mm (0.886 - 0.902 in.)
Valve lifter (1RZ:, 1RZ-E:)	Lifter diameter		37.922 - 37.932 mm (1.4930 - 1.4934 in.)
	Lifter bore diameter		37.960 - 37.975 mm (1.4955 - 1.4951 in.)
	Oil clearance	STD	0.028 - 0.053 mm (0.0011 - 0.0021 in.)
		Maximum	0.10 mm (0.0039 in.)
Valve lifter (2RZ-FE:, 3RZ-F:, 3RZ-FE:)	Lifter diameter		30.969 - 30.976 mm (1.1578 - 1.2195 in.)
	Lifter bore diameter		31.000 - 31.016 mm (1.2205 - 1.2211 in.)
	Oil clearance	STD	0.024 - 0.050 mm (0.0009 - 0.0020 in.)
		Maximum	0.07 mm (0.0028 in.)
Manifold (1RZ:, 1RZ-E:)	Warpage	Maximum Intake	0.20 (0.0079 in.)
		Exhaust	0.70 (0.00276 in.)
Manifold (2RZ-FE:, 3RZ-F:, 3RZ-FE:)	Warpage	Maximum Intake	0.20 mm (0.0078 in.)
		Exhaust	0.50 mm (0.0197 in.)
Chain and timing gear (1RZ:, 1RZ-E:)	Chain elongation at 16 links	Maximum	146.6 mm (5.772 in.)
	Gear diameter (w/ chain)	Minimum Camshaft	113.8 mm(4.480 in.)
		Crankshaft	59.4 mm (2.339 in.)
Chain and timing gear (2RZ-FE: 3RZ-F:)	Chain length at 16 links	Maximum	147.5 mm (5.802 in.)
	Camshaft timing gear wear (w/ chain)	Minimum	113.8 mm (4.480 in.)
	Crankshaft timing gear wear (w/ chain)	Minimum	59.4 mm (2.339 in.)
Chain and timing gear (3RZ-FE:)	Chain length at 16 links	Maximum (No.1)	147.5 mm (5.807 in.)
		(No.2)	123.6 mm (4.866 in.)
	Camshaft timing gear wear (w/ chain)	Minimum	113.8 mm (4.480 in.)
	Crankshaft timing gear wear (w/ chain)	Minimum	59.4 mm (2.339 in.)
	Balance shaft drive gear wear (w/ chain)	Minimum	75.9 mm(2.988 in.)
	No.2 crankshaft timing sprocket wear (w/ chain)	Minimum	96.7 mm (3.807 in.)
Spark plug tube (2RZ-FE:, 3RZ-FE:)	Protrusion		47.0 mm (1.850 in.)

CONTINUED

Chain tensioner Slipper and Vibration dumper	Wear	Maximum	1.0 mm (0.039 in.)
Cylinder block (1RZ:, 1RZ-E:)	Cylinder head surface warpage	Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD	85.990 - 86.003 mm (3.3854 - 3.3859 in.)
		Maximum	86.203 mm (3.3938 in.)
		O/S 0.50	86.703 mm (3.4135 in.)
	Main bearing cap bolt outside diameter	STD	10.760 - 10.970 mm (0.4236 - 0.4319 in.)
		Minimum	10.40 mm (0.4094 in.)
Cylinder block (2RZ-FE:)	Cylinder head surface warpage	Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD	94.990 - 95.003 mm (3.7400 - 3.7403 in.)
		Maximum	95.06 mm (3.7425 in.)
	Main bearing bolt outside diameter	STD	10.76 - 10.97 mm(0.4236 - 0.4319 in.)
		Minimum	10.40 mm (0.4094 in.)
	Cylinder block main journal bore diameter		
		STD Mark 1	64.004 - 64.010 mm (2.5198 - 2.5201 in.)
		Mark 2	64.011 - 64.016 mm (2.5201 - 2.5203 in.)
		Mark 3	64.017 - 64.022 mm (2.5203 - 2.5205 in.)
		U/S 0.25	64.000 - 64.024 mm (2.5197 - 2.5206 in.)
Cylinder block (3RZ-F:, 3RZ-FE:)	Cylinder head surface warpage	Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD	94.990 - 95.003 mm (3.7400 - 3.7403 in.)
		Maximum	95.06 mm (3.7425 in.)
	Main bearing bolt outside diameter	STD	10.76 - 10.97 mm(0.4236 - 0.4319 in.)
		Minimum	10.40 mm (0.4094 in.)
	Cylinder block main journal bore diameter		
		STD Mark 1	64.004 - 64.010 mm (2.5198 - 2.5201 in.)
		Mark 2	64.011 - 64.016 mm (2.5201 - 2.5203 in.)
		Mark 3	64.017 - 64.022 mm (2.5203 - 2.5205 in.)
		U/S 0.25	64.000 - 64.024 mm (2.5197 - 2.5206 in.)
Piston and piston ring (1RZ:, 1RZ-E:)	Piston diameter	STD	85.933 - 85.923 mm (3.3832 -3.3828 in.)
		O/S 0.50	86.450 - 86.460 mmn (3.4035 - 3.4039 in.
	Piston oil clearance	STD	0.030 - 0.053 mm (0.0012 - 0.0021 in.)
		Maximum	0.073 mm (0.0029 in.)
	Piston ring groove clearance	No.1	0.030 - 0.0080 mm (0.0012 - 0.0031 in.)
		No.2	0.040 - 0.080 mm (0.0016 - 0.0031 in.)
	Piston ring end gap	STD No.1	0.220 - 0.350 mm (0.0087 - 0.0138 in.)
		No.2	0.450 - 0.600 mm (0.0177 - 0.0236 in.)
		Oil	0.130 - 0.380 mm (0.0051 - 0.0150 in.)
		Maximum No.1	0.95 mm (0.0374 in.)
		No..2	1.20 mm (0.0472 in.)
		Oil	0.98 mm (0.0386 in.)
Piston and piston ring (2RZ-FE:)	Piston diameter	STD	94.923 - 94.933 mm (3.7371 - 3.7375 in.)
		O/S 0.50	95.423 - 95.433 mm (3.7568 - 3.7572 in.
	Piston oil clearance	STD	0.057 - 0.080 mm (0.0022 - 0.0031 in.)
		Maximum	
	Piston ring groove clearance	No.1	0.020 - 0.070 mm (0.0008 - 0.0028 in.)
		No.2	0.030 - 0.070 mm (0.0012 - 0.0028 in.)
	Piston ring end gap	No.1	0.300 - 0.400 mm (0.0118 - 0.0157 in.)
		No.2	0.400 - 0.500 mm (0.0157 - 0.0197 in.)
		Oil	0.13 - 0.38 mm (0.005 - 0.015 in.)
	Piston pin installing temperature		80 - 90°C (176 - 194°F)

CONTINUED

Piston and piston ring (3RZ-F:, 3RZ-EF:)	Piston diameter	STD	94.933 – 94.943 mm (3.7375 – 3.7379 in.)
		O/S 0.50	95.433 – 95.443 mm (3.7572 – 3.7576 in.)
	Piston oil clearance	STD	0.047 – 0.070 mm (0.0019 – 0.0028 in.)
		Maximum	
	Piston ring groove clearance	3RZ-FE: NO.1	0.020 – 0.070 mm (0.0008 – 0.0028 in.)
		NO.2	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
	Piston ring end gap	3RZ-FE: No.1	0.300 – 0.400 mm (0.0118 – 0.0157 in.)
		No.2	0.400 – 0.500 mm (0.0157 – 0.0197 in.)
	Piston ring groove clearance	3RZ-F: No.1	0.030 – 0.080 mm (0.0012 – 0.0031 in.)
		No.2	0.040 – 0.080 mm (0.0016 – 0.0031 in.)
	Piston ring end gap	3RZ-F: No.1	0.300 – 0.430 mm (0.0118 – 0.0169 in.)
		No..2	0.450 – 0.600 mm (0.0177 – 0.0236 in.)
		Oil	0.18 – 0.38 mm (0.0071 – 0.015 in.)
	Piston pin installing temperature		80 – 90°C (176 – 194°F)
Connecting rod (1RZ:, 1RZ-E:)	Thrust clearance	STD	0.160 – 0.312 mm (0.0063 – 0.0123 in.)
		Maximum	0.35 mm (0.0138 in.)
	Connecting rod bearing center wall thickness		
	(Reference)	STD Mark 4	1.482 – 1.485 mm (0.0583 – 0.0585 in.)
		Mark 5	1.485 – 1.488 mm (0.0585 – 0.0586 in.)
		Mark 6	1.488 – 1.491 mm (0.0586 – 0.0587 in.)
	Connecting rod oil clearance	STD STD	0.030 – 0.055 mm (0.0012 – 0.0022 in.)
		U/S 0.25	0.031 – 0.071 mm (0.0012 – 0.0028 in.)
		Maximum	0.08 mm (0.0031 in.)
	Rod bend	Maximum per 100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Maximum per 100 mm (3.94 in.)	0.15 mm (0.0059 in.)
	Bushing inside diameter		24.008 – 24.017 mm (0.9452 – 0.9455 in.)
	Piston pin diameter		24.000 – 24.009 mm (0.9449 – 0.9452 in.)
	Piston pin oil clearance	STD	0.005 – 0.011 mm (0.0002 – 0.0004 in.)
		Maximum	0.05 mm (0.0020 in.)
	Connecting rod bolt tension portion diameter	STD	7.800 – 7.900 mm (0.3071 – 0.3110 in.)
		Minimum	7.50 mm (0.2953 in.)
Connecting rod (2RZ-FE:)	Thrust clearance	STD	0.160 – 0.312 mm (0.0063 – 0.0123 in.)
		Maximum	0.35 mm (0.0138 in.)
	Connecting rod bearing center wall thickness		
		STD Mark 4	1.482 – 1.485 mm (0.0583 – 0.0585 in.)
		Mark 5	1.485 – 1.488 mm (0.0585 – 0.0586 in.)
		Mark 6	1.488 – 1.491 mm (0.0586 – 0.0587 in.)
		U/S 0.25	1.601 – 1.607 mm (0.0630 – 0.0633 in.)
	Connecting rod big end inside diameter		
		STD Mark 4	56.000 – 56.006 mm (2.2047 – 2.2050 in.)
		Mark 5	56.006 – 56.012 mm (2.2050 – 2.2052 in.)
		Mark 6	56.012 – 56.018 mm (2.2052 – 2.2054 in.)
		U/S 0.25	56.000 – 56.018 mm (2.2047 – 2.2054 in.)
	Connecting rod oil clearance	STD	0.030 – 0.055 mm (0.0012 – 0.0022 in.)
		U/S 0.25	0.031 – 0.071 mm (0.0012 – 0.0026 in.)
		Maximum	0.10 mm (0.0039 in.)
	Rod out-of-alignment		
		Maximum per 100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Maximum per 100 mm (3.94 in.)	0.15 mm (0.0059 in.)
	Bushing inside diameter		24.008 – 24.017 mm (0.9452 – 0.9455 in.)
	Piston pin diameter		24.000 – 24.009 mm (0.9449 – 0.9452 in.)
	Piston pin oil clearance	STD	0.005 – 0.011 mm (0.0002 – 0.0004 in.)
		Maximum	0.015mm (0.0006 in.)
	Connecting rod bolt outside diameter	STD	7.80 – 7.90 mm (0.3071 – 0.3110 in.)
		Minimum	7.60 mm (0.2992 in.)

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Connecting rod (3RZ-F:, 3RZ-FE:)	Thrust clearance	STD	0.160 - 0.312 mm (0.0063 - 0.0123 in.)
		Maximum	0.35 mm (0.0138 in.)
	Connecting rod bearing center wall thickness		
		STD Mark 4	1.482 - 1.485 mm (0.0583 - 0.0585 in.)
		Mark 5	1.485 - 1.488 mm (0.0585 - 0.0586 in.)
		Mark 6	1.488 - 1.491 mm (0.0586 - 0.0587 in.)
		U/S 0.25	1.601 - 1.607 mm (0.0630 - 0.0633 in.)
	Connecting rod big end inside diameter		
		STD Mark 4	56.000 - 56.006 mm (2.2047 - 2.2050 in.)
		Mark 5	56.006 - 56.012 mm (2.2050 - 2.2052 in.)
		Mark 6	56.012 - 56.018 mm (2.2052 - 2.2054 in.)
		U/S 0.25	56.000 - 56.018 mm (2.2047 - 2.2054 in.)
	Connecting rod oil clearance	STD	0.030 - 0.055 mm (0.0012 - 0.0022 in.)
		U/S 0.25	0.031 - 0.071 mm (0.0012 - 0.0026 in.)
		Maximum	0.10 mm (0.0039 in.)
	Rod out-of-alignment		
		Maximum per 100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Maximum per 100 mm (3.94 in.)	0.15 mm (0.0059 in.)
	Bushing inside diameter		24.008 - 24.017 mm (0.9452 - 0.9455 in.)
	Piston pin diameter		24.000 - 24.009 mm (0.9449 - 0.9452 in.)
	Piston pin oil clearance	STD	0.005 - 0.011 mm (0.0002 - 0.0004 in.)
		Maximum	0.015mm (0.0006 in.)
	Connecting rod bolt outside diameter	STD	7.80 - 7.90 mm (0.3071 - 0.3110 in.)
		Minimum	7.60 mm (0.2992 in.)
Crankshaft (1RZ:, 1RZ-E:)	Thrust clearance	STD	0.020 - 0.220 mm(0.0008 - 0.0087 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.440 - 2.490 mm (0.0961 - 0.0980 in.)
	Main journal oil clearance	STD No.3	0.030 - 0.055 mm (0.0012 - 0.0022 in.)
		Others	0.024 - 0.049 mm (0.0009 - 0.0019 in.)
		U/S 0.25 No.3	0.030 - 0.070 mm (0.0012 - 0.0028 in.)
		Others	0.025 - 0.065 mm (0.0010 - 0.0026 in.)
		Maximum	0.08 mm (0.0031 in.)
	Main journal diameter	STD No.3	59.981 - 59.994 mm (2.3615 - 2.3620 in.)
		Others	59.987 - 60.000 mm (2.3617 - 2.3622 in.)
		U/S 0.25 No.3	59.740 - 59.750 mm (2.3520 - 2.3524 in.)
		Others	59.745 - 59.755 mm (2.3522 - 2.3526 in.)
	Main bearing center wall thickness	STD Mark 1	1.987 - 1.990 mm (0.0782 - 0.0783 in.)
	(Reference)	Mark 2	1.990 - 1.993 mm (0.0783 - 0.0785 in.)
		Mark 3	1.993 - 1.996 mm (0.0785 - 0.0786 in.)
	Crank pin diameter	STD	52.987 - 53.000 mm (2.0861 -2.0866 in.)
		U/S 0.25	52.745 - 52.755 mm (2.0766 - 2.0770 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Main journal taper and out -of-round	Maximum	0.02 mm (0.0008 in.)
	Crank pin taper and out-of-round	Maximum	0.02 mm (0.0008 in.)

CONTINUED

Crankshaft (2RZ-FE:)	Thrust clearance	STD	0.020 – 0.0220 mm (0.0008 – 0.0087 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.440 – 2.490 mm (0.0961 – 0.0980 in.)
	Main journal oil clearance	STD No.3	0.030 – 0.055 mm (0.0012 – 0.0022 in.)
		Others	0.024 – 0.049 mm (0.0009 – 0.0019 in.)
		U/S 0.25 No.3	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
		Others	0.025 – 0.065 mm (0.0010 – 0.0026 in.)
		Maximum	0.10 mm (0.0039 in.)
	Main journal diameter	STD No.3	59.981 – 59.994 mm (2.2615 – 2.3620 in.)
		Others	59.987 – 60.000 mm (2.3617 – 2.3622 in.)
		U/S 0.25 No.3	59.740 – 59.750 mm (2.3520 – 2.3524 in.)
		Others	59.745 – 59.755 mm (2.3522 – 2.3526 in.)
	Main bearing center wall thickness		
		STD Mark 1	1.987 – 1.990 mm (0.0782 – 0.0783 in.)
		Mark 2	1.991 – 1.993 mm (0.0784 – 0.0785 in.)
		Mark 3	1.994 – 1.996 mm (0.0785 – 0.0786 in.)
		U/S 0.25	2.106 – 2.112 mm (0.0829 – 0.0831 in.)
	Crank pin diameter	STD	52.987 – 53.000 mm (2.0861 –2.0866 in.)
		U/S 0.25	52.745 – 52.755 mm (2.0766 – 20.770 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Main journal taper and out -of-round	Maximum	0.005 mm (0.0002 in.)
	Crank pin taper and out-of-round	Maximum	0.005 mm (0.0002 in.)
Crankshaft (3RZ-F:, 3RZ-FE:)	Thrust clearance	STD	0.020 – 0.0220 mm (0.0008 – 0.0087 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.440 – 2.490 mm (0.0961 – 0.0980 in.)
	Main journal oil clearance	STD No.3	0.030 – 0.055 mm (0.0012 – 0.0022 in.)
		Others	0.024 – 0.049 mm (0.0009 – 0.0019 in.)
		U/S 0.25 No.3	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
		Others	0.025 – 0.065 mm (0.0010 – 0.0026 in.)
		Maximum	0.10 mm (0.0039 in.)
	Journal diameter	STD No.3	59.981 – 59.994 mm (2.2615 – 2.3620 in.)
		Others	59.987 – 60.000 mm (2.3617 – 2.3622 in.)
		U/S 0.25 No.3	59.740 – 59.750 mm (2.3520 – 2.3524 in.)
		Others	59.745 – 59.755 mm (2.3522 – 2.3526 in.)
	Main bearing center wall thickness		
		STD Mark 1	1.987 – 1.990 mm (0.0782 – 0.0783 in.)
		Mark 2	1.991 – 1.993 mm (0.0784 – 0.0785 in.)
		Mark 3	1.994 – 1.996 mm (0.0785 – 0.0786 in.)
		U/S 0.25	2.106 – 2.112 mm (0.0829 – 0.0831 in.)
	Crank pin diameter	STD	52.987 – 53.000 mm (2.0861 –2.0866 in.)
		U/S 0.25	52.745 – 52.755 mm (2.0766 – 20.770 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Main journal taper and out -of-round	Maximum	0.005 mm (0.0002 in.)
	Crank pin taper and out-of-round	Maximum	0.005 mm (0.0002 in.)
Balance shaft (3RZ-FE:)	Thrust clearance	STD	0.07 – 0.13 mm (0.0027 – 0.0051 in.)
		Maximum	0.20 mm (0.0079 in.)
	Bearing inside diameter	No.1	38.025 – 38.045 mm (1.4970 – 1.4978 in.)
		No.2	37.525 – 37.545 mm (1.4774 – 1.4781 in.)
	Journal diameter	No.1	37.969 – 37.985 mm (1.4948 – 1.49554 in.)
		No.2	37.449 – 37.465 mm (1.4744 – 1.4750 in.)
	Journal oil clearance	STD No.1	0.040 – 0.076 mm (0.0016 – 0.0031 in.)
		No.2	0.060 – 0.096 mm (0.0024 – 0.0038 in.)
		Maximum	0.15 mm (0.0059 in.)

SS0B2-01

TORQUE SPECIFICATION

1RZ, 1RZ-E:

Part tightened		N·m	kgf·cm	ft·lbf
Distributor x Cylinder head		20	200	14
Camshaft bearing cap x Cylinder head		15	160	11
Cylinder head rear plate x Cylinder head		18	185	13
Plug plate, Water outlet x Cylinder head		20	200	15
Intake manifold x Cylinder head		29	300	21
Exhaust manifold x Cylinder head		49	500	36
Cylinder head x Cylinder block	1 st 2nd 3rd	39 Turn 90° Turn 90°	400 Turn 90° Turn 90°	29 Turn 90° Turn 90°
Cylinder head x Timing chain cover		21	210	15
Camshaft timing gear x Camshaft		73	750	54
Chain tensioner x Cylinder head		21	210	15
Fuel inlet pips x Delivery pipe, Fuel filter		29.5	300	22
Intake manifold stay x Intake manifold, LH engine mounting bracket		37	380	27
Cylinder head cover x Cylinder head		5.0	55	44 in.·lbf
Oil jet x Cylinder block		18	185	13
Chain tensioner slipper x Cylinder biock		27	270	20
Chain vibration damper x Cylinder block		29	300	21
Timing chain cover x Cylinder bolck	12 mm head for 35 mm (1.38 in.) length bolt 12 mm head for except 35 mm (1.38 in.) length bolt 14 mm head	18 20 39	185 200 440	13 15 29
Water bypass pipe x Thermostat guide plate		19.5	200	14
Alternator drive belt adjusting bar x Cylinder block		63.7	650	47
Crankshaft pulley x Crankshaft		259	2,650	191
Fluid coupling x Water pump		20.5	210	15
Alternator drive belt adjusting bar x Alternator		19	195	14
Alternator x Alternator bracket		59	600	44
Main bearing cap x Cylinder block	1 st 2 nd	39 Turn 90°	400 Turn 90°	29 Turn 90°
Connecting rod cap x Connecting rod	1 st 2 nd	45 Turn 90°	460 Turn 90°	33 Turn 90°
Rear oil seal retainer x Cylinder block		13	135	10
Engine coolant drain union x Cylinder block		24.5	250	18
Oil filter bracket x Cylinder block	Union bolt Nut	68.5 12	700 120	51 9
Engine mounting bracket x Clinder block		51	520	38
Fuel filter x Cylinder block		20	200	15
Alternator bracket x Cylinder block		74.5	760	55
Rear end plate x Cylinder block		18	185	13
Flywheel x Crankshaft		88	900	65
Intake manifold x TVSV	(1RZ)	250	18	25
Water by-pass flange x Thermostat valve	(1RZ)	250	18	25
Puel pump x Cylinder head	(1RZ)	200	14	20

CONTINUED

2RZ-FE:

Part tightened		N·m	kgf·cm	ft·lbf
Spark plug x Cylinder head		18	180	13
Cylinder head x Cylinder block	1 st 2nd 3rd	39 Turn 90° Turn 90°	400 Turn 90° Turn 90°	29 Turn 90° Turn 90°
Camshaft bearing cap x Cylinder head		16	160	12
Ignition coil x Cylinder head		10	100	7
Camshaft position sensor x Cylinder head		5.4	55	48 in.·lbf
Chain tensioner x Cylinder head		21	210	15
Engine hanger x Cylinder head		20	200	14
Cylinder head rear plate x Cylinder head		18	185	13
Water outlet x Cylinder head		20	200	14
Exhaust manifold x Cylinder head		49	500	36
Heat insulator x Exhaust manifold		11.5	115	8
Intake manifold x Cylinder head		29	300	22
Fuel inlet pipe x Fuel filter		29	300	22
Fuel inlet pipe x Delivery pipe		29	300	22
Intake manifold stay x Intake manifold, LH engine mounting bracket		37	380	27
Oil jet x Cylinder block		18	185	13
Vibration damper x Cylinder block		29	300	22
Timing chain tensioner slipper x Cylinder block		27	270	20
Timing chain case x Cylinder block	14 mm head bolt 12 mm head bolt A and nut Bolt B	64 20 44	650 200 440	47 14 32
Timing chain case mounting bolt		18	185	13
Water bypass pipe mounting nut		20	200	14
Crankshaft pulley x crankshaft		260	2,650	192
Oil strainer x Cylinder block		18	185	13
Oil pan x Cylinder block		13	130	9
Alternator bracket x Cylinder block		74.5	760	55
connecting rod cap x Connecting rod	1 st 2 nd	45 Turn 90°	460 Turn 90°	33 Turn 90°
Main bearing cap x Cylinder bolck	1 st 2 nd	39 Turn 90°	400 Turn 90°	29 Turn 90°
Rear oil seal retainer x Cylinder block		13	135	9.7
Engine mounting bracket x Cylinder block		51	520	38
Engine coolant drain plug x Cylinder block		24.5	250	18
Oil filter bracket x Cylinder block	Nut Union bolt	12 68.5	120 700	8.9 51
Kock sensor x Cylinder block		44	450	33
Fuel filter x Cylinder block		20	200	14
Rear end plate x Cylinder block		18	185	13
Flywheel x Crankshaft		88	900	65
Drive plate x Crankshaft		74	750	54

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3RZ-F:, 3RZ-FE:

Part tighttened		N·m	kgf·cm	ft·lbf
Spark plug x Cylinder head		19	200	14
Cylinder head x Vacuum pipe		8.5	85	74 in.·lbf
Cylinder head x Cylinder block	1 st 2 nd 3 rd	39 Turn 90° Turn 90°	400 Turn 90° Turn 90°	29 Turn 90° Turn 90°
Cylinder head x Timing chain cover		21	210	15
Camshaft bearing cap x Cylinder head		15.5	160	12
Camshaft timing gear x Intake camshaft		73.5	750	54
Ignition coil x Cylinder head (3RZ-FE:)		10	100	7
Camshaft position sensor x Cylinder head (3RZ-FE:)		5.4	55	48 in.·lbf
No.1 chain tensioner x Cylinder head		21	210	15
Front engine hanger x Cylinder head		42	420	30
Intake manifold x Water bypasss flange (3RZ-F:)		9.0	90	78 in.·lbf
Intake manifold x Accelerator cable		21	210	15
Intake manifold x Vacuum pipe		8.5	85	74 in.·lbf
Cylinder head rear cover x Cylinder head		13.5	135	10
Water outlet x Cylinder head		20	200	14
Exhaust manifold x Cylinder head		49	500	36
Heat insulator x Exhaust manifold		5.5	55	48 in.·lbf
Intake manifold x Cylinder head		29	300	22
Fuel inlet pipe x Fuel filter (3RZ-FE:)		29	300	22
Air intake chamber (3RZ-FE:) x Intake manifold		21	210	15
Fuel inlet pipe x Delivery pipe (3RZ-FE:)		29	300	22
Intake chamber stay x Air intake chamber (3RZ-FE:)		20	200	15
Intake manifold stay x LH engine mounting bracket (3RZ-FE:)		20	200	15
Intake manifold stay x Intake manifold, LH mounting bracket		20	200	15
Intake air connector x Cylinder head		18	185	13
Balance shaft drive gear x Balance shaft (3RZ-FE:)		25	250	18
No.2 chain tensioner, No.3 vibration damper x Cylinder block (3RZ-FE:)		18	185	13
No.2 vibration damper x Cylinder block (3RZ-FE:)		27	270	20
No.1 vibration damper x Cylinder block		29	300	22
No.1 timing chain tensioner slipper x Cylinder block		27	270	20
Timing chain cover x Cylinder block	12 mm head bolt A bolt B 14 mm head bolt Nut	20 24.5 44 20	200 250 440 200	14 18 32 14
Timing chain cover mounting bolt		18	185	13
Water bypass pipe mounting nut		20	200	14
Crankshaft pulley x Crankshaft		260	2,650	193
No.2 crankshaft pulley, No.3 crankshaft pulley x Crankshaft pulley		25	250	18
Oil strainer x Cylinder block		18	185	13
Oil pan x Cylinder block		12.5	130	9
Timing chain cover x Crankshaft position sensor		8.5	85	74 in.·lbf
Connecting rod cap x Connecting rod	1 st 2 nd	45 Turn 90°	460 Turn 90°	33 Turn 90°

CONTINUED

Main bearing cap x Cylinder block	1 st 2 nd	39 Turn 90°	400 Turn 90°	29 Turn 90°
No.1 balance shaft, No.2 balance chaft x Timing gear (3RZ-FE:)		36	365	26
Balance shaft thrust plate x Cylinder block (3RZ-FE:)		18	185	13
Rear oil seal retainer x Cylinder block		13.5	135	9.7
Engine mounting bracket x Cylinder block		51	520	38
Engine coolant drain plug x Cylinder block		24.5	250	18
Oil filter bracket union x Cylinder block		25	250	18
Oil filter bracket x Cylinder block		28	290	21
Water bypass pipe x Cylinder block		20	200	14
Knock sensor (3RZ-FE) x Cylinder block		37	380	27
Fuel filter (3RZ-FE) x Cylinder block		20	200	14
Rear end plate x Cylinder block		18	185	13
Rear end plate x Water bypass pipe		20	200	14
Flywheel x Crankshaft	1 st 2 nd	26.5 Turn 90°	270 Turn 90°	19 Turn 90°
Drive plate x Crankshaft		74	750	54
Ffuel pump x Cylinder head (3RZ-F)		28	280	21
Accelerator bracket x Cylinder head (3RZ-F)		21	210	15

EMISSION CONTROL

TORQUE SPECIFICATION

SS0B3-01

Part tightened		N·m	kgf·cm	ft·lbf
EGR pipe x Intake chamber assembly	2RZ-FE:	19	195	14
EGR pipe x Cylinder head	2RZ-FE:	20	200	15
EGR valve x Intake chamber assembly	2RZ-FE:	19	195	14
Converter x Front pipe	2RZ-FE:	48	490	35
Front pipe x Oxygen sensor	2RZ-FE:	20	200	14

ELECTRONIC FUEL INJECTION

SERVICE DATA

SS0B4-01

Fuel pressure regulator	Fuel pressure	at no vacuum	265 - 304 kPa (2.7 - 3.1 kgf/cm^2, 38 - 44 psi)
Fuel pump	Resistance	at 20°C (68°F)	0.2 - 3.0 Ω
Injector (1RZ-E:)	Resistance Injection volume Difference between each cylinder Fuel leakage	at 20°C (68°F)	13.4 - 14.2 Ω 44 - 54 cm^3 (3.3 - 3.4 cu in.) per 15 seconds 10 cm^3 (0.3 cu in.) or less 1 drop or less per 3 minutes
Injector (2RZ-FE:)	Resistance Injection volume Difference between each cylinder Fuel leakage	at 20°C (68°F)	13.4 - 14.2 Ω 64 - 78 cm^3 (4.0 - 4.8 cu in.) per 15 seconds 14 cm^3 (0.3 cu in.) or less 1 drop or less per 3 minutes
Injector (3RZ-FE:)	Resistance Injection volume Difference between each cylinder Fuel leakage	at 20°C (68°F)	13.4 - 14.2 Ω 72 - 86 cm^3 (13.4 - 14.2 cu in.) per 15 seconds 14 cm^3 (0.3 cu in.) or less 1 drop or less per 3 minutes
Throttle position sensor (1RZ-E:)	Clearance between stop screw and lever 0 mm (0 in.) 0.57 mm (0.0022 in.) 0.74 mm (0.029 in.) Throttle valve fully open	 VTA-E2 IDL-E2 IDL-E2 VTA-E2 VC-E2	 0.2 - 5.7 kΩ 2.3 kΩ or less Infinity 2.0 - 10.2 kΩ 2.5 - 5.9 kΩ
Throttle position sensor (2RZ-FE:, 3RZ-FE:)	Clearance between stop screw and lever 0 mm (0 in.) Throttle valve fully open	 VTA-E2 VTA-E2 VC-E2	 0.2 - 5.7 kΩ 2.0 - 10.2 kΩ 2.5 - 5.9 kΩ
Throttle body (1RZ-E:)	Throttle body fully closed angle Dashpot setting speed Throttle opener setting speed		10° 2,000 ± 200 rpm 1,200 - 1,500 rpm
Throttle body (2RZ-FE:, 3RZ-FE:)	Throttle body fully closed angle Throttle opener setting speed		6° 1,200 - 1,500 rpm
ISC valve (2RZ-FE:, 3RZ-FE:)	Resistance (+B - RSC or RSO)	 at cold at hot	 17.0 - 24.5 Ω 21.5 - 28.5 Ω
Air flow meter (2RZ-FE:, 3RZ-FE:)	-20°C (-4°F) 20°C (68°F) 60°C (140°F)	THA - E2 THA - E2 THA - E2	12.5 - 16.9 kΩ 2.19 - 1.67 kΩ 0.5 - 0.68 kΩ
VSV for EGR (2RZ-FE:)	Resistance	at 20°C (68°F)	33 - 39 Ω
VSV for EVAP	Resistance	at 20°C (68°F)	30 - 34 Ω
Water temperature sensor	Resistance	at -20°C (-4°F) at 0°C (32°F) at 20°C (68°F) at 40°C (104°F) at 60°C (140°F) at 80°C (176°F)	10 - 20 kΩ 4 - 7 kΩ 2 - 3 kΩ 0.9 - 1.3 kΩ 0.4 - 0.7 kΩ 0.2 - 0.4 kΩ

CONTINUED

Intake air temperature sensor	Resistance	at -20°C (-4°F)	10 - 20 kΩ
		at 0°C (32°F)	4 - 7 kΩ
		at 20°C (68°F)	2 - 3 kΩ
		at 40°C (104°F)	0.9 - 1.3 kΩ
		at 60°C (140°F)	0.4 - 0.7 kΩ
		at 80°C (176°F)	0.2 - 0.4 kΩ
Oxygen sensor (2RZ-FE:)	Heater resistance	20°C (68°F)	11.7 - 14.3 Ω
Variable resistor	Voltage	VCC-E2	4.5 - 5.5 V
	Resistance		4 - 6 kΩ
Fuel cut RPM (1RZ-E:)	Fuel return rpm		1,200 rpm
Fuel cut RPM (2RZ-FE:)	Fuel return rpm		1,400 rpm
Fuel cut RPM (3RZ-FE:)	Fuel return rpm	M/T	1,200 rpm
		A/T	1,500 rpm

SS0B5-01

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Fuel line (Flare nut type)	w/ SST	28	285	21
Fuel pump bracket assembly x Fuel tank		4.0	35	40 in.·lbf
Fuel pressure regulator x Delivery pipe	1RZ-E:	8.8	90	78 in.·lbf
	2RZ-FE:, 3RZ-FE:	8.0	80	69 in.·lbf
Delivery pipe x Cylinder head		29	300	22
Pulsation damper x Delivery pipe		21	210	15
Water temperature sensor x Cylinder head		20	200	14
Knock sensor x Cylinder block		44	450	33

COOLING

SERVICE DATA

SS0B6-01

Thermostat	Valve opening temperature Valve lift at 95°C (203°F)	80 - 84°C (176 - 183°F) 8 mm (0.31 in.) or more
Radiator cap	Relief valve opening pressure STD	93 - 123 kPa (0.95 - 1.25 kgf/cm^2, 13.1 - 18.2 psi)
Radiator	Lock plate hight	7.4 - 7.8 mm (0.2959 - 0.3119 in.)

SS0B7-01

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
Cylinder block x Drain plug	24.5	250	18
Water pump pulley x Water pump	21	210	16

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LUBRICATION

SERVICE DATA

SS0B8-01

Oil pressure	Normal operating temperature	ar idle speed	29 kPa (0.3 kgf/cm^2, 4.3 psi) or more
		at 3,000 rpm	245 - 490 kPa (2.5 - 5.0 kgf/cm^2, 36 - 71 psi)
Oil Pump	Body clearance	STD	0.100 - 0.175 mm (0.014 - 0.0069 in.)
		Maximum	0.30 mm (0.0118 in.)
	Tip clearance	STD	0.110 - 0.240 mm (0.0043 - 0.0094 in.)
		Maximum	0.25 mm (0.0098 in.)
	Side clearance	STD	0.030 - 0.090 mm (0.0012 - 0.0035 in.)
		Maximum	0.15 mm (0.0059 in.)

SS0B9-01

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
Oil pan x Drain plug	37	375	27

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

IGNITION

SERVICE DATA

SS0BA-01

Spark plug	Resistance	Maximum	25 kΩ per cold
Spark Plug	Recommended spark plug	IRZ ND	W16EX-U
		NGK	BP5EY
		1RZ-E ND	W16EXR-U
		NGK	BPR5EY
		2RZ-FE, 3RZ-F, 3RZ-FE ND	K16R-U
		NGK	BKR5EYA
	Correct electrode gap for new spark plug		0.8 mm (0.031 in.)
IIA (1RZ:)	Ignition coil		
	Primary coil resistance	at cold	1.12 – 1.68 Ω
		at hot	1.42 – 1.98 Ω
	Secondary coil resistance	at cold	9.6 – 14.4 kΩ
		at hot	12.2 – 17.0 kΩ
	Distributor		
	Air gap		0.2 – 0.4 mm (0.008 – 0.016 in.)
	Pickup coil	NE⊕ – NE⊖ at cold	185 – 275 Ω
		at hot	240 – 325 Ω
IIA (1RZ-E:)	Ignition coil		
	Primary coil resistance	at cold	1.12 – 1.68 Ω
		at hot	1.42 – 1.98 Ω
	Secondary coil resistance	at cold	9.6 – 14.4 kΩ
		at hot	12.2 – 17.0 kΩ
	Distributor		
	Air gap		0.2 – 0.4 mm (0.008 – 0.016 in.)
	Pickup coil	NE⊕ – NE⊖ at cold	370 – 550 Ω
		at hot	475 – 650 Ω
Ignition coil (3RZ-F:)	Primary coil resistance	at cold	0.36 – 0.55 Ω
		at hot	0.45 – 0.65 Ω
	Secondary coil resistance	at cold	9.0 – 15.4 kΩ
		at hot	11.4 – 18.1 kΩ
Distributor (3RZ-F:)	Air gap		0.2 – 0.4 mm (0.008 – 0.0016 in.)
	Signal generator (pickup coil) resistance		
		at cold	185 – 275 Ω
		at hot	240 – 325 Ω
Ignition coil (2RZ-FE:, 3RZ-FE:)	Resistance	Secondary at cold	9.7 – 16.7 kΩ
		at hot	12.4 – 19.6 kΩ
Camshaft position sensor	Resistance	at cold	835 – 1,400 Ω
		at hot	1,060 – 1,645 Ω
Crankshaft position sensor	Resistance	at cold	1,630 – 2,740 Ω
		at hot	2,065 – 3,225 Ω

SS0BB-01

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Spark plug x Cylinder head		20	200	14
Ignition coil x Cylinder head	2RZ-FE:, 3RZ-FE:	10	100	7
Camshaft position sensor x Cylinder head	2RZ-FE:, 3RZ-FE:	5.4	55	48 in.·lbf
Crankshaft position sensor x Oil pump	2RZ-FE:, 3RZ-FE:	8.5	85	74 in.·lbf

STARTING

SERVICE DATA

SS0BC-01

Starter (1.0 kW, 1.2 kW, 1.4 kW type)	Rated voltage and output			12V 1.0 kW, 1.2 kW, 1.4 kW,
	No-load characteristics		Current	90 A or less at 11.5 V
			rpm	3,000 rpm or more
	Brush length	STD	1.0 kW	13.5 mm (0.531 in.)
			1.2 kW, 1.4 kW	15.5 mm (0.610 in.)
		Minimum	1.0 kW	8.5 mm (0.335 in.)
			1.2 kW, 1.4 kW	10.0 mm (0.394 in.)
	Spring installed load	STD	1.2 kW	13.7 - 19.6 N (1.4 - 2.0 kgf, 3.1 - 4.4 lbf)
			1.0 kW, 1.4 kW	17.6 - 23.5 N (1.8 - 2.4 kgf, 4.0 - 5.3 lbf)
		Minimum	1.2 kW	9.8 N (1.0 kgf, 2.2 lbf)
			1.0 kW, 1.4kW	11.8 N (1.2 kgf, 2.6 lbf)
	Commutator			
	Diameter		STD	30 mm (1.18 in.)
			Minimum	29 mm (1.14 in.)
	Undercut depth		STD	0.6 mm (0.024 in.)
			Minimum	0.2 mm (0.08 in.)
	Circle runout		Maximum	0.05 mm (0.0020 in.)
	Magnetic switch			
	Contact plate for wear		Maximum	0.9 mm (0.035 in.)
Starter (2.0 kW type)	Rated voltage and output power			12V 2.0 kW
	No-load characteristics		Current	100 A or less at 11.5 V
			rpm	2,000 rpm or more
	Brush length		STD	15.0 mm (0.591 in.)
			Minimum	9.0 mm (0.354 in.)
	Spring installed load		STD	21.5 - 27.5 N (2.20 - 2.80 kgf, 4.9 - 6.2 lbf)
			Minimum	12.7 N (1.30 kgf, 2.7 lbf)
	Commutator			
	Diameter		STD	35.0 mm (1.378 in.)
			Minimum	34.0 mm (1.339 in.)
	Undercut depth		STD	0.7 mm (0.028 in.)
			Minimum	0.2 mm (0.008 in.)
	Circle runout		Maximum	0.05 mm (0.0020 in.)
	Magnetic switch			
	Contact plate for wear		Maximum	0.9 mm (0.035 in.)

SS0BD-01

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Field frame x Armature		5.9	60	52 in.·lbf
End frame x Starter housing	1.2 kW, 1.4 kW 1.0 kW, 2.0 kW	5.9 9.3	60 93	52 in.·lbf 82 in.·lbf
Starter housing x Magnetic switch assembly	1.2 kW, 1.4 kW 1.0 kW, 2.0 kW	5.9 9.3	60 93	52 in.·lbf 82 in.·lbf
End cover x Brush holder	1.0 kW, 1.2 kW, 1.4 kW 2.0 kW	1.5 3.8	15 39	13 in.·lbf 34 in.·lbf
Lead wire x Terminal C		5.9	60	52 in.·lbf
Terminal nut x Terminal 30 of starter, Terminal C of starter		17	170	12
Magnetic switch end cover x Magnetic switch	1.2 kW, 1.4 kW type 1.0 kW, 2.0 kW type	2.5 3.6	26 37	23 in.·lbf 32 in.·lbf

CHARGING

SERVICE DATA

SS0BE-01

Battery	Specific gravity	at 20°C (68°F)	1.25 - 1.29
Drive belt	Deflection	New belt	5 - 7 mm (0.20 - 0.28 in.)
		Used belt	7 - 8 mm (0.28 - 0.31 in.)
	Tension		520 - 750 N (53 - 77 kgf)
			295 - 392 N (30 - 40 kgf)
Alternator	Rated output		12 V 45 A, 55 A, 70 A
	Rotor coil resistance	45 A	2.7 - 3.1 Ω
		55 A	2.7 - 3.1 Ω
		70 A	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.)
	Bush exposed length	STD	10.5 mm (0.413 in.)
		Minimum	1.5 mm (0.059 in.)
IC regulator	Regulating voltage	at 25°C (77°F)	13.8 - 14.7 V

SS0BF-01

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Pulley x Rotor		110	1125	81
Retainer x Drive end frame		2.5	27	23 in.·lbf
Drive end frame x Rectifier end frame		4.5	46	40 in.·lbf
Rectifier end frame x Rectifier holder	Screw	2.0	20	17.4 in.·lbf
	Bolt	3.9	40	35 in.·lbf
Rectifier end frame x End cover		4.5	46	40 in.·lbf
Terminal insulator x Rectifier holder		4.1	42	36 in.·lbf

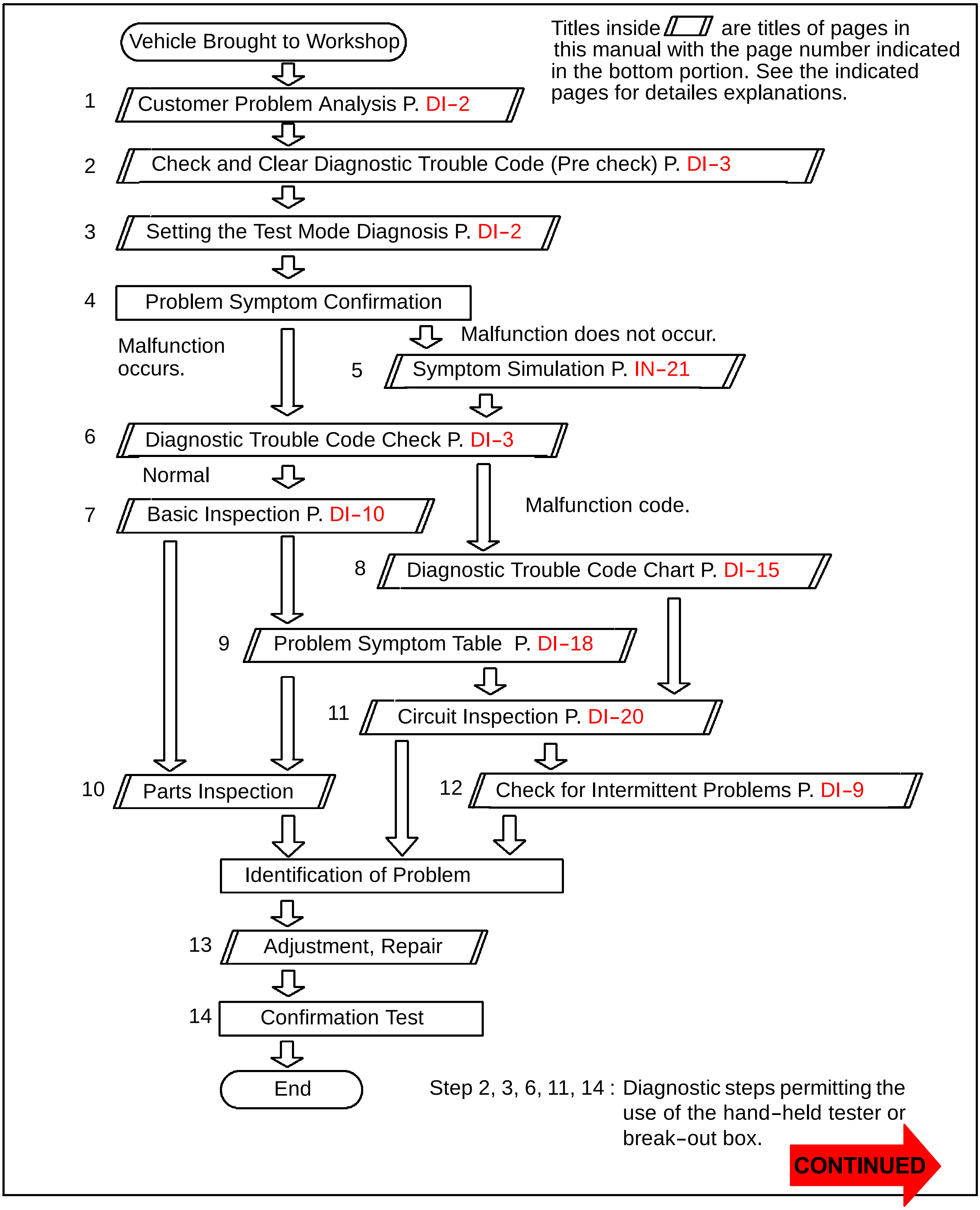
DIAGNOSTICS

ENGINE (1RZ-E)

DI1HG-01

HOW TO PROCEED WITH TROUBLESHOOTING

Troubleshoot in accordance with the procedure on the following page.



DI1HH–01

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

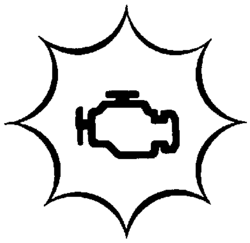
Inspector's Name ______________________

Customer's Name		Model and Model Year	
Driver's Name		Frame No.	
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 Driveaability	☐ 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	

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

Condition of Check Engine Warning Light		☐ Remains on	☐ Sometimes light up ☐ Does not light up
Diagnostic Trouble Code Inspection	Normal mode (Precheck)	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )
	Test Mode	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )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DI1HI-01

PRE-CHECK

1. DIAGNOSIS SYSTEM

(a) Description

The Engine ECU contains a built-in self-diagnosis system by which troubles with the engine signal network are detected and a check engine warning light in the combination meter lights up.

By analyzing various signals as shown in the later table (See page DI-15) the Engine ECU detects system malfunctions relating to the sensors or actuators.

In the normal mode, the self-diagnosis system monitors 14 items, indicated by code No. as shown in DI-15. A check engine warning light informs the driver that a malfunction has been detected. The ECU stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch off.

The diagnostic trouble code can be read by the number of blinks of the check engine warning light when TE1 and E1 terminals on the check connector are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.

In the test mode, 10 items, indicated by code No. as shown in DI-15 are monitored. If a malfunction is detected in any one of the systems indicated by code Nos. 13, 22, 24, 31, and 41 the ECU lights the check engine warning light to warn the technician that malfunction has been detected. In this case, TE2 and E1 terminals on the check connector should be connected as shown later. (See page DI-5) In the test mode, even if the malfunction is corrected, the malfunction code is stored in the ECU memory even when the ignition switch is off. This also applies in the normal mode. The diagnostic mode (normal or test) and the output of the check engine warning light can be selected by connecting the TE1, TE2, and E1 terminals on the check connector, as shown later.

A test mode function has been added to the functions of the self-diagnosis system of the normal mode for the purpose of detecting malfunctions such as poor contact, which are difficult to detect in the normal mode. This function fills up the self-diagnosis system. The test mode can be implemented by the technician following the appropriate procedures of check terminal connection and operation described later. (See page DI-5)

CONTINUED

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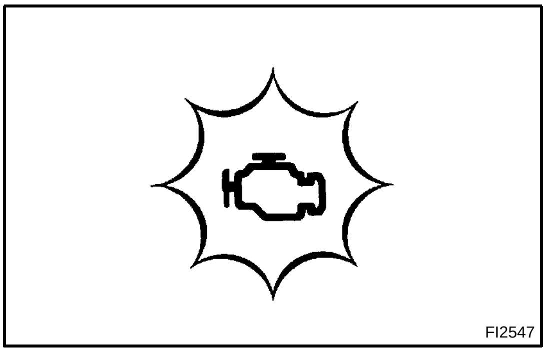


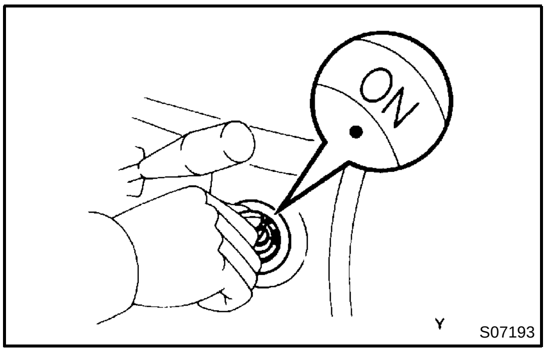
2. DIAGNOSIS INSPECTION (Normal Mode)

(a) Check Engine warning Light Check

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

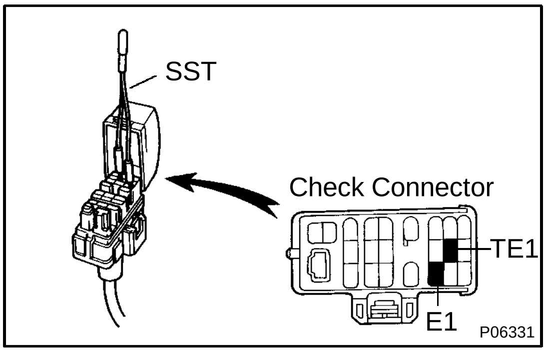
HINT:
If the check engine warning light does not light up, proceed to troubleshooting of the combination meter.

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



(b) Diagnostic Trouble Code Check

(1) Turn ignition switch ON.



(2) Using SST, connect terminals between TE1 and E1 of check connector.

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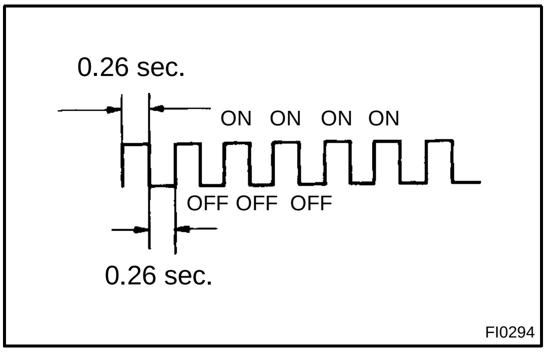

(3) Read the diagnostic trouble code from check engine warning light.

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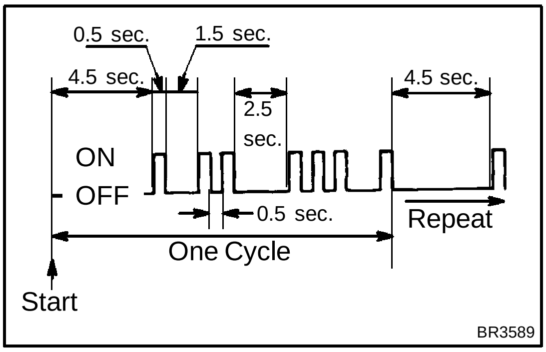


As an example, the blinking patterns for codes; normal, 12 and 31 are as shown on the illustration.

HINT:

If a diagnostic trouble code is not output, check the TE1 terminal circuit (See Page DI–64).

(4) Check the details of the malfunction using the diagnostic trouble code chart on page DI–15.

(5) After completing the check, disconnect the SST from terminals TE1 and E1, and turn off the display.

HINT:

If the event of 2 or more malfunction codes, indication will begin from the smallest numbered code and continue in order to the largest.

3. DIAGNOSIS INSPECTION (Test Mode)

HINT:

Compared to the normal mode, the test mode has an increased sensing ability to detect malfunctions.

The same diagnostic items which are detected in the normal mode can also be detected in the test mode.

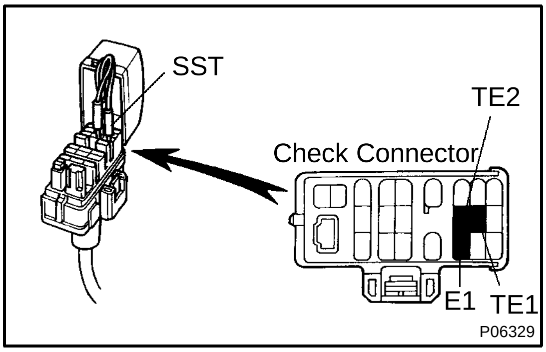
(a) Diagnostic Trouble Code Check

(1) Initial conditions.

S Battery positive voltage 11 V or more.

S Throttle valve fully closed.

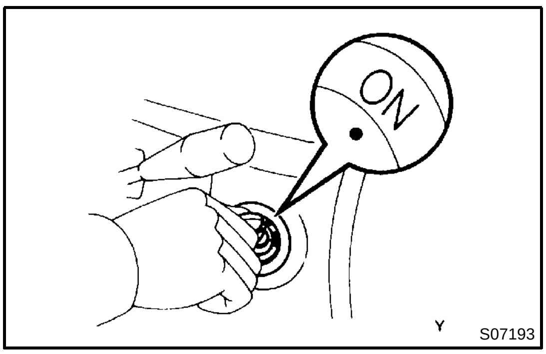
S Air conditioning switched OFF.



(2) Turn ignition switch OFF.

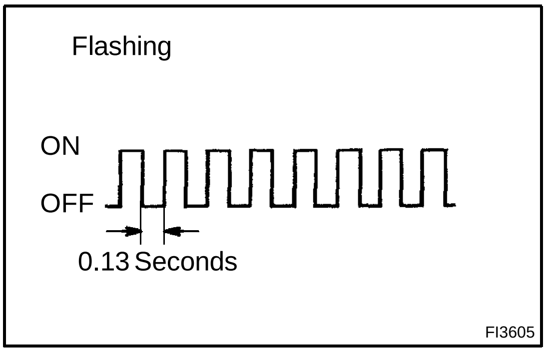
(3) Using SST, connect terminals TE2 and E1 of check connector.

SST 09843–18020



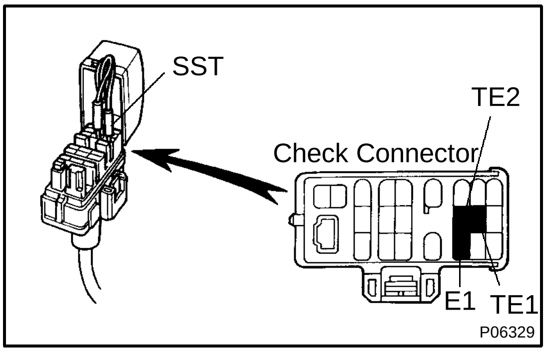
(4) Turn ignition switch ON.

CONTINUED



HINT:

- To confirm that the test mode is operating, check that the check engine warning light flashes when the ignition switch turned ON.
- If the check engine warning light does not flash, refer to diagnostic chart for the TE2 terminal circuit on page DI–64.



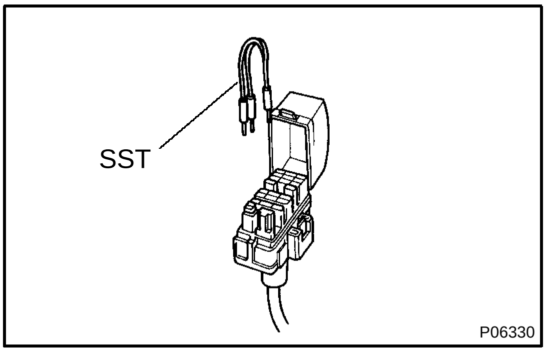
(5) Start the engine.

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

(7) After the road test, using SST, connect terminals TE1 and E1 of check connector.

SST 09843–18020

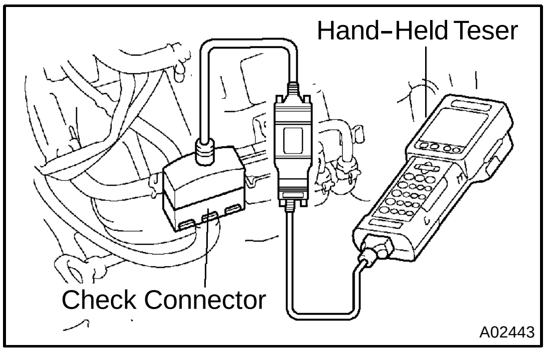
(8) Read the diagnostic trouble code on check engine warning light in the combination meter .



(9) After completing the check, disconnect the SST from terminals TE1, TE2 and E1, and turn off the display.

HINT:

- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch turned ON.
- When vehicle speed is 5 km/h (3 mph) or below, diagnostic trouble code ”42” (Vehicle speed signal) is output, but this is not abnormal.



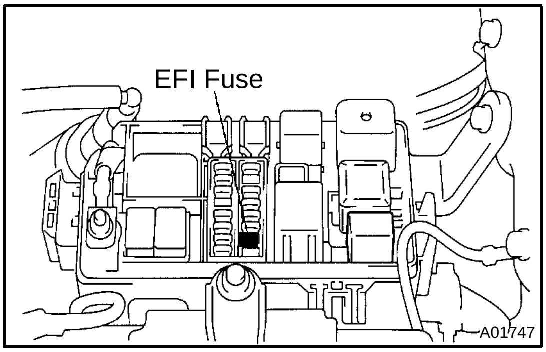
(b) Diagnostic Trouble Code Check Using Hand–Held Tester

(1) Hook up the hand–held tester to the check connector.

(2) Read the diagnostic trouble codes by following the prompts on the tester screen.

HINT:

Please refer to the hand–held tester operator's manual for further details.



(c) Diagnostic Trouble Code Clearance

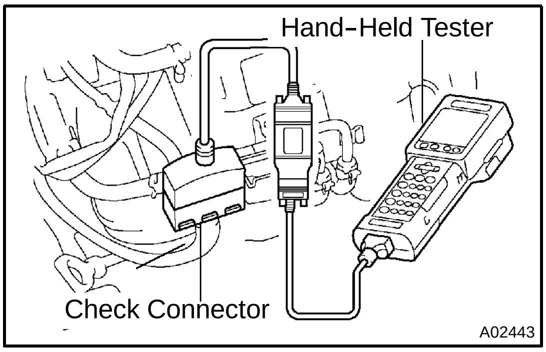
(1) After repair the trouble areas, the diagnostic trouble code retained in the ECU memory must be cleared out by removing the EFI fuse (15 A) from engine room J/B for 10 seconds or more, with the ignition switch OFF.

CONTINUED

HINT:

- Cancellation can also be done by removing the negative (–) terminal cable from the battery, but in this case, other memory systems (clock, etc.) will also be cancelled out.
- If it is necessary to work on engine components requiring removal of the negative (–) terminal cable from the battery, a check must first be made to see if a diagnostic trouble code has been recorded.

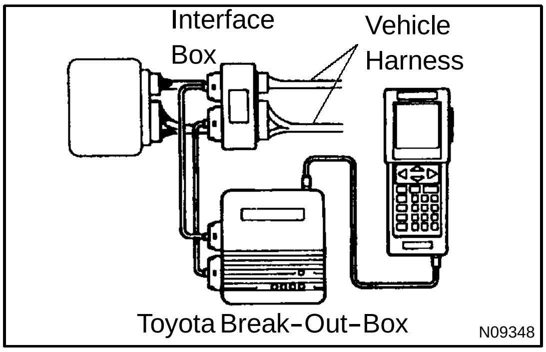
(2) After cancellation, road test the vehicle to check that a normal code is now read on the check engine warning light.
If the same diagnostic trouble code(s) appears, it indicates that the trouble area has not been repaired throughly.



(d) ECU Data Monitor Using Hand-Held Tester
(1) Hook up the hand-held tester to the check connector.
(2) Monitor the ECU data by following the prompts on the tester screen.

HINT:

- Hand-held tester has a "Snapshot" function which records the monitored data.
- Please refer to the hand-held tester operator's manual for further details.



(e) ECU Terminal Values Measurement Using Break-Out-Box and Hand-Held Tester
(1) Hook up the break-out-box and hand-held tester to the vehicle.
(2) Read the ECU input/output values by following the prompts on the tester screen.

HINT:

- Hand-held tester has a "Snapshot" function. This records the measured values and is effective in the diagnosis of intermittent problems.
- Please refer to the hand-held tester/break-out-box operator's manual for further details.

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4. FAIL-SAFE CHART

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

Trouble Code No.	Fail-Safe Operation	Fail-Safe Deactivation Conditions
14	Fuel cut	1 IGF detected in consecutive 2 ignitions
22	Engine coolant temp. is fixed at 80°C (176°F)	Returned to normal condition
24	Intake air temperature is fixed at 20°C (68°F)	Returned to normal condition
31	• Ignition timing fixed at 5° BTDC • Manifold absolute pressure is fixed at 46.7 kPa (350 mmHg, 13.8 in. Hg)	Returned to normal condition
41	Throttle position is fixed at 0°	The following must each be repeated at least 2 times consecutively • 0.1 V ≦ VTA and 0.95 V

CONTINUED

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DTC	Circuit
13	NE signal circuit
22	Water temp. sensor circuit
24	Intake air temp. sensor circuit
31	Vacuum sensor circuit
41	Throttle position sensor circuit

5. CHECK FOR INTERMITTENT PROBLEMS

As previously described , abnormality detection ability in the test mode is increased compared to that in the normal mode, so that when intermittent problems occur in the ECU signal circuits (NE, THW, THA, PIM, VTA) shown in the table opposite, the appropriate diagnostic trouble code is output.
Accordingly, when the diagnostic trouble codes shown in the table opposite (13, 22, 24, 31, 41) are output during the diagnostic trouble code check, and inspection of the appropriate circuits reveals no abnormality, check for intermittent problems as described below.
By check for intermittent problems, the place where intermittent problems are occurring due to poor contacts can be isolated.

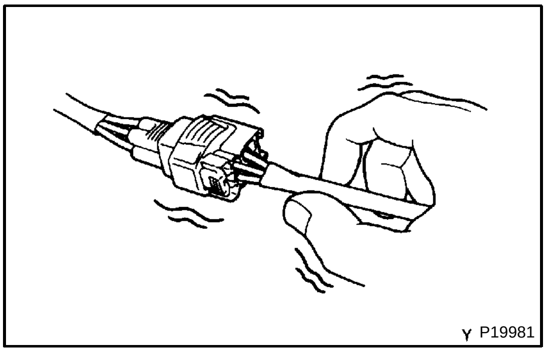
(1) Clear Diagnostic Trouble Codes
(See step 3.)

(2) Set Test Mode

- With the ignition switch OFF, using SST, connect the terminals TE2 and E1 of the check connector.

SST 09843-18020

- Start the engine and check to see if the check engine warning light to goes off.



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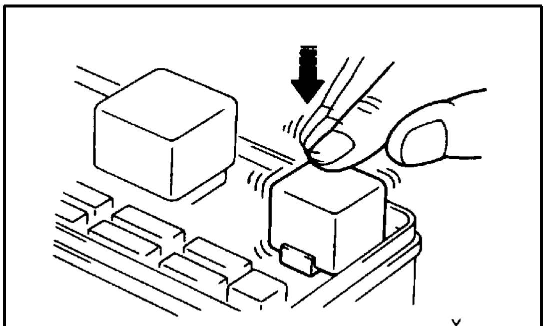

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(3) Perform a Simulation Test
Using the symptom simulation
(See page IN-9), apply vibration to and pull lightly on the wire harness, connector or terminals in the circuit indicated by the malfunction code.
In this test, if the check engine warning light lights up, it indicates that the place where the wire harness, connector or terminals being pulled or vibrated has faulty contact. Check that point for loose connections, dirt on the terminals, poor fit or other problems and repair as necessary.

HINT:
After cancelling out the diagnostic trouble code in memory and set the test mode, if the check engine warning light does not go off after the engine is started, check thoroughly for faulty contact, etc., then try the check again. If the check engine warning light still does not go off, check and replace ECU.

CONTINUED

6. BASIC INSPECTION

When the normal code is displayed in the diagnostic trouble code check, troubleshooting should be performed in the order for all possible circuits to be considered as the causes of the problems.

In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, use of this check is essential in engine troubleshooting.

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

NO → Charge or replace battery.

YES

2	Does engine crank ?

NO → Proceed to problem symptoms table on page DI-18.

YES

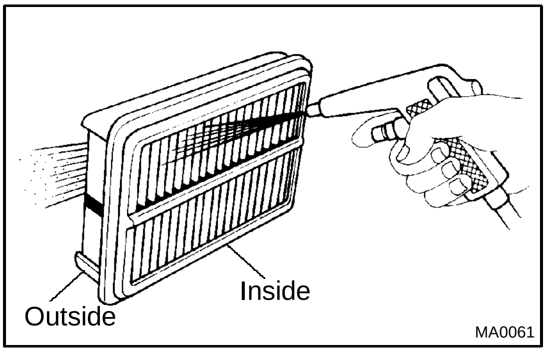
3	Does engine start ?

NO → Go to step 7.

YES

CONTINUED

4	Check air filter.

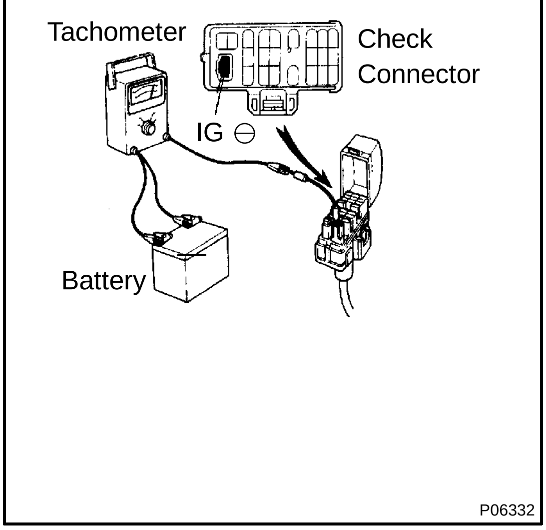


PREPARATION:
Remove air filter.
CHECK:
Visually check that the air filter is not excessively dirty or oily.
HINT:
If necessary, clean the air filter with compressed air. First blow from inside thoroughly, then blow from outside of the air filter.

NG → **Repair or replace.**

OK

5	Check idle speed.



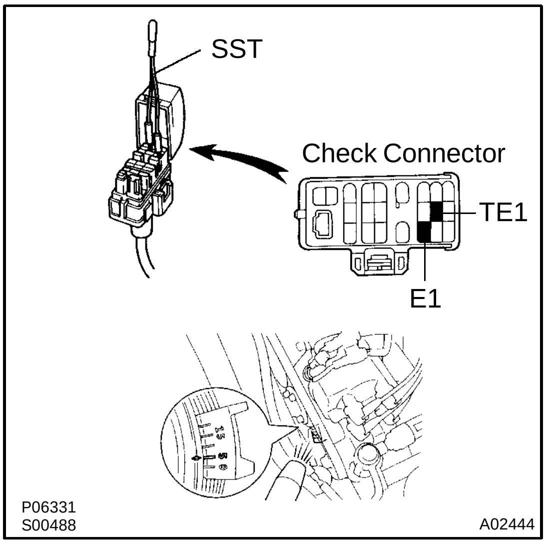
PREPARATION:
(a) Shift transmission into neutral.
(b) Warm up engine to normal operating temperature.
(c) Switch off all accessories.
(d) Switch off air conditioning.
(e) Connect tachometer test probe to terminal IG⊖ of check connector and set the tachometer to the 4–cylinder range.
CHECK:
Check idle speed.
OK:
Idle speed: 700 – 800 rpm
CAUTION:
- **Never allow tachometer test probe to touch ground as it could result in damage to igniter and/or ignition coil.**
- **As some tachometers are not compatible with this ignition system, confirm the compatibility of your unit before use.**

NG → **Proceed to problem symptoms table on page** **DI–18.**

OK

CONTINUED

6	**Check ignition timing.**



PREPARATION:

(a) Shift transmission into "N" position or neutral.
(b) Warm up engine to normal operating temperature.
(c) Keep the engine speed at idle.
(d) Using SST, connect terminals TE1 and E1 of check connector.
SST 09843–18020
(e) Connect a timing light probe to No.1 high–tension cord.

CHECK:

Check ignition timing.

OK:

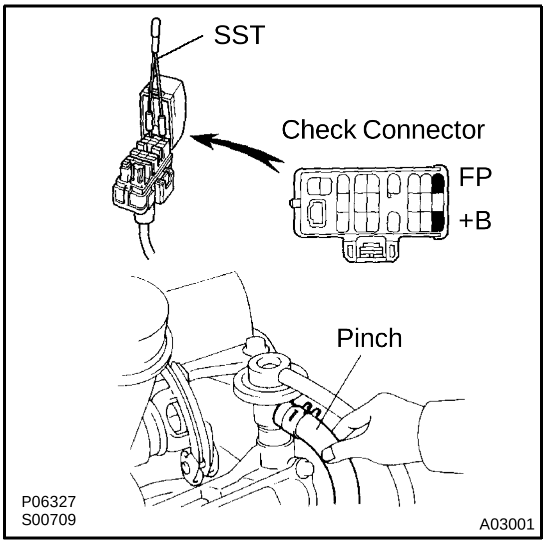
Ignition timing: 5° BTDC at idle

NG	**Proceed to page EM–14 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–18.

7	**Check fuel pressure.**



PREPARATION:

(a) Be sure that there is enough fuel in the tank.
(b) Turn ignition switch ON.
(c) Using SST, connect terminals FP and +B of check connector.
SST 09843–18020

CHECK:

Check the fuel pressure by pinching the fuel return hose.

HINT:

At this time, you will hear fuel return noise.

NOTICE:

Never make a mistake with the terminal connecting position as this will cause a malfunction.

NG	**Proceed to page FI–1 and continue to troubleshoot.**

OK

CONTINUED

8	Check for spark.

CHECK:
Disconnect the high–tension cord from the distributor and hold the end about 12.5 mm (1/2”) from the ground. See if spark occurs while the engine is being cranked.

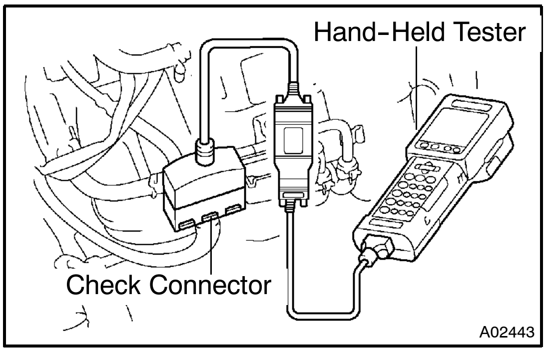
NOTICE:
To prevent excessive fuel being injected from the injectors during this check, don’t crank the engine for more than 1–2 seconds at a time.

NG → **Proceed to (See Pub. RM467E) and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–18.

CONTINUED



7. Reference Value of Engine ECU Data

HINT:
Engine ECU data can be monitored by hand-held tester.
(a) Hook up the hand-held tester to the check connector.
(b) Monitor ECU data by following the prompts on the tester screen.
Please refer to the hand-held tester operator's manual for further detail.

(c) Reference Value

Item	Inspection Condition	Reference Value
INJECTOR	Engine cold to hot Engine idling at normal operating temp. *1	Gradually decreases Approx. 3 - 4 msecs
IGNITION	Increase engine speed	Gradually increases
ENGINE SPEED	RPM kept stable (Comparison with tachometer)	No great changes
INTAKE MAN.	Engine idling at normal operating temp. *1 Increase engine load	Approx. 160 - 350 Gradually increases
COOLANT TEMP.	Engine at normal operating temp.	75 - 95°C (185 - 203°F) *2
THROTTLE	Closed throttle position Wide open throttle From closed throttle position to wide open throttle	Below 5° Above 70° Gradually increases
VEHICLE SPD	During driving (Comparison with speedometer)	No large differences
TARGET A/F L	Engine idling at normal operating temp.	2.50 ± 0.7 V *3
A/F FB LEFT	RPM stable at 2,500 rpm with normal operating temp.	ON
STA SIGNAL	During cranking	ON
IDL SIGNAL	Closed throttle position	ON
A/C SIGNAL	A/C switch ON	ON

*1: All accessories and A/C are switched OFF.
*2: If the water temp. sensor circuit is open or shorted, the engine ECU assumes an engine coolant temp. value of 80°C (176°F).
*3: When feedback control is forbidden, 0 V is displayed.

DI1HJ-01

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

DTC No. (See Page)	Detection Item	Trouble Area	*1 Check Engine Warning Light Normal Mode/ Test Node	*2 Memory
12 (DI-20)	NE Signal Circuit	Open or short in NE circuit IIA Open or short in STA circuit Engine ECU	ON / N.A.	f
13 (DI-23)	NE Signal Circuit	Open or short in NE circuit IIA Engine ECU	ON / ON.	f
14 (DI-24)	Ignition Signal Circuit	Open or short in IGF or IGT circuit from IIA to engine ECU Igniter Engine ECU	ON / N.A.	f
22 (DI-29)	Water Temp. Sensor Circuit	Open or short in water temp. sensor circuit Water temp. sensor Engine ECU	ON / ON	f
24 (DI-32)	Intake Air Temp. Sensor Circuit	Open or short intake air temp. sensor circuit Intake air temp. sensor Engine ECU	OFF / ON	f
31 (DI-35)	Vacuum Sensor Circuit	Open or short in vacuum sensor circuit Vacuum sensor Engine ECU	ON / ON	f
41 (DI-37)	Throttle Position Sensor Circuit	Open or short in throttle position sensor circuit Throttle position sensor Engine ECU	OFF / ON	f
42 (DI-40)	Vehicle Speed Sensor Signal Circuit	Open or short in vehicle speed sensor circuit Vehicle speed sensor Combination meter Engine ECU	ON / OFF	f
43 (DI-42)	Starter Signal Circuit	Open or short in starter signal circuit Open or short in ignition switch or starter relay circuit Engine ECU	N.A. / OFF	X
51 (DI-44)	Switch Condition Circuit	A/C switch system Throttle position sensor IDL circuit Accelerator pedal and cable Engine ECU	N.A. / OFF	X

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

*2: " f " in the memory column indicates that a diagnostic trouble code is recorded in the ECU memory when a malfunction occurs. "X" indicates that a diagnostic trouble code is not recorded in the ECU memory even if a malfunction occurs.

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

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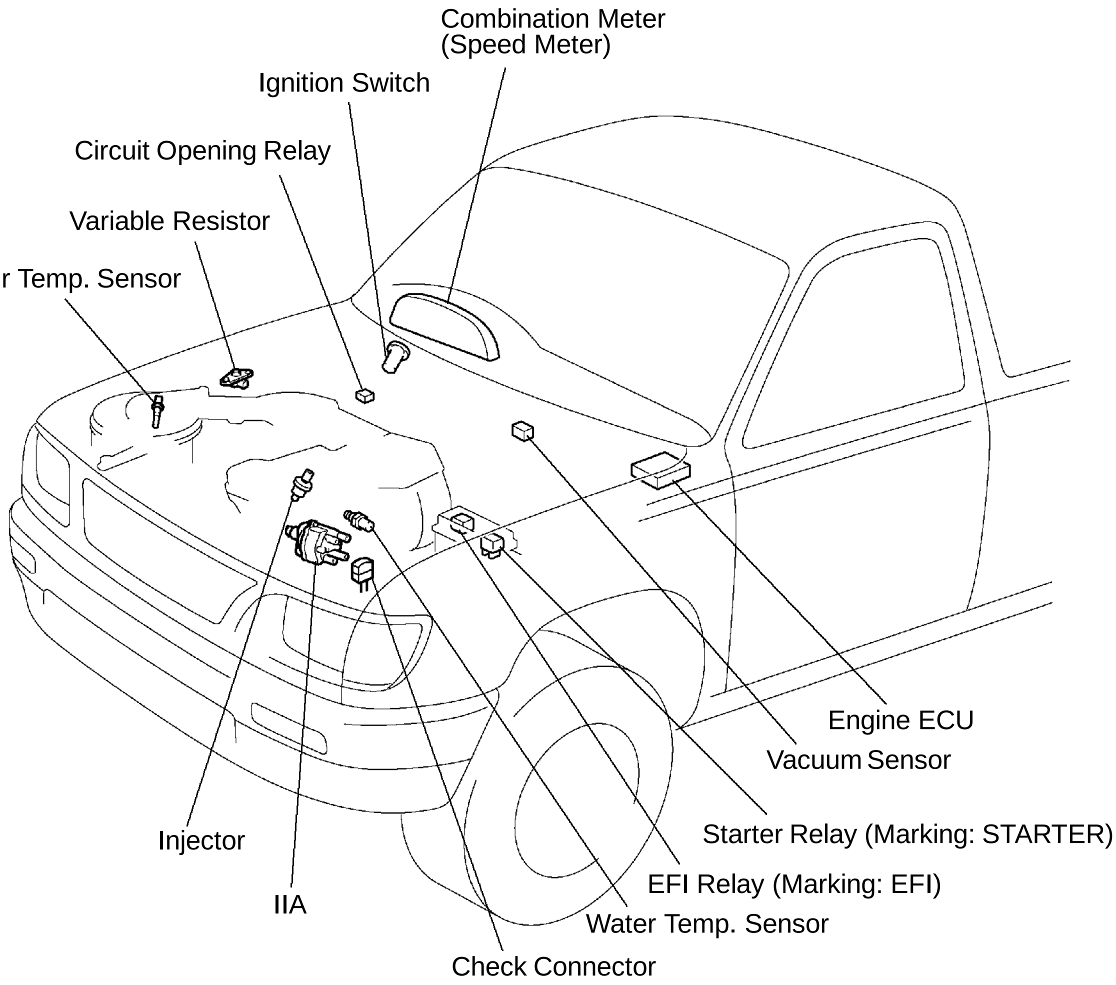
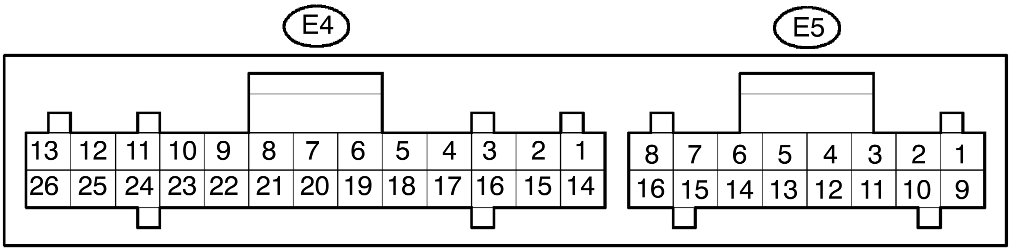
PARTS LOCATION



DI1HL-01

TERMINALS OF ECU

ECU Terminals



A01436

Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
BATT (E5 - 2) - E1 (E4 - 24)	Y ↔ BR	Always	9 ~ 14
+ B (E5 - 9) - E1 (E4 - 24)	R-L ↔ BR	IG switch ON	9 ~ 14
VC (E5 - 18) - E2 (E4 - 16)	P ↔ LG - B	IG switch ON	4.5 ~ 5.5
VTA (E4 - 17) - E2 (E4 - 16)	Y ↔ LG - B	IG switch ON Throttle valve fully closed	0.3 ~ 0.8
		IG switch ON Throttle valve fully open	3.2 ~ 4.9
PIM (E4 - 4) - E2 (E4 - 16)	GR ↔ LG - B	IG switch ON	3.3 ~ 3.9
		Apply vacuum 26.7 kPa (200 mmHg, 7.9 in.Hg)	2.5 ~ 3.1
THW (E4 - 3) - E2 (E4 - 16)	G-R ↔ LG - B	Idling, Engine coolant temp. 80°C (176°F)	0.2 ~ 1.0
STA (E4 - 11) - E1 (E4 - 24)	P - B ↔ BR	Cranking	6.0 or more
#10 (E4 - 12) - E01 (E4 - 13)	R - L ↔ BR	IG switch ON	9 ~ 14
		Idling	Pulse generation (See page DI-57)
#20 (E4 - 25) - E02 (E4 - 26)	L ↔ BR	IG switch ON	9 ~ 14
		Idling	Pulse generation (See page DI-57)
IGT (E4 - 6) - E1 (E4 - 24)	B - L ↔ BR	Idling	Pulse generation (See page DI-24)
IGF (E4 - 7) - E1 (E4 - 24)	B - Y ↔ BR	IG switch ON Disconnect IIA connector	4.5 ~ 5.5
		Idling	Pulse generation (See page DI-24)
NE+ (E4 - 21) - NE - (E4 - 9)	R ↔ G	Idling	Pulse generation (See page DI-20)
FC (E5 - 4) - E1 (E4 - 24)	G - R ↔ BR	IG switch ON	9 ~ 14
THA (E4 - 5) - E2 (E4 - 16)	Y - G ↔ LG - B	Idling, Intake air temp. 20°C (68°F)	0.5 ~ 3.4
SPD (E5 - 13) - E1 (E4 - 2)	G - O ↔ BR	IG switch ON Rotor driving wheel slowly	Pulse generation (See page DI-40)
TE1 (E5 - 8) - E1 (E4 - 24)	L - W ↔ BR	IG switch ON	9 ~ 14
TE2 (E5 - 7) - E1 (E4 - 24)	G - B ↔ BR	IG switch ON	9 ~ 14
W (E5 - 10) - E1 (E4 - 24)	P ↔ BR	Idling	9 ~ 14
VAF (E4 - 10) - E2 (E4 - 16)	G - B ↔ LG - B	IG switch ON	Below 3.0

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DI1HM-01

PROBLEM SYMPTOMS TABLE

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

Symptom	Suspect Area	See page
Engine does not crank (Does not start)	1. Starter 2. Starter relay	ST-5 ST-15
No initial combustion (Does not start)	1. Engine ECU power source circuit 2. Ignition signal circuit 3. Fuel system circuit 4. Spark plug 5. Injector circuit	DI-49 DI-24 DI-60 * DI-57
No complete combustion (Does not start)	1. Fuel system circuit 2. Ignition signal circuit 3. IIA 4. Spark plug 5. Injector circuit	DI-60 DI-24 * * DI-57
Engine cranks normally (Difficult to start)	1. Starter signal circuit 3. Fuel system circuit 4. IIA 5. Spark plug 6. Compression 7. Injector circuit	DI-42 DI-60 * * * DI-57
Cold engine (Difficult to start)	1. Starter signal circuit 3. Fuel system circuit 4. Injector circuit 5. IIA 6. Spark plug	DI-42 DI-60 DI-57 * *
Hot engine (Difficult to start)	1. Starter signal circuit 3. Fuel system circuit 4. Injector circuit 5. IIA 6. Spark plug	DI-42 DI-60 DI-57 * *
High engine idle speed (Poor idling)	1. Engine ECU power source circuit 2. Back up power source circuit	DI-49 DI-54
Low engine idle speed (Poor idling)	3. Fuel system circuit 4. Injector circuit 5. Vacuum sensor circuit 6. Back up power source circuit	DI-60 DI-57 DI-35 DI-54
Rough idling (Poor idling)	2. Vacuum sensor circuit 3. Injector circuit 4. Variable resistor circuit 5. Ignition signal circuit 6. Compression 7. Fuel system circuit 8. IIA 9. Spark plug 10. Back up power source circuit	DI-35 DI-57 DI-67 DI-24 * DI-60 * * DI-54
Hunting (Poor idling)	2. Vacuum sensor circuit 3. Engine ECU power source circuit 4. Fuel system circuit	DI-35 DI-49 DI-60

*: See Pub RM467E

CONTINUED

Symptom	Suspect Area	See page
Hesitation/Poor acceleration (Poor driveability)	1. Vacuum sensor circuit 2. Injector circuit 3. Fuel system circuit 4. Variable resistor circuit 5. Ignition signal circuit 6. IIA 7. Spark plug	DI-35 DI-57 DI-60 DI-67 DI-24 * *
Muffler explosion, after fire (Poor driveability)	1. IIA 2. Spark plug 3. Injector circuit	* * DI-57
Surging (Poor driveability)	1. Fuel system circuit 2. Variable resistor circuit 3 Spark plug 4. Injector circuit	DI-60 DI-67 * DI-57
Soon after starting (Engine stall)	1. Fuel system circuit 2. Vacuum sensor circuit	DI-60 DI-35
After accelerator pedal depressed (Engine stall)	1. Vacuum sensor circuit	DI-35
After accelerator pedal released (Engine stall)	1. Injector circuit 3. Engine ECU	DI-57 DI-49
During A/C operation (Engine stall)	1. Engine ECU	*1

*: See Pub RM467E

*1: See Pub RM585E

DIAGNOSTICS – ENGINE (1RZ – E)

CONTINUED

DIAGNOSTICS – ENGINE (1RZ – E)

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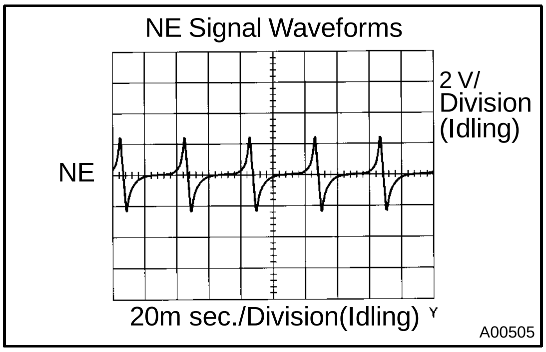
DI1HN-01

DTC	12	NE Signal Circuit

CIRCUIT DESCRIPTION

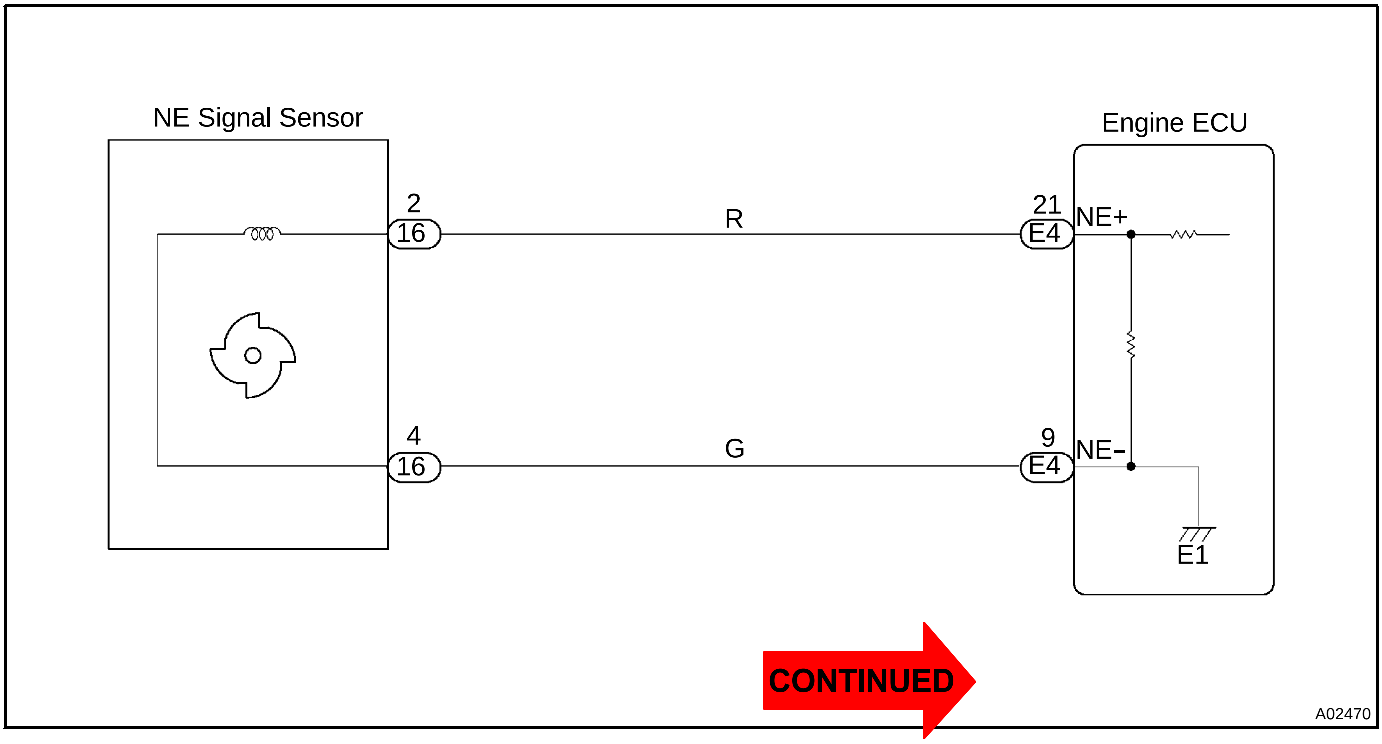
The IIA in the Engine Control System contains signal plate and a pickup coil for NE signal.
The NE signal plate has 4 teeth on its outer circumference. The NE signal sensor generates 4 signals for every engine revolution. The ECU detects the engine speed by the NE signals.

DTC No.	Detection Item	Trouble Area
12	No NE signal to ECU during cranking	• Open or short in NE circuit • IIA • Open or short in STA circuit • Engine ECU



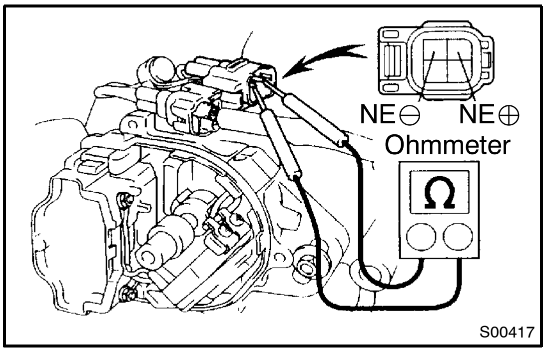
Reference: INSPECTION USING OSILLOSCOPE
During cranking or idling, check between terminals NE+ and NE– of engine ECU.
HINT:
The correct wavaforms are as shown.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	Check resistance of pickup coil in distributor (NE).



PREPARATION:
Disconnect distributor connector.

CHECK:
Measure resistance between each terminal shown in table below

OK:

		Resistance
NE Pickup Coil (NE⊕ – NE⊖)	Cold	370 – 550 Ω
	Hot	475 – 650 Ω

”Cold” is from –10°C (14°F) to 50°C (122°F) and ”Hot” is from 50°C (122°F) to 100°C (212°F).

NG → **Replace distributor housing.**

OK

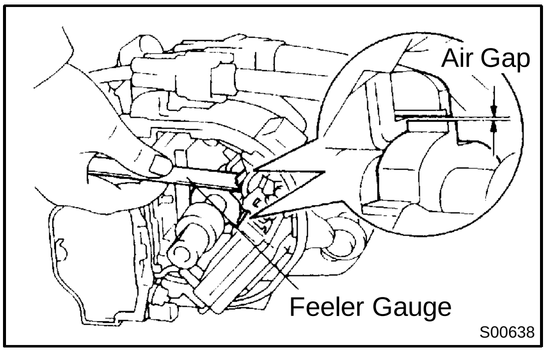
2	Check for open and short in harness and connector between engine ECU and distributor (See page IN–21).

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

OK

CONTINUED

3	Check air gap.



PREPARATION:
Remove distributor cap, rotor and dust cover.

CHECK:
Using a feeler gauge, measure the air gap between the signal rotor and pickup coil projection.

OK:
Air gap: 0.2 – 0.4 mm (0.008 – 0.016 in.)

NG → **Replace distributor housing.**

OK

Check and replace engine ECU.

DI1HO-01

DTC 13 NE Signal Circuit

CIRCUIT DESCRIPTION

Refer to NE signal circuit on page DI–20.

DTC No.	Detection Item	Trouble Area
13	No NE signal to ECU for 0.3 sec. or more at 1,500 rpm or more	• Open or short in NE circuit • IIA • Engine ECU

This code indicates that an intermittent problem of the NE signal from the distributor to the ECU has occurred, but that it has returned to normal. Note that although this problem may not necessarily appear at the time of inspection, it cannot be ignored because this diagnostic trouble code is output, indicating that there is or was a malfunction in the NE signal circuit; this ”malfunction” is usually a loose connector.

The distributor connector and the NE terminal of the ECU connector must therefore be checked for the following:

(1) Loose connectors
(2) Dirty connector terminals
(3) Loose connector terminals

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DI1HP-01

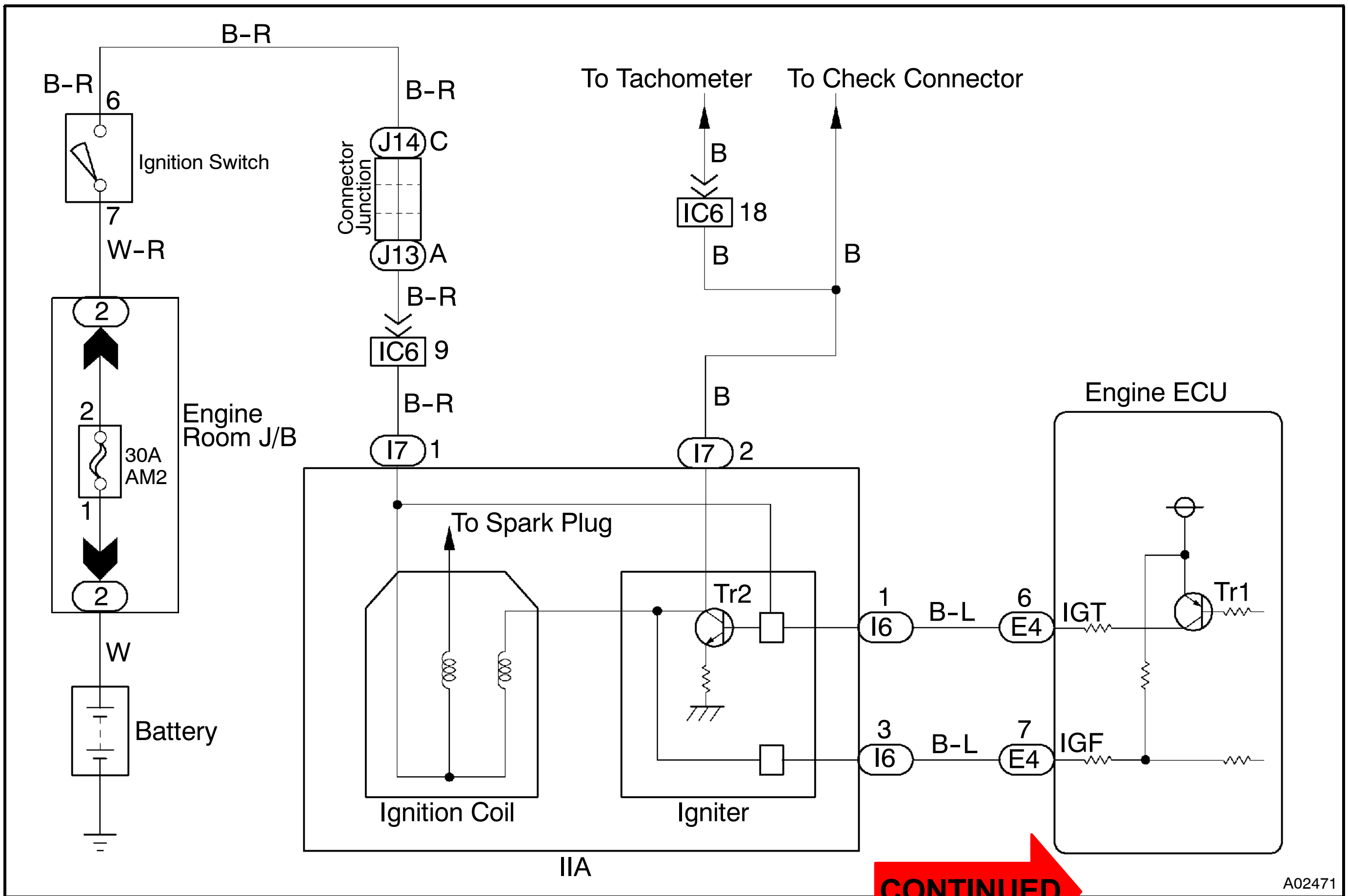
DTC	14	Ignition Signal Circuit

CIRCUIT DESCRIPTION

The ECU determines the ignition timing, turns ON Tr1 at a predetermined angle (°CA) before the desired ignition timing and outputs an ignition signal (IGT) ”1” to the igniter.
Since the width of the IGT signal is constant, the dwell angle control circuit in the igniter determines the time the control circuit starts primary current flow to the ignition coil based on the engine speed and ignition timing one revolution ago, that is, the time the Tr2 turns ON.
When it reaches the ignition timing, the ECU turns Tr1 OFF and outputs the IGT signal ”0”.
This turns Tr2 OFF, interrupting the primary current flow and generating a high voltage in the secondary coil which causes the spark plug to spark. Also, by the counter electromotive force generated when the primary current is interrupted, the igniter sends an ignition confirmation signal (IGF) to the ECU.
The ECU stops fuel injection as a fail safe function when the IGF signal is not input the ECU.

DTC No.	Detection Item	Trouble Area
14	No IGF signal to ECU for 4 consecutive IGT signal	• Open or short in IGF or IGT circuit from IIA to engine ECU • Igniter • Engine ECU

WIRING DIAGRAM



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INSPECTION PROCEDURE

1	**Check spark plug and spark (See Pub. No. RM467E).**

NG → **Go to step 4.**

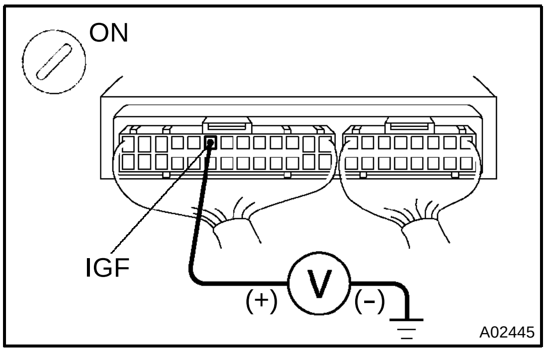
OK

2	**Check for open and short in harness and connector in IGF signal circuit between engine ECU and IIA (See page IN-21).**

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

OK

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



PREPARATION:
(a) Disconnect IIA connector.
(b) Remove the glove compartment.(See page FI-61)
(c) Turn ignition switch ON.

CHECK:
Measure voltage between terminal IGF of ECU connector and body ground.

OK:
Voltage: 4.5 - 5.5 V

OK → **Replace igniter.**

NG

Check and replace engine ECU (See page IN-21).

CONTINUED

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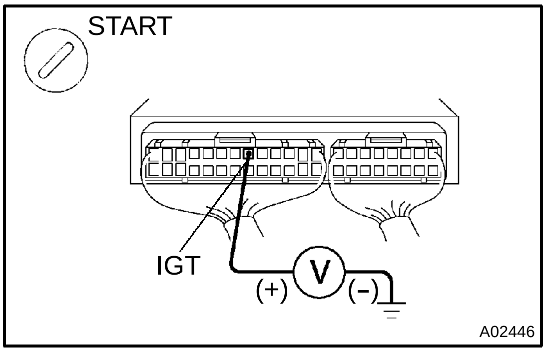
4	**Check for open and short in harness and connector in IGT signal circuit between engine ECU and IIA (See page IN-21).**

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

OK

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



PREPARATION:

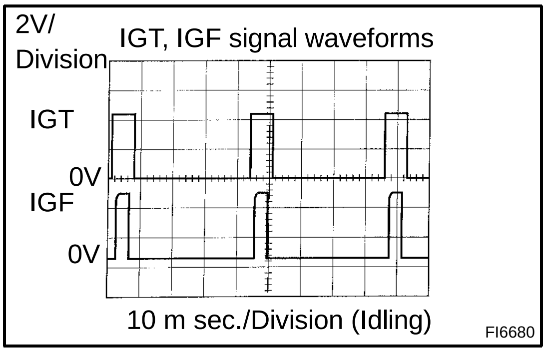
Remove the glove compatment.(See page FI-61)

CHECK:

Measure voltage between terminal IGT of ECU connector and body ground when engine is cranked.

OK:

Voltage: More than 0.1 V and less than 4.5 V



Reference: INSPECTION USING OSCILLOSCOPE

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

HINT:

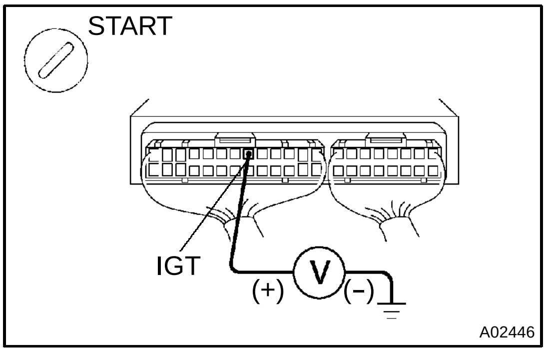
The correct waveform are as shown.

NG → **Check and replace engine ECU (See page IN-21).**

OK

CONTINUED

6	Disconnect IIA connector and check voltage between terminal IGT of engine ECU connector and body ground.



PREPARATION:
(a) Disconnect igniter connector.
(b) Remove the glove compatment.(See page FI–61)

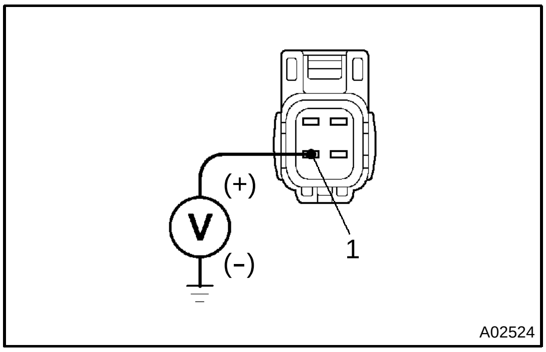
CHECK:
Measure voltage between terminal IGT of ECU connector and body ground when engine is cranked.

OK:
Voltage: More than 0.1 V and less than 4.5 V

NG	Check and replace engine ECU (See page IN–21).

OK

7	Check voltage of IIA power source .



PREPARATION:
Disconnect IIA connector.

CHECK:
Measure voltage between terminal 1 of IIA connector and body ground, when ignition switch is turned to ”ON” and ”START” position.

OK:
Voltage: 9 – 14 V

NG	Check for open and short in harness and connector between ignition switch and IIA (See page IN–21).

OK

CONTINUED

8	**Check ignition coil (See Pub. No. RM467E).**

NG → **Replace ignition coil.**

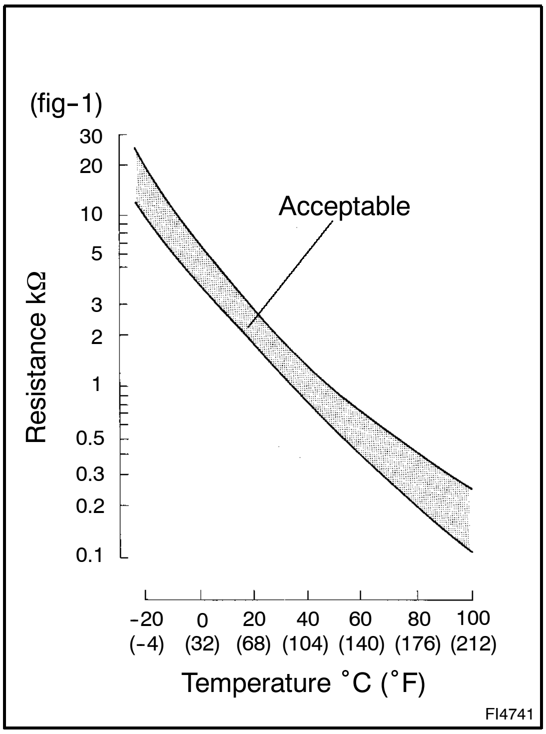
OK ↓

Replace igniter.

DI1HQ-01

DTC	22	Water Temp. Sensor Circuit

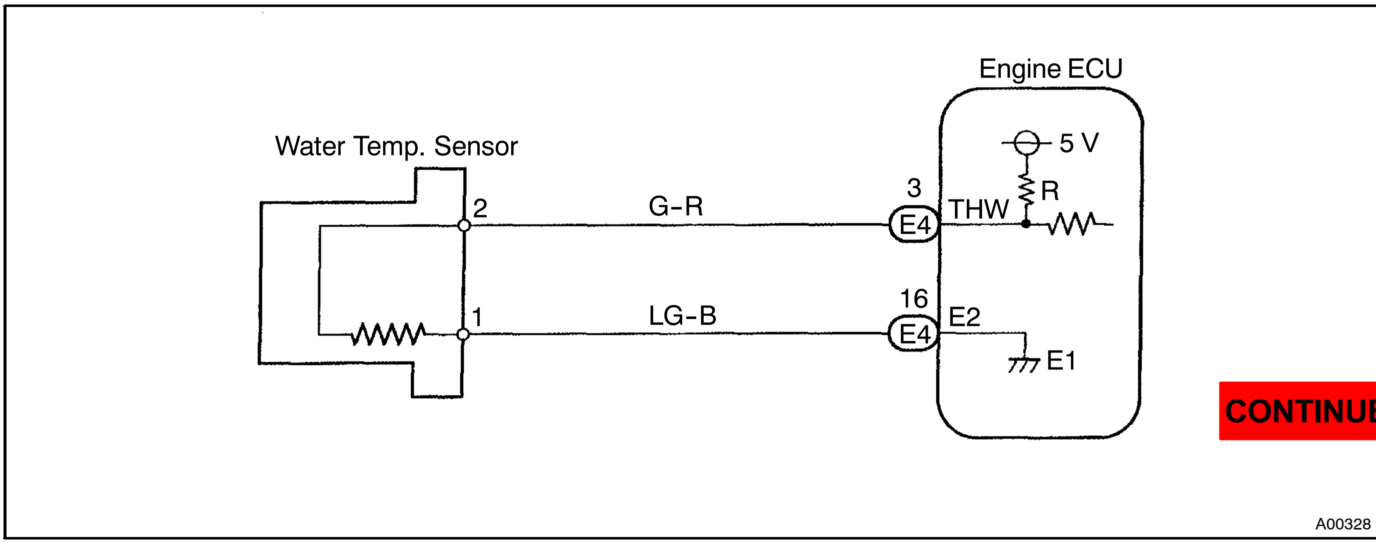
CIRCUIT DESCRIPTION



The water temperature sensor senses the coolant temperature. A thermistor built into the sensor changes the resistance value according to the coolant temperature. The lower the coolant temperature, the greater the thermistor resistance value, and the higher the coolant temperature, the lower the thermistor resistance value (See Fig.1).
The water temperature sensor is connected to the ECU (See below). The 5 V power source voltage in the ECU is applied to the water temperature sensor from the terminal THW via a resistor R. That is, the resistor R and the water temperature sensor are connected in series. When the resistance value of the water temperature sensor changes in accordance with changes in the coolant temperature, the potential at the terminal THW also changes. Based on this signal, the ECU increases the fuel injection volume to improve driveability during cold engine operation. If the ECU detects the diagnostic trouble code 22, it operates the fail safe function in which the engine coolant temperature is assumed to be 80°C (170°F).

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

WIRING DIAGRAM



CONTINUED

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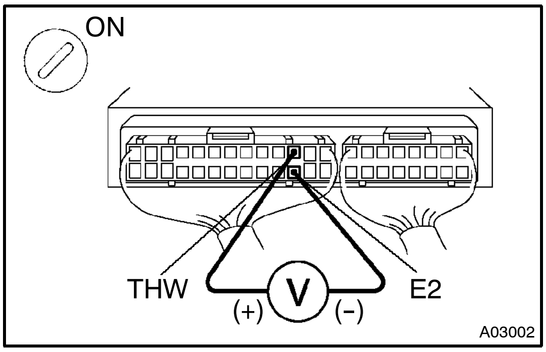
INSPECTION PROCEDURE

HINT:
If diagnostic trouble code "22" (water temperature sensor circuit), "24" (intake air temperature sensor circuit), "31" (vacuum sensor circuit) and "41" (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open.

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



PREPARATION:
(a) Remove the glove compartment. (See page FI-61)
(b) Turn ignition switch ON.

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

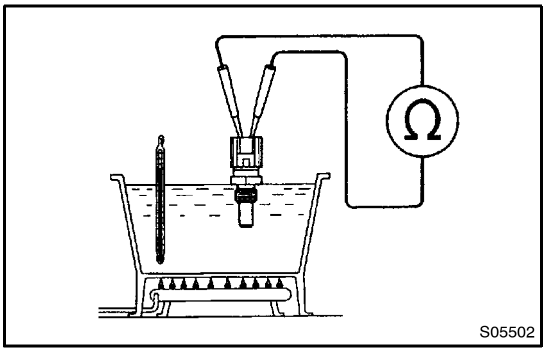
OK:

Engine Coolant Temp.	Voltage
20°C (68°F) (Engine is cool)	0.5 - 3.4 V
80°C (176°F) (Engine is hot)	0.2 - 1.0 V

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

NG ↓

2 Check water temp. sensor.



PREPARATION:
Disconnect the water temp. sensor connector.

CHECK:
Measure resistance between terminals.

OK:
Resistance is within acceptable zone on chart.

Engine Coolant Temp.	Resistance
20°C (68°F)	2 - 3 kΩ
80°C (176°F)	0.2 - 0.4 kΩ

NG → **Replace water temp. sensor.**

OK ↓

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

3	Check for open and short in harness and connector between engine ECU and water temp. sensor (See page IN-21).

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

OK

Check and replace engine ECU.

CLICK HERE TO VIEW CHAPTER INDEX

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DI1HR-01

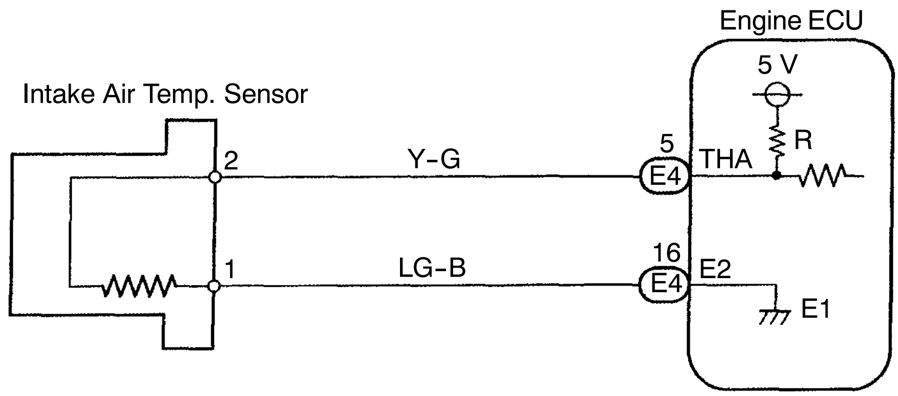
DTC	24	Intake Air Temp. Sensor Circuit

CIRCUIT DESCRIPTION

The intake air temp. sensor is built into the air cleaner cap and senses the intake air temperature.
The structure of the sensor and connection to the engine ECU is the same as in the water temp. sensor shown on page DI-29.
If the engine ECU detects the diagnostic trouble code "24", it operates the fail safe function in which the intake air temperature is assumed to be 20°C (68°F).

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

WIRING DIAGRAM

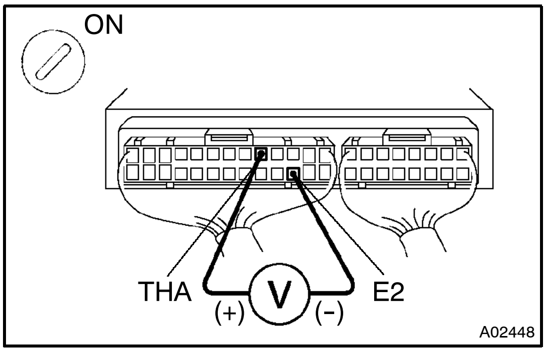


CONTINUED

INSPECTION PROCEDURE

HINT:
If diagnostic trouble code "22" (water temperature sensor circuit), "24" (intake air temperature sensor circuit), "31" (vacuum sensor circuit) and "41" (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open.

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



PREPARATION:
(a) Remove the glove compatrment. (See page FI-61)
(b) Turn ignition switch ON.

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

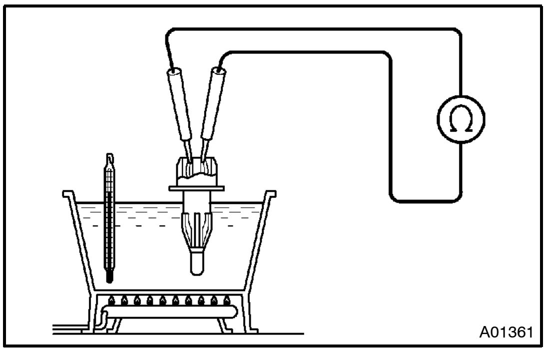
OK:

Engine Coolant Temp.	Voltage
20°C (68°F) (Engine is cool)	0.5 - 3.4 V
80°C (176°F) (Engine is hot)	0.2 - 1.0 V

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

NG

2 Check intake air temp. sensor.



PREPARATION:
Disconnect the intake air temp. sensor connector.

CHECK:
Measure resistance between terminals.

OK:
Resistance is within acceptable zone on chart.

Engine Coolant Temp.	Resistance
20°C (68°F)	2 - 3 kΩ
80°C (176°F)	0.2 - 0.4 kΩ

NG → **Replace intake air temp. sensor.**

CONTINUED

OK

CLICK HERE TO VIEW CHAPTER INDEX

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3	Check for open and short in harness and connector between engine ECU and intake air temp. sensor (See page IN–21).

NG → Repair or replace harness or connector.

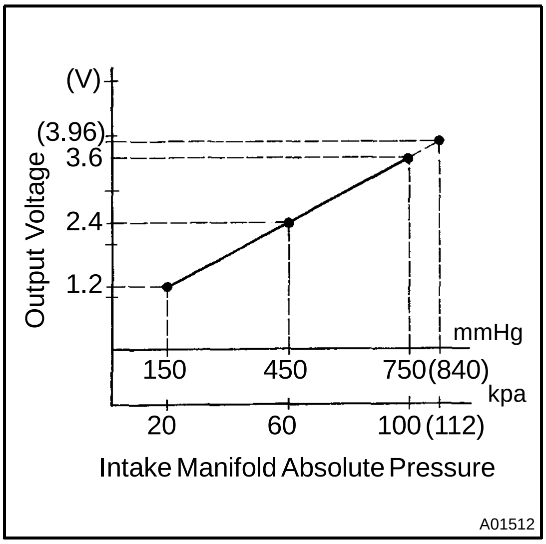
OK

Check and replace engine ECU.

DI1HS-01

DTC	31	Vacuum Sensor Circuit

CIRCUIT DESCRIPTION

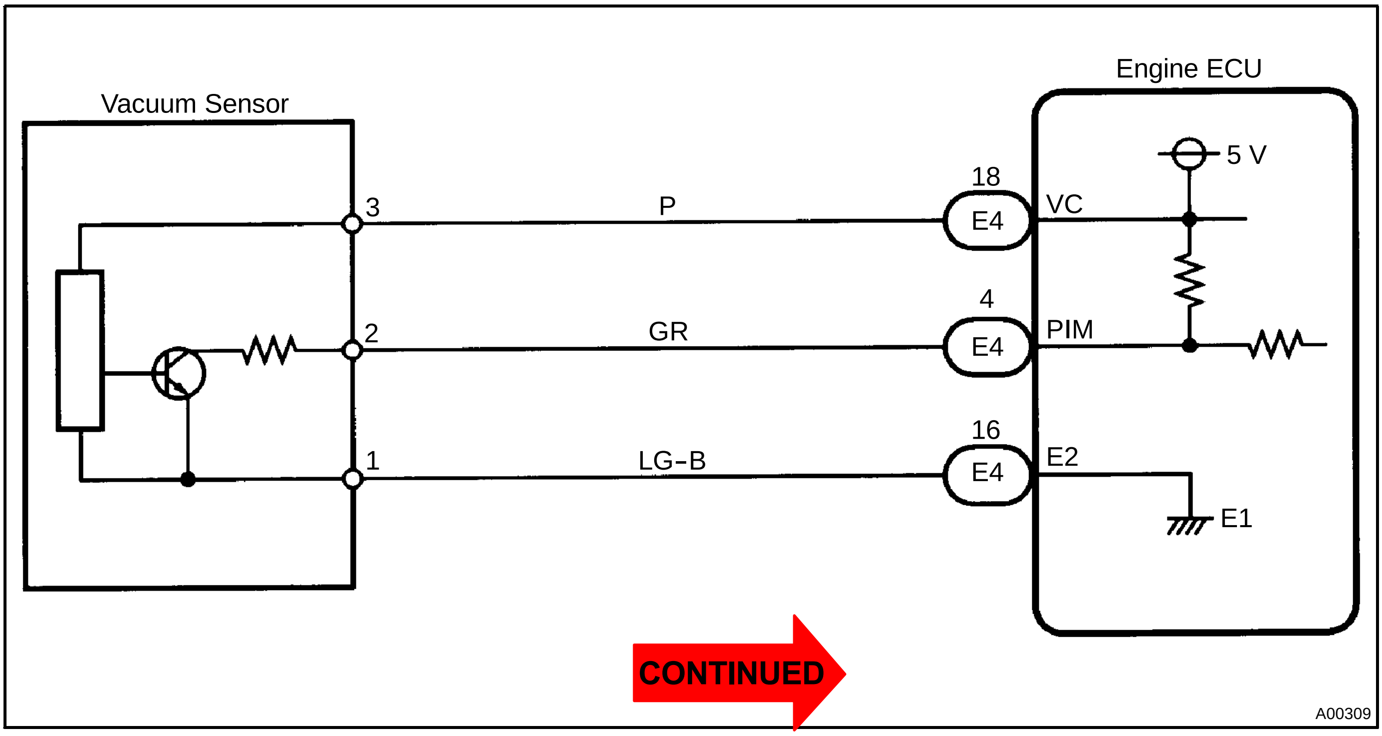


By a built-in sensor unit, the vacuum sensor detects the intake manifold pressure as a voltage. The ECU then determines the basic injection duration and basic ignition advance angle based on this voltage.
Since the vacuum sensor does not use the atmospheric pressure as a criterion, but senses the absolute pressure inside the intake manifold (the pressure in proportion to the preset absolute vacuum 0), it is not influenced by fluctuations in the atmospheric pressure due to high altitude and other factors. this permits it to control the air fuel ratio at the proper level under all conditions.

DTC No.	Detection Item	Trouble Area
31	Open or short in vacuum sensor circuit for 0.5 sec. or more	Open or short in vacuum sensor circuit Vacuum sensor Engine ECU

If the ECU detects diagnostic trouble code "31", it operates the fail safe function, keeping the ignition timing and fuel injection volume constant and making it possible to drive the vehicle.

WIRING DIAGRAM



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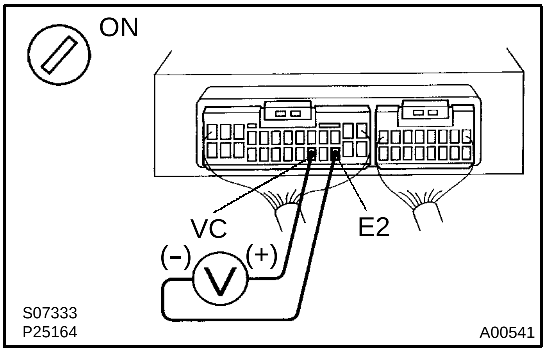
INSPECTION PROCEDURE

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



PREPARATION:

(a) Remove the glove compartment. (See page FI–61)

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminals VC and E2 of engine ECU.

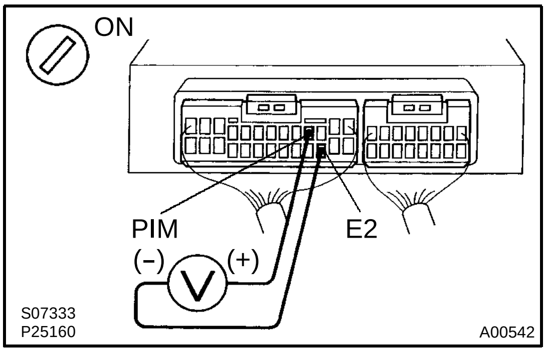
OK:

Voltage: 4.5 – 5.5 V

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

OK ↓

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



PREPARATION:

(a) Remove the glove compartment. (See page FI–61)

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminals PIM and E2 of engine ECU.

OK:

Voltage: 3.3 – 3.9 V

OK → **When diagnostic trouble code 31 is displayed, check and replace engine ECU.**

NG ↓

3	Check for open and short in harness and connector between engine ECU and vacuum sensor (See page IN–21).

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

OK ↓

Replace vacuum sensor.

CLICK HERE TO VIEW CHAPTER INDEX

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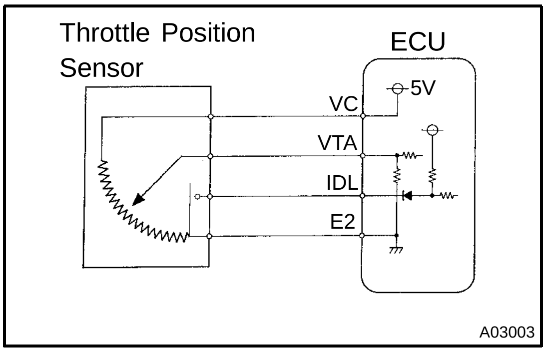
DI1HT–01

DTC	41	Throttle Position Sensor Circuit

CIRCUIT DESCRIPTION

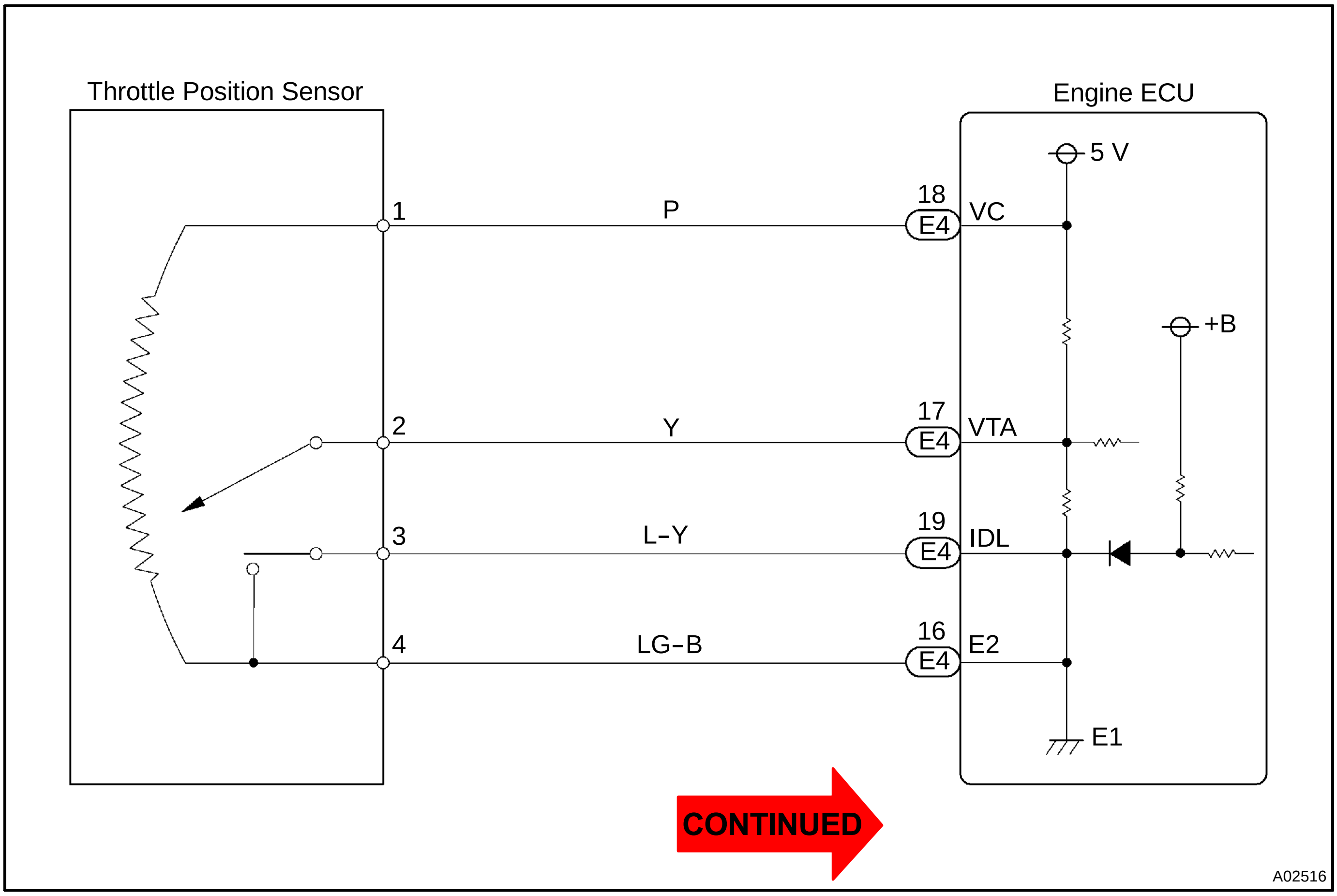


The throttle position sensor is mounted in the throttle body and detects the throttle valve opening angle. When the throttle valve is fully closed, a voltage of approximately 0.3 ~ 0.8 V is applied to the terminal VTA of the ECU. When the throttle valve is opened, the voltage applied to the terminal VTA of the ECU increases in proportion to the opening angle of the throttle valve and becomes approximately 3.2 – 4.9 V when the throttle valve is fully opened. The ECU judges the vehicle driving conditions from these signals input from the terminals VTA, and uses them as one of the conditions for deciding the air–fuel ratio correction, power increase correction and fuel–cut control etc.

DTC No.	Detection Item	Trouble Area
41	Open or short in throttle position sensor circuit for 0.5 sec. or more	• Open or short in throttle position sensor circuit • Throttle position sensor • Engine ECU

HINT:
When the connector for the throttle position sensor is disconnected, diagnostic trouble code 41 is not displayed. Diagnostic trouble code 41 is displayed only when there is an open or short in the VTA signal circuit of the throttle position sensor.

WIRING DIAGRAM

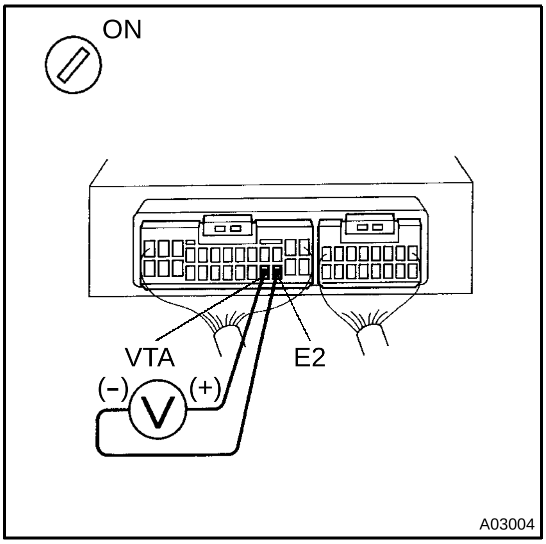


CLICK HERE TO VIEW CHAPTER INDEX

INSPECTION PROCEDURE

HINT:
If diagnostic trouble codes ”22” (water temperature sensor circuit), ”24” (intake air temperature sensor circuit) ”31” (vacuum sensor circuit) and ”41” (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open.

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



PREPARATION:

(a) Remove the glove compartment. (See page FI-61)
(b) Turn ignition switch ON.
(c) Apply vacuum to the throttle opener.

CHECK:

Measure voltage between terminals VTA and E2 of engine ECU connector when the throttle valve is opened gradually from the closed condition.

OK:

Throttle Valve	Voltage
Fully closed	0.3 - 1.0 V
Fully open	2.7 - 5.2 V

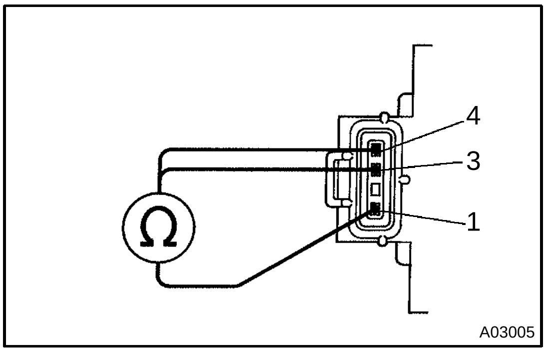
HINT:
The voltage should increase steadily in proportion to the throttle valve opening angle.

OK	**Check for problem symptoms table** **(See page DI-18).**

NG

CONTINUED

2	Check throttle position sensor.



PREPARATION:

Disconnect throttle position sensor connector.

CHECK:

Measure resistance between terminals 3, 4 and 1 of throttle position sensor connector when the throttle valve is opened gradually from the closed condition.

OK:

Terminals	Throttle valve	Resistance
1 - 4	-	2.5 - 5.9 kΩ
1 - 3	Fully closed	0.2 - 5.7 kΩ
	Fully open	2.0 - 10.2 kΩ

HINT:

Resistance between terminals 1 and 3 should increrace gradually in accordance with the throttle valve opening angle.

NG → **Replace throttle position sensor .**

OK

3	Check for open and short in harness and connector between engine ECU and throttle position sensor (See page IN-21).

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

OK

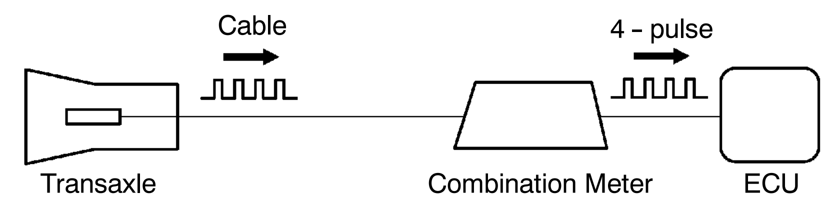
Check and replace engine ECU.

DI1HU-01

DTC	42	Vehicle Speed Sensor Signal Circuit

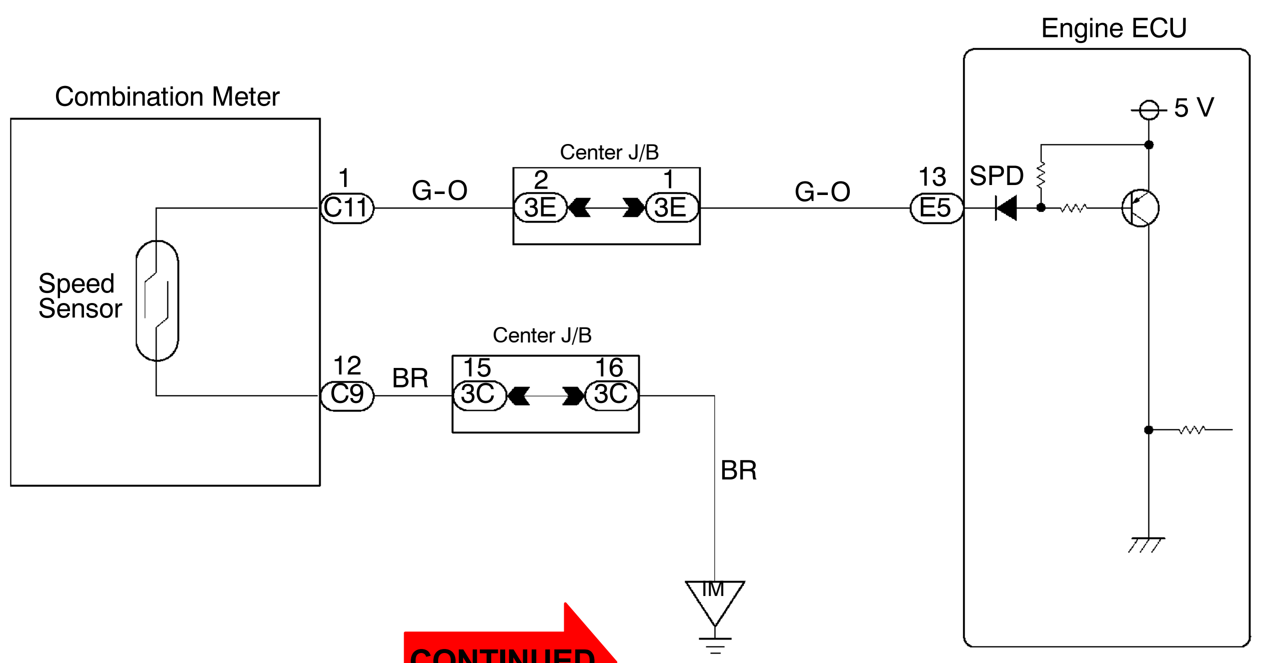
CIRCUIT DESCRIPTION

This sensor is mounted in the combination meter. It contains a magnet which is rotated by the speedometer cable.
Turning the reed switch ON and OFF 4 times for every revolution of the speedometer.
It is then transmitted to the ECU. The ECU determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
42	All conditions below are detected continuously for 8 sec. or more: (a) Vehicle speed signal: 0 km/h (0 mph) (b) Engine speed: 2,500 ~ 4,500 rpm (c) Water temp.: 80°C (176°F) or more (d) Load driving	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • Combination meter • Engine ECU

WIRING DIAGRAM



CONTINUED

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INSPECTION PROCEDURE

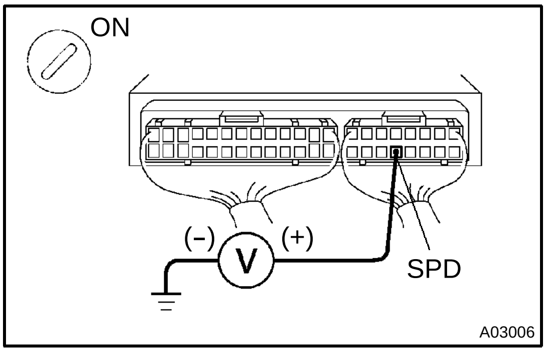
1	Check operation of speedometer.

CHECK:
Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.
HINT:
The vehicle speed sensor is operating normally if the speedometer display is normal.

NG → **Check speedometer circuit. See combination meter troubleshooting.**

OK

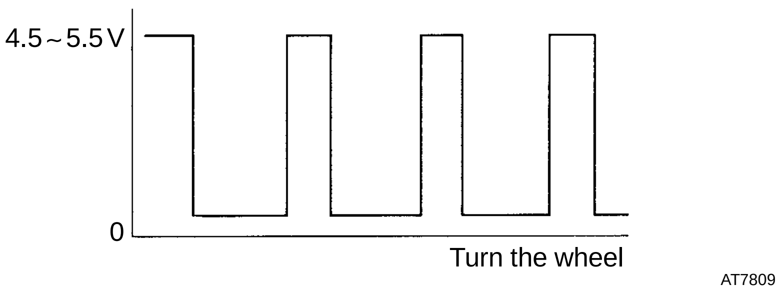
2	Check voltage between terminal SPD of engine ECU connector and body ground.



PREPARATION:
(a) Remove the glove compartment.(See page FI–61)
(b) Shift the shift lever to N position.
(c) Jack up one of the rear wheels.
(d) Turn ignition switch ON.

CHECK:
Measure voltage between terminal SPD of engine ECU connector and body ground when the wheel is turned slowly.

OK:
Voltage is generated intermittently.



NG → **Check and repair harness and connector between combination meter and engine ECU**

OK

Check and replace engine ECU.

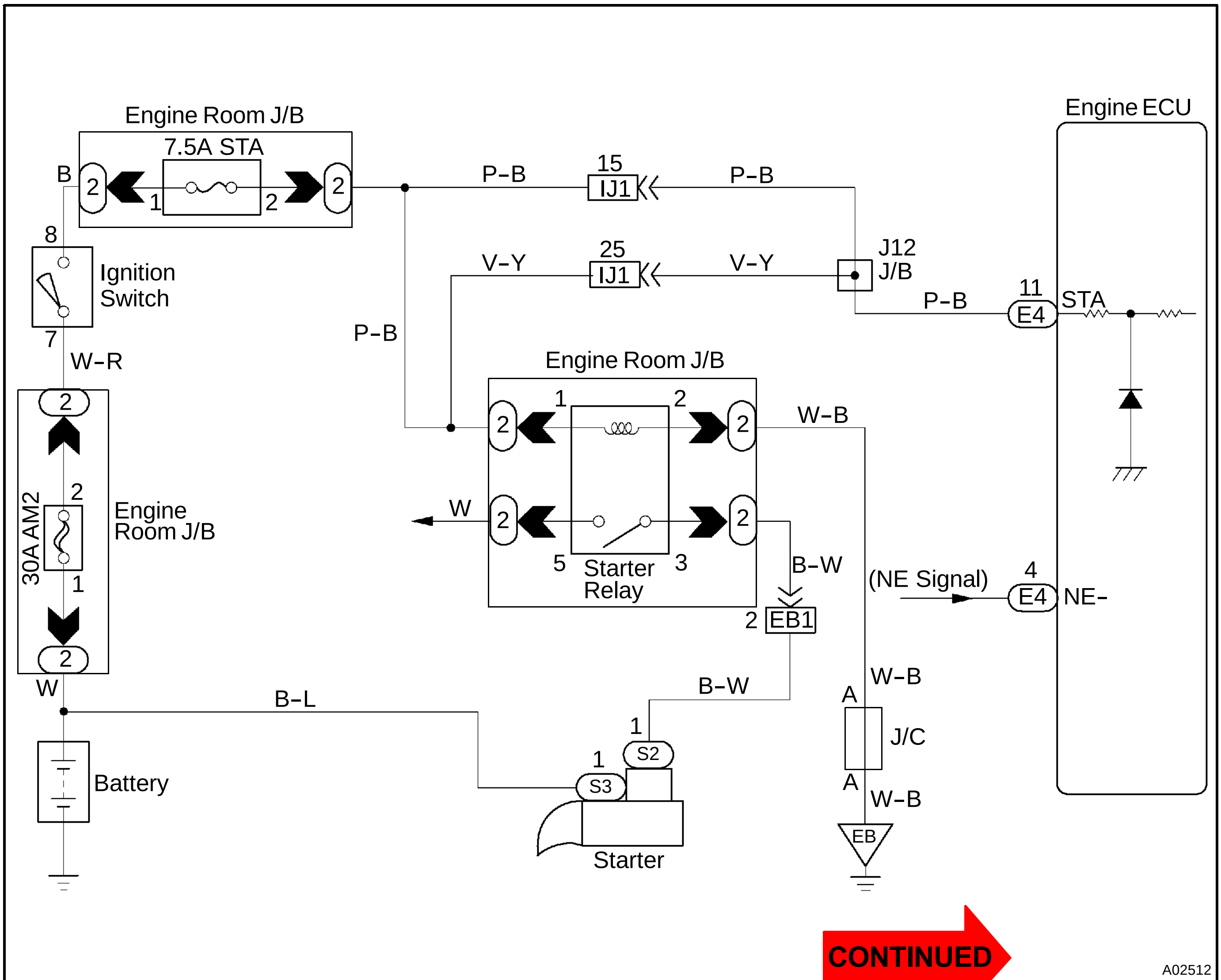
DTC	43	Starter Signal Circuit

CIRCUIT DESCRIPTION

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

DTC No.	Detection Item	Trouble Area
43	No starter signal to ECU	• Open or short in starter signal circuit • Open or short in ignition switch or starter relay circuit • Engine ECU

WIRING DIAGRAM

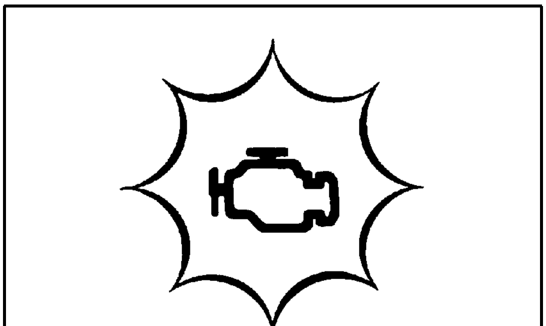


CONTINUED

INSPECTION PROCEDURE

HINT:
This diagnostic chart is based on the premise that the engine is cranked normally. If the engine is not cranked, proceed to the problem symptoms table on page DI–18.

1	**Check output condition of diagnostic trouble code 43.**


FI2547

PREPARATION:
Setting the test mode.
(a) Turn ignition switch OFF.
(b) Using SST, connect terminals TE2 and E1 of check connector.
SST 09843 – 18020
(c) Turn ignition switch ON. (Don’t start the engine).
(d) Using SST, connect terminals TE1 and E1 of check connector.
SST 09843 – 18020

CHECK:
Check if code ”43” is output by the check engine warming light.

OK:
Code ”43” is output.

CHECK:
Start the engine.
Check if the code ”43” disappear.

OK:
Code ”43” is not output.

OK	**Proceed to next circuit inspection shown on problem symptom table (See page DI–18).**

NG

2	**Check for open in harness and connector between engine ECU and starter relay (Marking: ST)(See page IN–21).**

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

OK

Check and replace engine ECU (See page IN–21).

CLICK HERE TO VIEW CHAPTER INDEX

DTC 51 Switch Condition Signal Circuit

CIRCUIT DESCRIPTION

Air Conditioning Switch Signal

The ECU uses the output from the air conditioning switch to determine whether or not the air conditioning is operating so that it can increase the idling speed of the engine if necessary.

Throttle Position Sensor IDL Signal

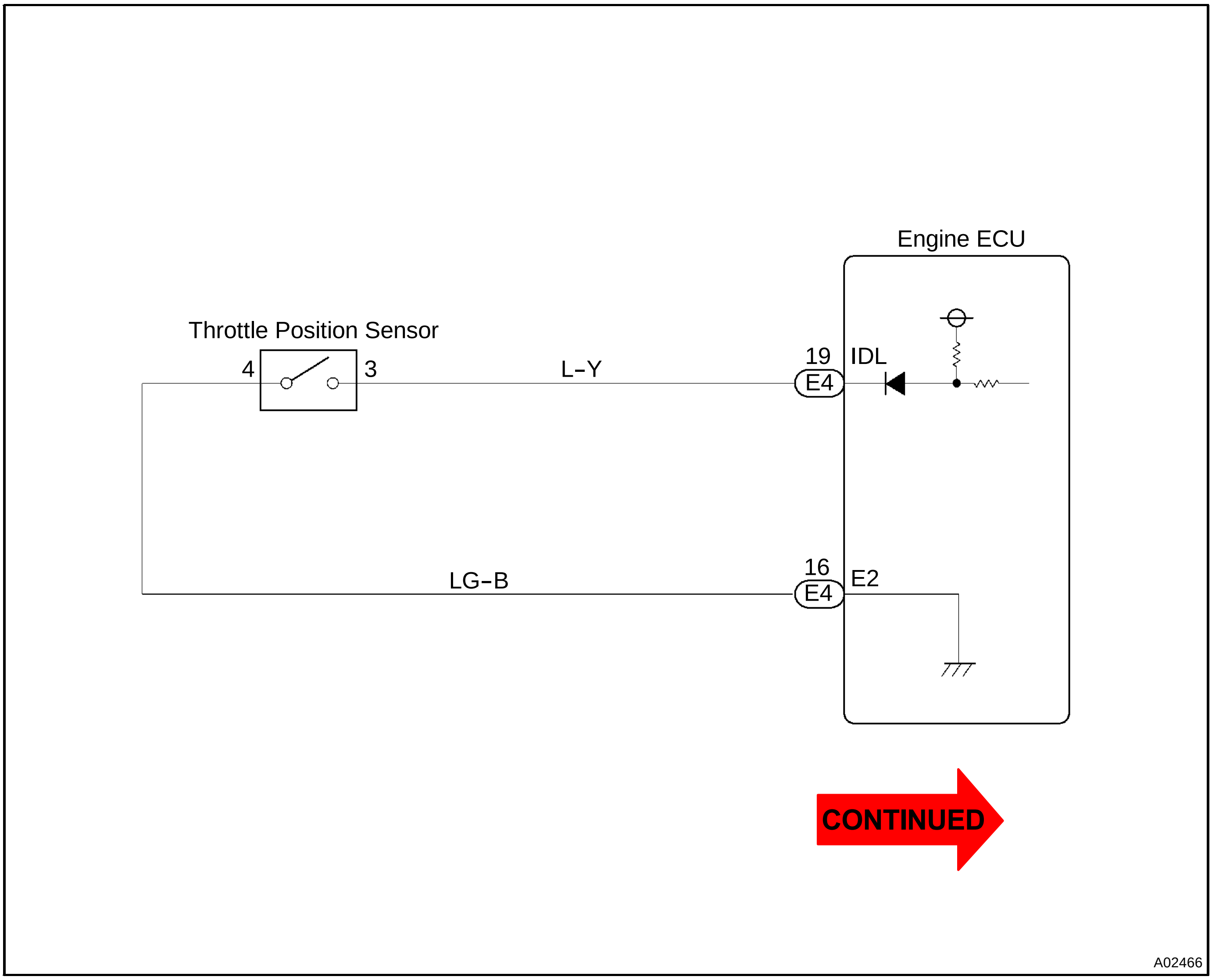
The IDL contacts are mounted in the throttle position sensor, and detects the idle condition.

DTC No.	Detection Item	Trouble Area
51	(1) 3 sec. or more after engine starts idle switch OFF (IDL1). (3) A/C switch ON.	• Throttle position sensor IDL circuit • Accelerator pedal and cable • A/C switch circuit • Engine ECU

HINT:

In this circuit, diagnosis can only be made in the test mode.

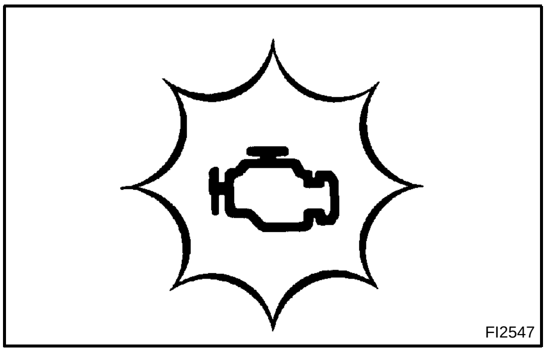
WIRING DIAGRAM



CONTINUED

INSPECTION PROCEDURE

1	Check output condition of diagnostic trouble code 51.


FI2547

PREPARATION:

Setting the test mode.

(a) Turn ignition switch OFF.

(b) Using SST, connector terminals TE2 and E1 of check connector.

SST 09843–18020

(c) Turn ignition switch ON.

(For checking terminal A/C, start the engine.)

(d) Using SST, connect terminals TE1 and E1 of check connector.

SST 09843–18020

CHECK:

Check if code ”51” is output by the check engine warning light.

OK:

	Condition	Code
Throttle Position Sensor (IDL)	Accelerator pedal released	Normal*1
	Accelerator pedal depressed	51*1
A/C Switch (A/C)	A/C SW ON	51
	A/C SW OFF	Normal

*1: Before the STA signal is input (ST is not ON), diagnostic trouble code 43 is also output.

HINT:

Diagnostic trouble code 42 output with vehicle speed 3 mph (5 km/h) or below

NG | **IDL.....Go to step 2, A/C.....Go to step 3.**

OK

Proceed to next circuit inspection shown on problem symptoms table
(See page DI–18).

CONTINUED

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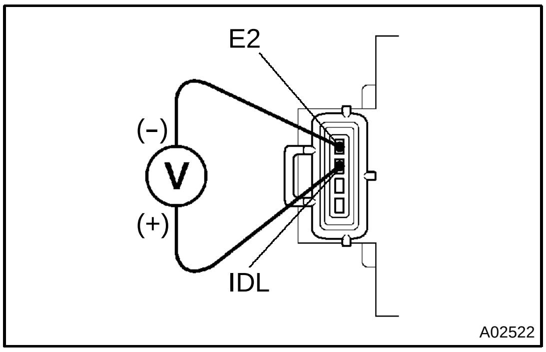
2 Check resistance of throttle position sensor.



PREPARATION:
Disconnect throttle position sensor connector.

CHECK:
Measure resistance between terminals IDL and E2 of throttle position sensor connector.

OK:

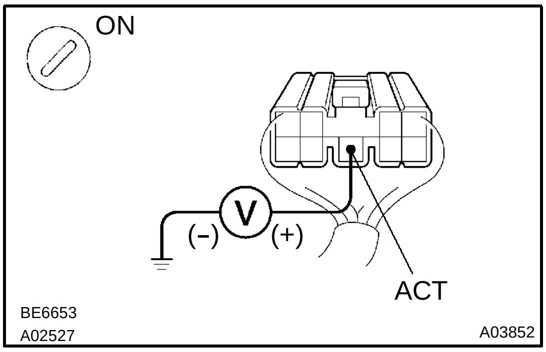
Throttle Valve	Resistance
Fully closed	Less than 2.3 kΩ
Opened	Infinity

NG → **Adjust or replace throttle position sensor (See page FI-31).**

OK

Check and repair harness or connector between engine control module and throttle position sensor.

3 Disconnect A/C amplifier connector, check voltage between terminal ACT of A/C amplifier connector and body ground.



PREPARATION:
(a) Remove glove compartment.(See page FI-61)
(b) Disconnect A/C amplifier connector.
(c) Turn ignition switch ON.

CHECK:
Measure voltage between terminal ACT of A/C amplifier connector and body ground.

OK:
Voltage: 9 - 14 v

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

NG

CONTINUED

4	Check for open and short in harness and connector between engine ECU and A/C amplifier (See page IN–21).

NG → Repair or replace harness or connector.

OK

Check and replace engine ECU.

DI1HX-01

Starter Signal Circuit *

CIRCUIT DESCRIPTION

Refer to DTC43 (Starter Signal Circuit) on page DI-42.

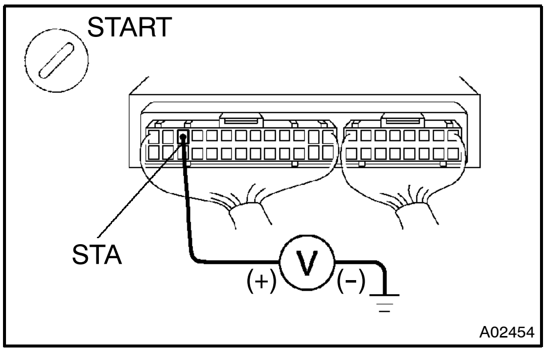
WIRING DIAGRAM

Refer to page DI-42 for the WIRING DIAGRAM.

INSPECTION PROCEDURE

HINT:
This diagnostic chart is based on the premise that the engine is being cranked under normal conditions. If the engine does not crank, proceed to the problem symptoms table on page DI-18.

1	Check the starter signal.



PREPARATION:
Remove the glove compartment. (See page FI-61)

CHECK:
Measure voltage between terminal STA of engine ECU connector and body ground during cranking.

OK:
Voltage: 6.0 V or more

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI-18).**

NG ↓

2	Check for open in harness and connector between engine ECU and starter relay (See page IN-21).

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

OK ↓

Check and replace engine ECU.

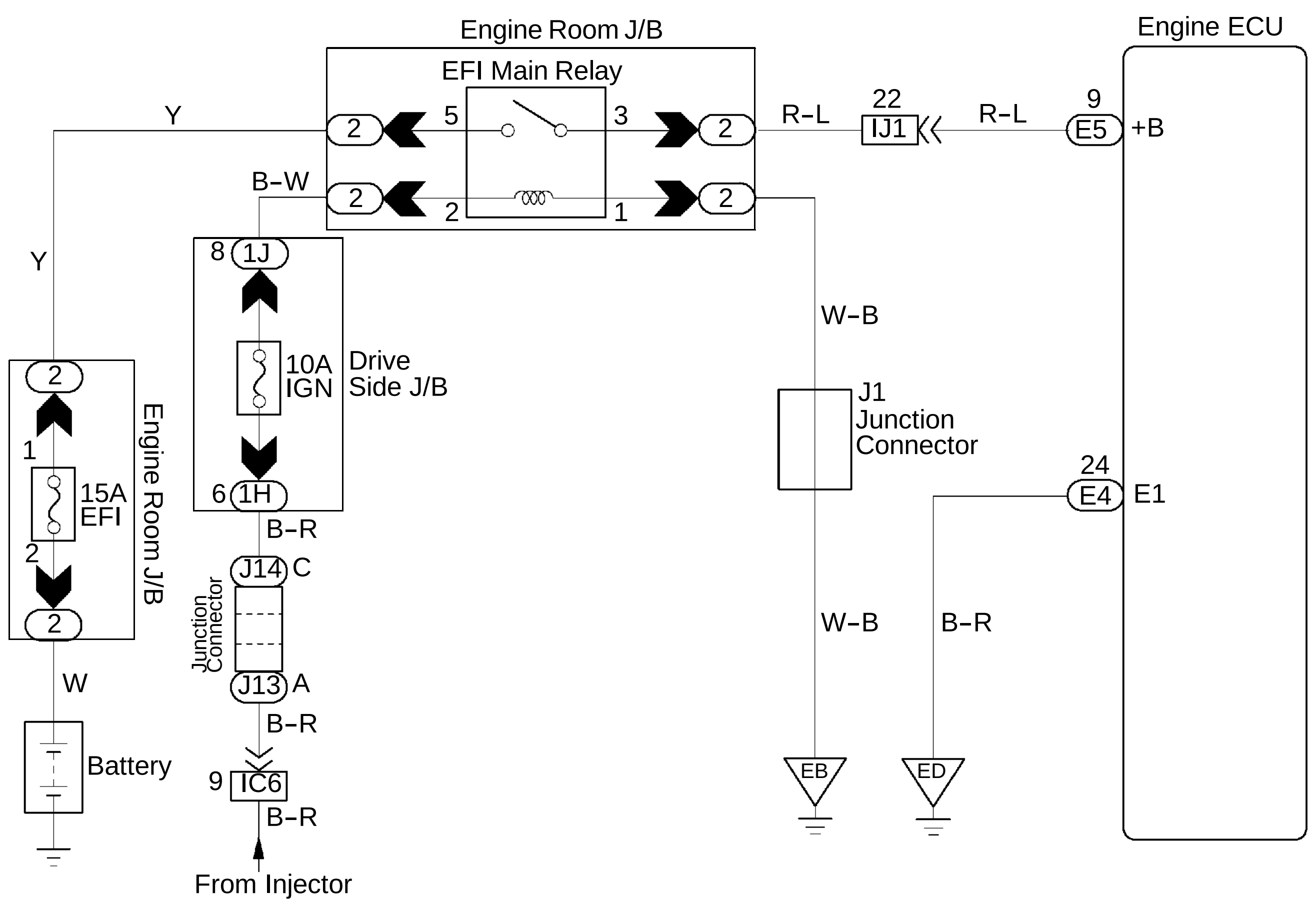
DI1HY-01

ECU Power Source Circuit

CIRCUIT DESCRIPTION

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

WIRING DIAGRAM



CONTINUED

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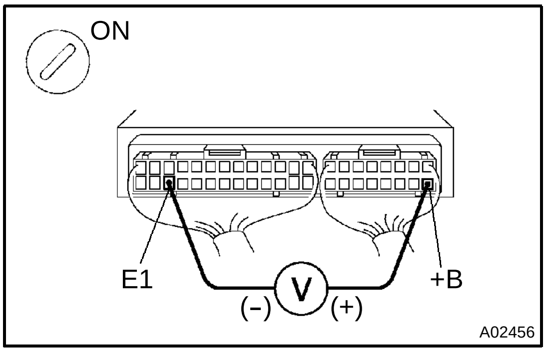
INSPECTION PROCEDURE

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



PREPARATION:

(a) Remove the glove compartment. (See page FI–61)

(b) Turn ignition switch ON.

CHECK:

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

OK:

Voltage: 9 – 14 V

OK → **Proceed to next circuit inspection shown on problem symptoms table** **(See page DI–18).**

NG

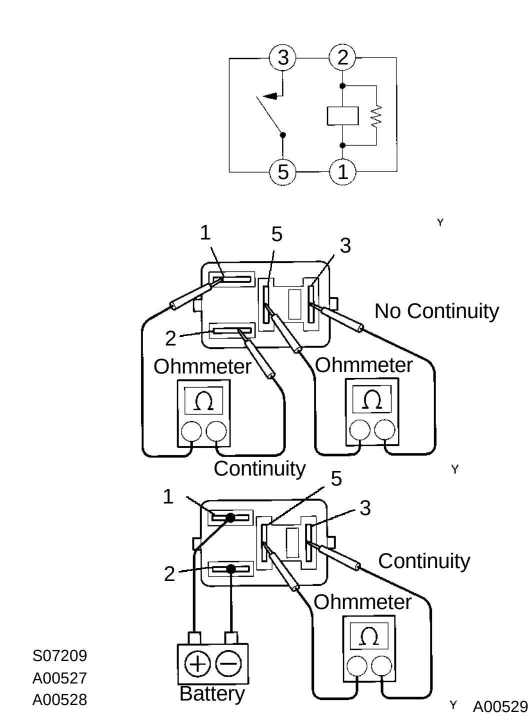
2	Check for open in harness and connector between terminal E1 of engine ECU and body ground (See page IN–21).

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

OK

CONTINUED

3 Check EFI main relay.



PREPARATION:
Remove EFI main relay from engine room J/B.

CHECK:
Check continuity between terminals EFI main relay shown below.

OK:

Terminals 3 and 5	Open
Terminals 1 and 2	Continuity

CHECK:
(a) Apply battery positive voltage between terminals 1 and 2.
(b) Check continuity between terminals 3 and 5.

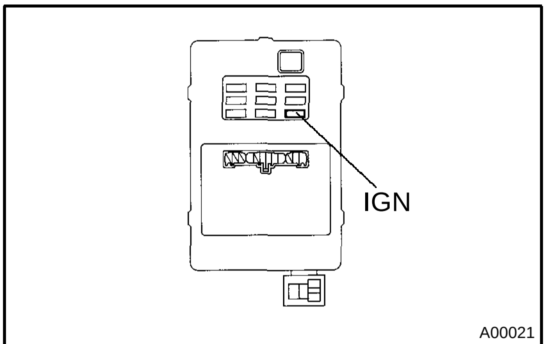
OK:

Terminals 3 and 5	Continuity

NG → **Replace EFI main relay.**

OK

4 Check IGN fuse.



PREPARATION:
Remove IGN fuse from drive side J/B.

CHECK:
Check continuity of IGN fuse.

OK:
Continuity

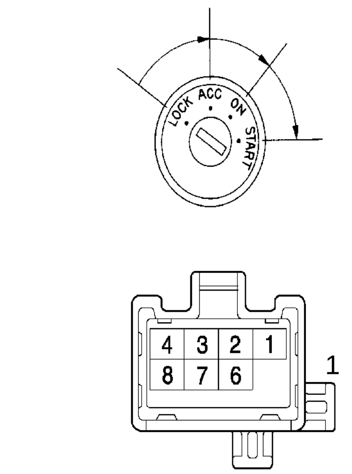
NG → **Check for short in all the harness and components connected to IGN fuse (See attached wiring diagram)**

OK

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

5	Check ignition switch.



BE3582
A02521
A03273

PREPARATION:

(a) Remove lower finish panel.

(b) Disconnect the ignition switch connector.

CHECK:

Check continuity between terminals shown below.

OK:

Switch Position	Terminal No. to continuity	
Lock	-	-
ACC	2-3	-
ON	2-3-4	6-7
START	1-2-4	6-7-8

NG → **Replace ignition switch.**

OK

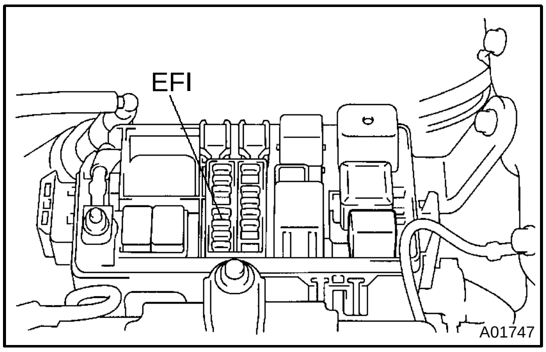
6	Check for open in harness and connector between IG switch and EFI main relay, EFI main relay and body ground (See page IN-21).

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

OK

CONTINUED

7	Check EFI fuse.



PREPARATION:
Remove EFI fuse from engine room J/B.

CHECK:
Check continuity of EFI fuse.

OK:
Continuity

NG → **Check for short in all the harness and components connected to EFI fuse (See attached wiring diagram).**

OK ↓

Check for open in harness and connector between main relay and battery, main relay and ECU.

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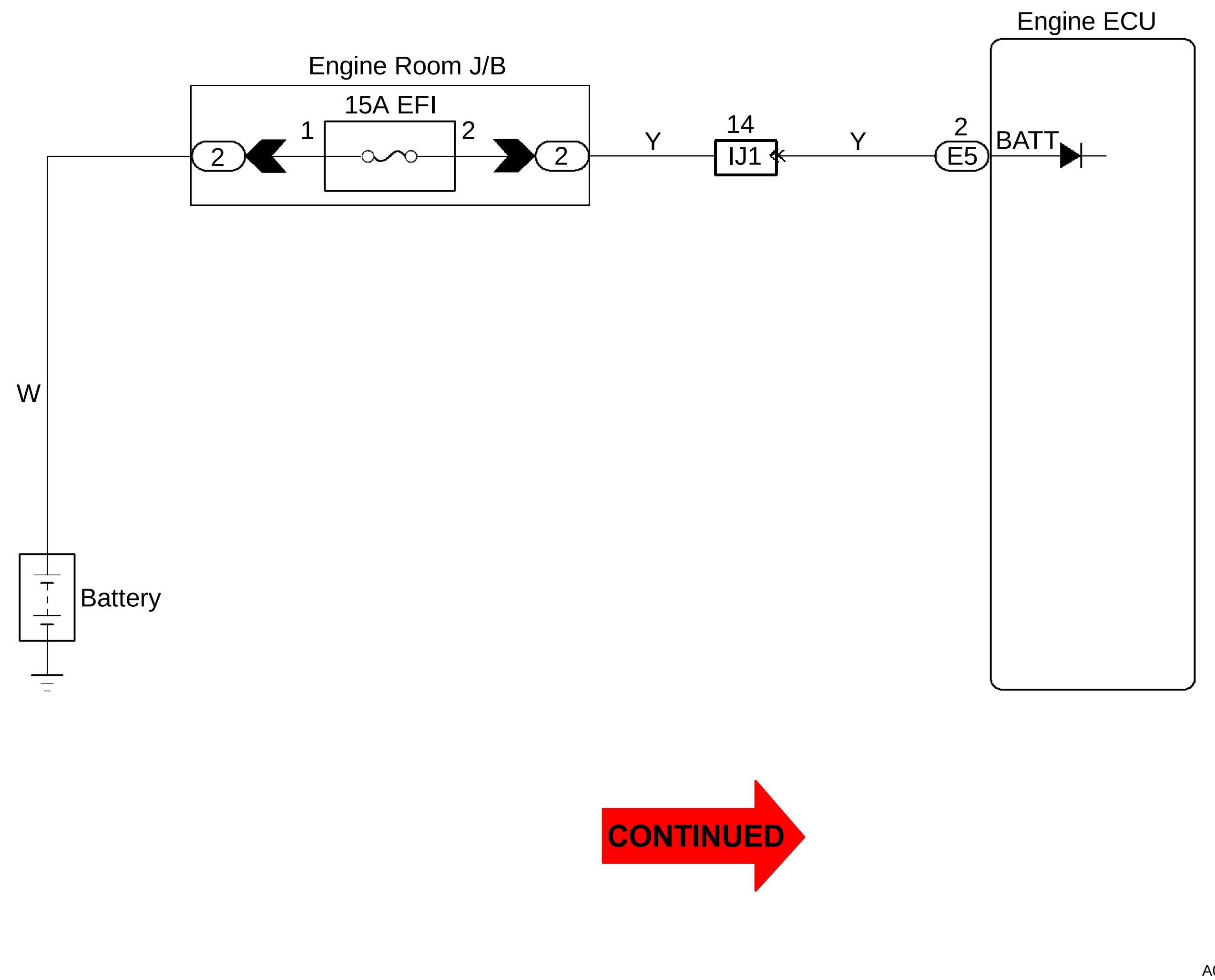
DI1HZ-01

Back Up Power Source Circuit

CIRCUIT DESCRIPTION

Battery positive voltage is supplied to terminal BATT of the ECU even when the ignition switch is OFF for use by the diagnostic trouble code memory, air-fuel ratio adaptive control value memory, etc.

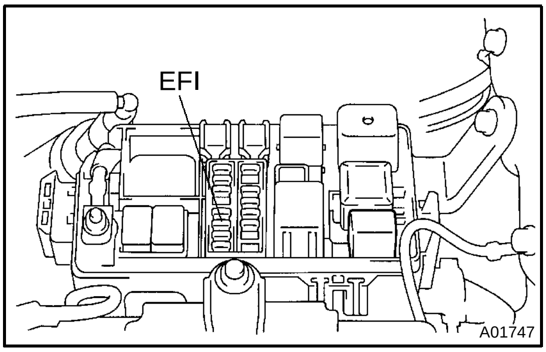
WIRING DIAGRAM



CONTINUED

INSPECTION PROCEDURE

1	Check EFI fuse.

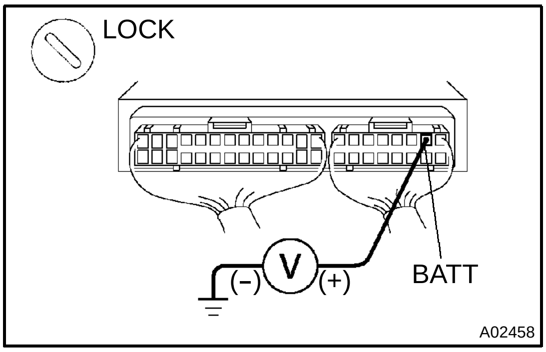


PREPARATION:
Remove EFI fuse from engine room J/B.
CHECK:
Check continuity of EFI fuse.
OK:
Continuity

NG → **Check for short in all the harness and components connected to EFI fuse (See attached wiring diagram).**

OK

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



PREPARATION:
Remove the glove compartment.(See page FI–61)
CHECK:
Measure voltage between terminal BATT of engine ECU connector and body ground.
OK:
Voltage: 9 – 14 V

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

OK

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

3	Are the diagnostic trouble codes still in the memory when the ignition switch is turned OFF?

NO → **Check and replace engine ECU.**

YES

Proceed to next circuit inspection shown on problem symptoms table
(See page DI–18).

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DI1I0-01

Injector Circuit

CIRCUIT DESCRIPTION

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

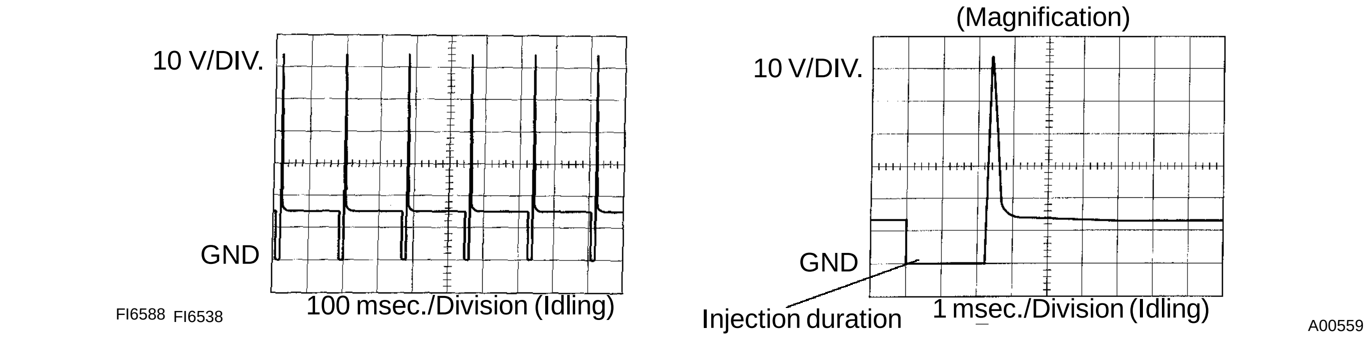
Reference: INSPECTION USING OSCILLOSCOPE

INJECTOR SIGNAL WAVEFORM

With the engine idling measure waveform between terminals #10, #20 and E01 of engine ECU.

HINT:

The correct waveforms are as shown.



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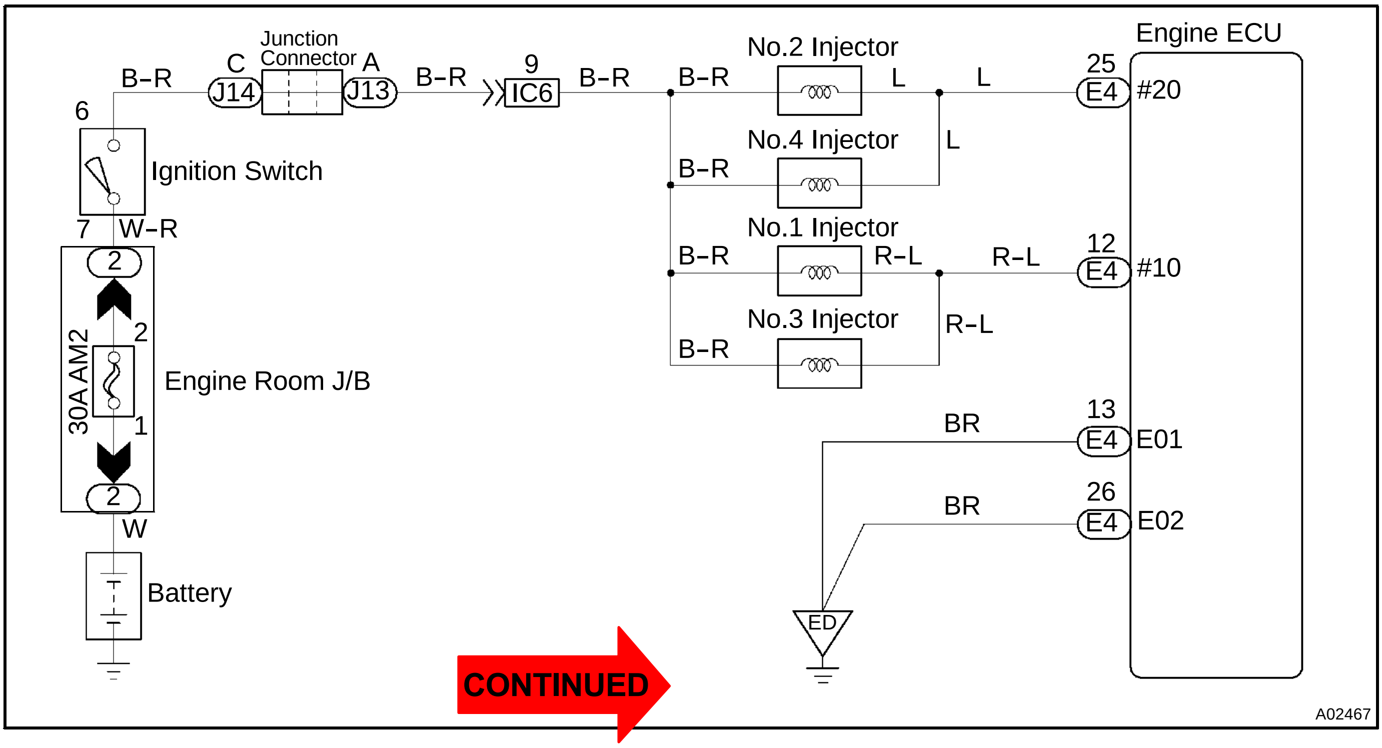
WIRING DIAGRAM



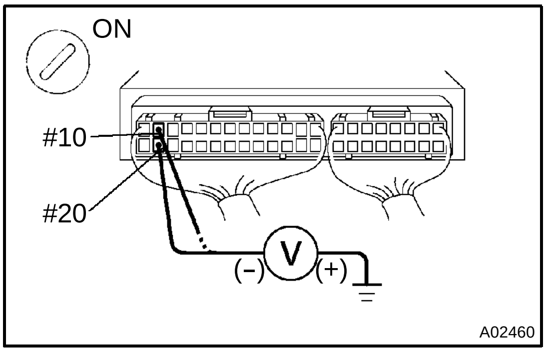
CONTINUED

A02467

CLICK HERE TO VIEW CHAPTER INDEX

INSPECTION PROCEDURE

1	Check voltage between terminals #10, #20 of engine ECU and body ground.



PREPARATION:
(a) Remove the glove compartment.(See page FI–61)
(b) Turn ignition switch ON.

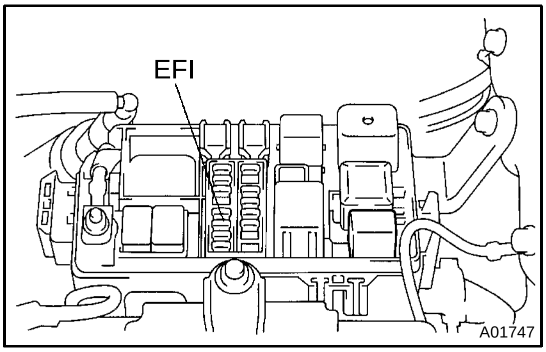
CHECK:
Measure voltage between terminals #10, #20 of engine ECU and body ground.

OK:
Voltage: 9 – 14 V

OK → **Go to step 3.**

NG

2	Check EFI fuse.



PREPARATION:
Remove EFI fuse from engine room J/B.

CHECK:
Check continuity of EFI fuse.

OK:
Continuity

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

OK

Check for open in harness and connector between engine ECU and battery.

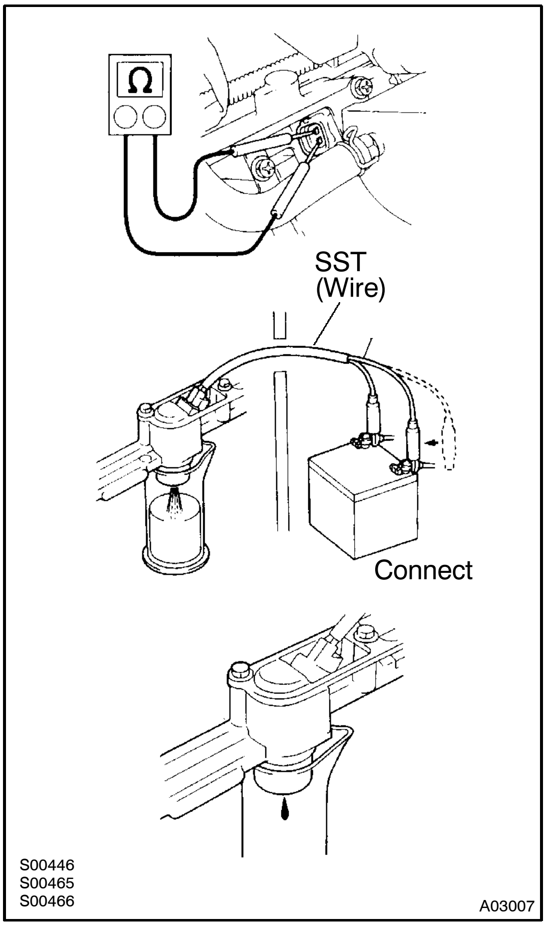
3	Check for open in harness and connector between terminals E01, E02 of engine ECU connector and body ground (See page IN–21).

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

OK

CONTINUED

4 Check injectors.



PREPARATION:

Disconnect injector connectors.

CHECK:

Measure resistance of injectors.

OK:

Resistance: At 20°C (68°F): 13.4 – 14.2 Ω

CHECK:

Check injection volume of injectors.

OK:

Injection volume:
44 – 54 cm^3 (3.3 – 3.4 cu in.)/15 sec.
Difference between each injector:
Less than 10 cm^3 (0.3 cu in.)
Leakage: 1 drop or less per 3 minutes

NG	**Replace injector(s).**

OK

Check and replace engine ECU.

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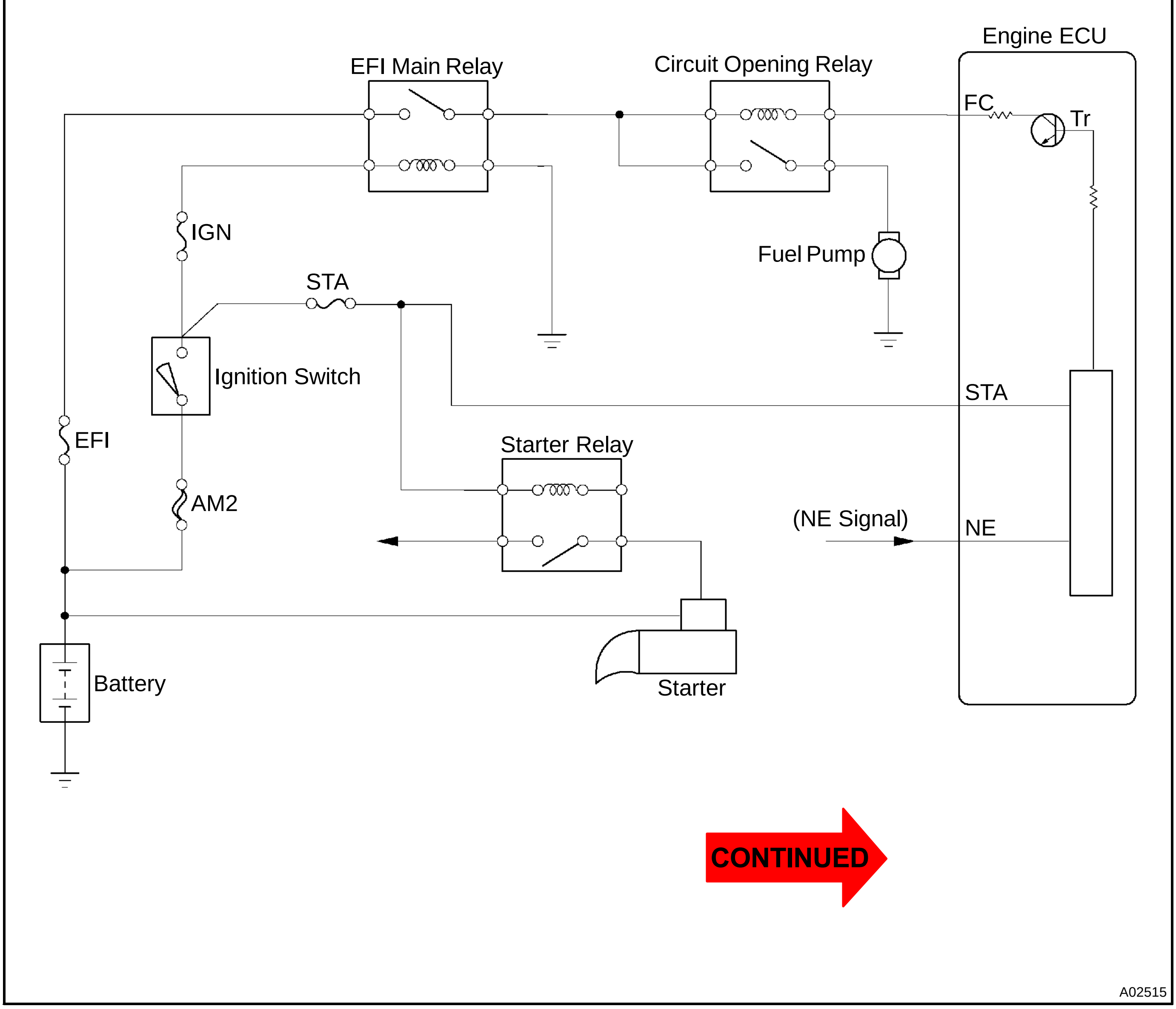
DI1I1-01

Fuel System Circuit

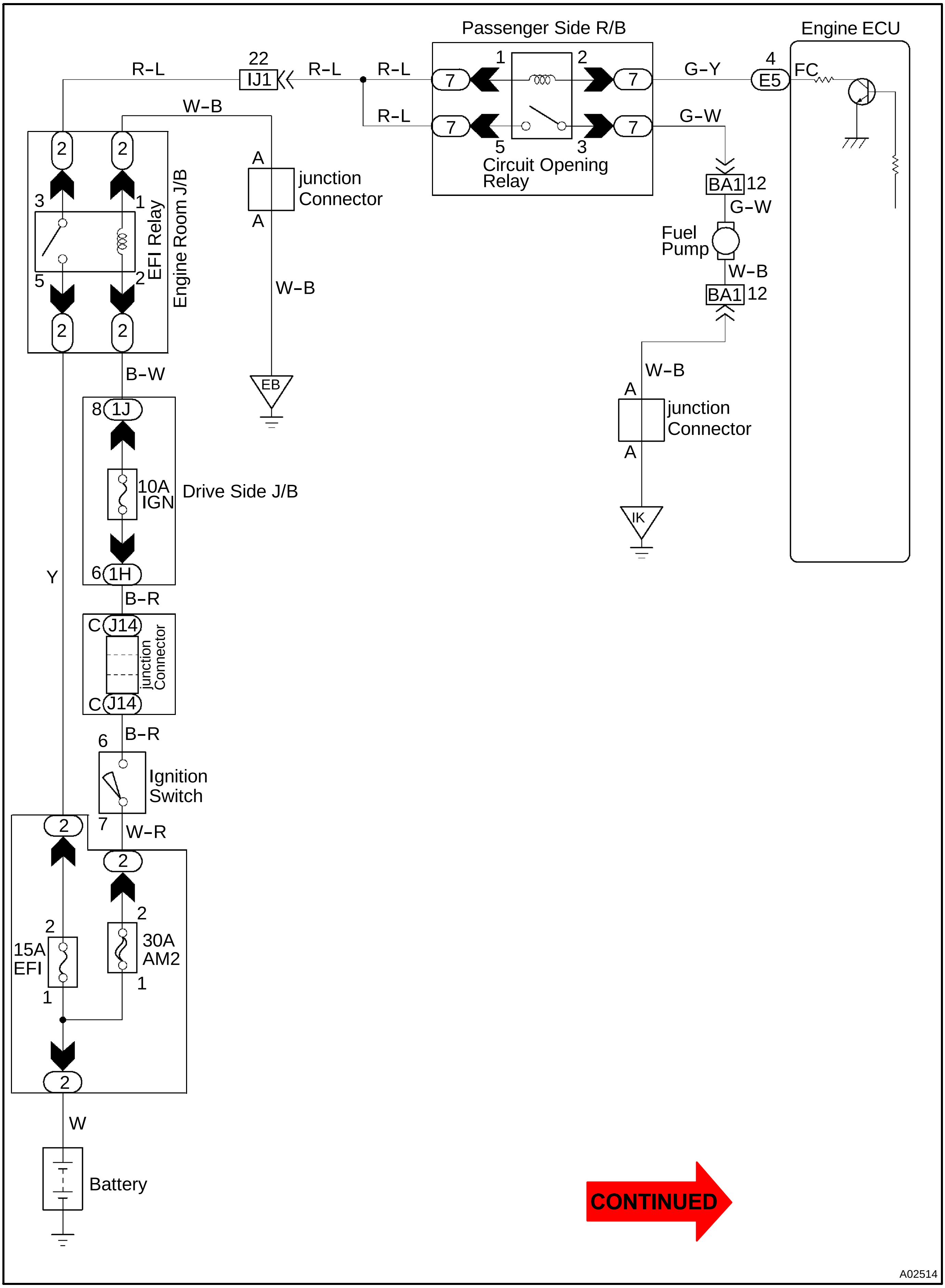
CIRCUIT DESCRIPTION

In the diagram below, when the engine is cranked, current flows from terminal ST of the ignition switch to the starter relay coil and also current flows to terminal STA of ECU (STA signal).
When the STA signal and NE signal are input to the ECU, Tr is turned ON, current flows to coil of the circuit opening relay, the relay switches on, power is supplied to the fuel pump and the fuel pump operates.
While the NE signal is generated (engine running), the ECU keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.



CONTINUED

WIRING DIAGRAM



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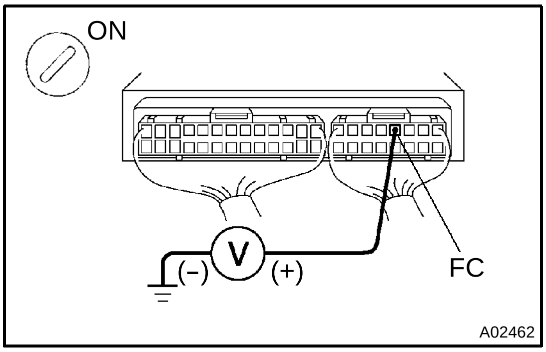
INSPECTION PROCEDURE

1	Check voltage terminal FC.



PREPARATION:
(a) Remove the glove compartment.(See page FI-61)
(b) Turn ignition switch ON.

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

OK:
Voltage: 9 - 14 V

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

NG

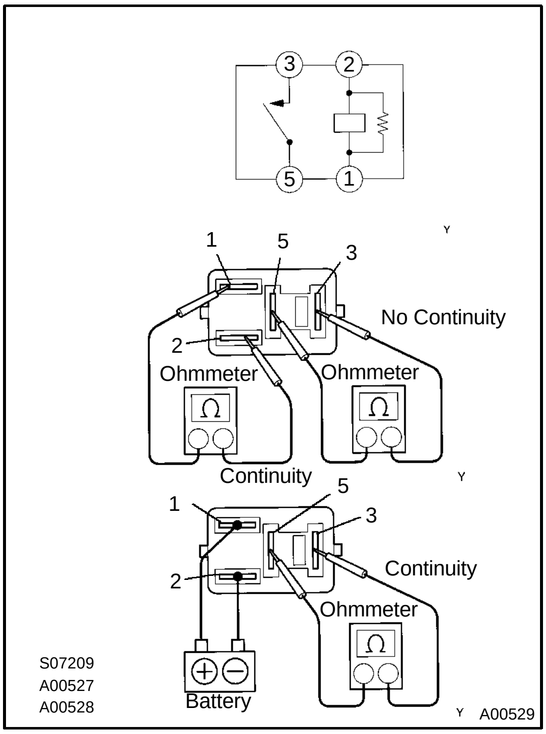
2	Check for ECU power source circuit (See page DI-49).

NG → **Repair or replace.**

OK

CONTINUED

3	Check circuit opening relay.



PREPARATION:

(a) Remove the driver's cowl side trim.

(b) Remove circuit opening relay.

CHECK:

Check continuity between terminals of circuit opening relay shown below.

OK:

Terminals 3 and 5	Open
Terminals 1 and 2	Continuity

CHECK:

(a) Apply battery positive voltage between terminals 1 and 2.

(b) Check continuity between terminals 3 and 5.

OK:

Terminals 3 and 5	Continuity

NG → **Replace circuit opening relay.**

OK ↓

4	Check for open in harness and connector between EFI main relay and circuit opening relay, circuit opening relay and engine ECU (See page IN-21).

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

OK ↓

5	Check fuel pump (See page FI-11)

NG → **Replace fuel pump.**

OK ↓

Check for open in harness and connector between circuit opening relay and fuel pump, fuel pump and body ground.

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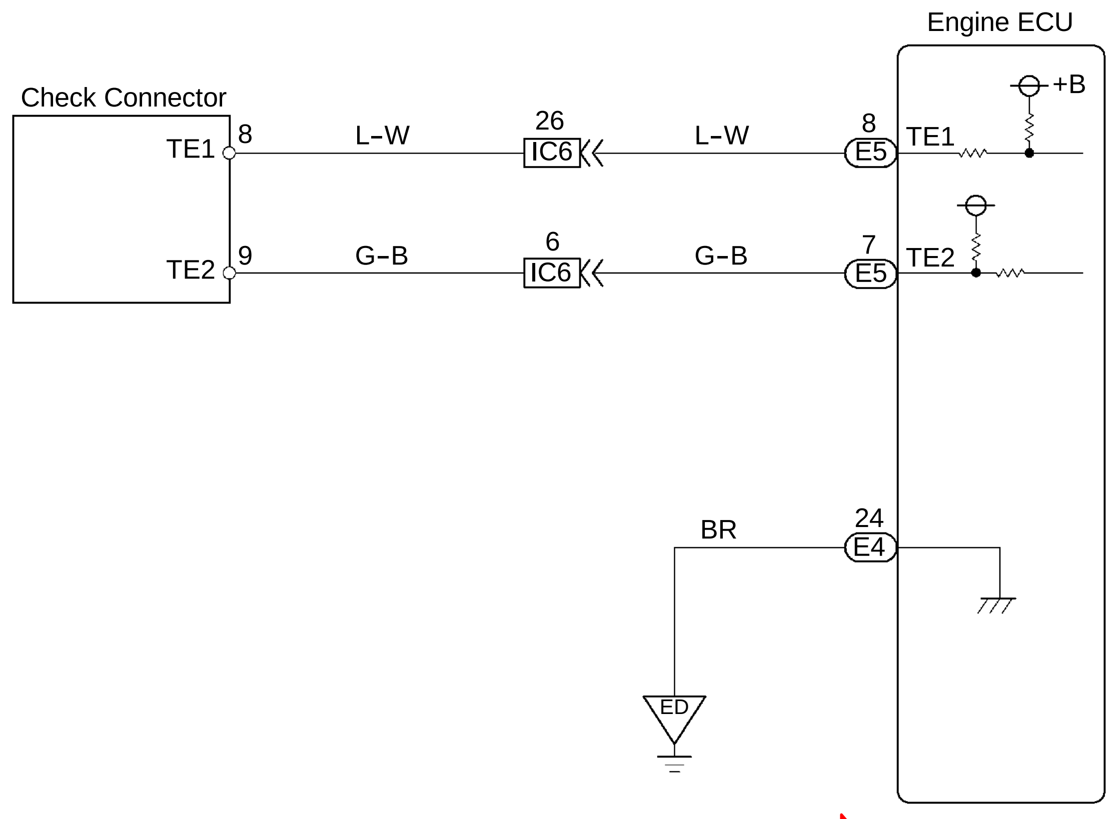
DI1I2-01

TE1, TE2 Terminal Circuit

CIRCUIT DESCRIPTION

Terminals TE1 and TE2 are located in the check connector.
The check connector is located in the engine compartment. When these terminals are connected with the E1 terminal, diagnostic trouble codes in normal mode or test mode can be read from the check engine warning light in the combination meter.

WIRING DIAGRAM



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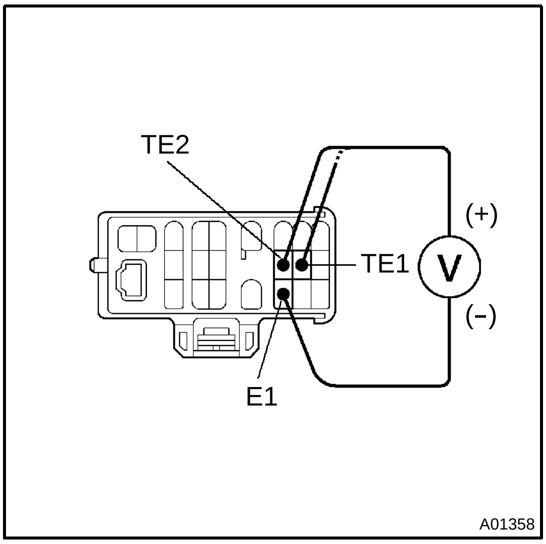
INSPECTION PROCEDURE

HINT:

- If terminals TE1 and TE2 are connected with terminal E1, diagnostic trouble code is not output or test mode is not activated.
- Even though terminal TE1 is not connected with terminal E1, the check engine warning light blinks.
- For the above phenomenon, the likely cause is an open or short in the wire harness, or malfunction inside the ECU.

1	**Check voltage between terminals TE1, TE2 and E1 of check connector.**



PREPARATION:

Turn ignition switch ON.

CHECK:

Measure voltage between terminal TE1, TE2 and E1 of check connector.

OK:

Voltage: 9 – 14 V

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

NG

2	**Check continuity between terminal E1 of check connector and body ground.**

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

OK

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

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3	Check for open and short in harness and connector between terminal TE1, TE2 of engine ECU and check connector (See page IN-21).

NG → Repair or replace harness or connector.

OK

Check and replace engine ECU.

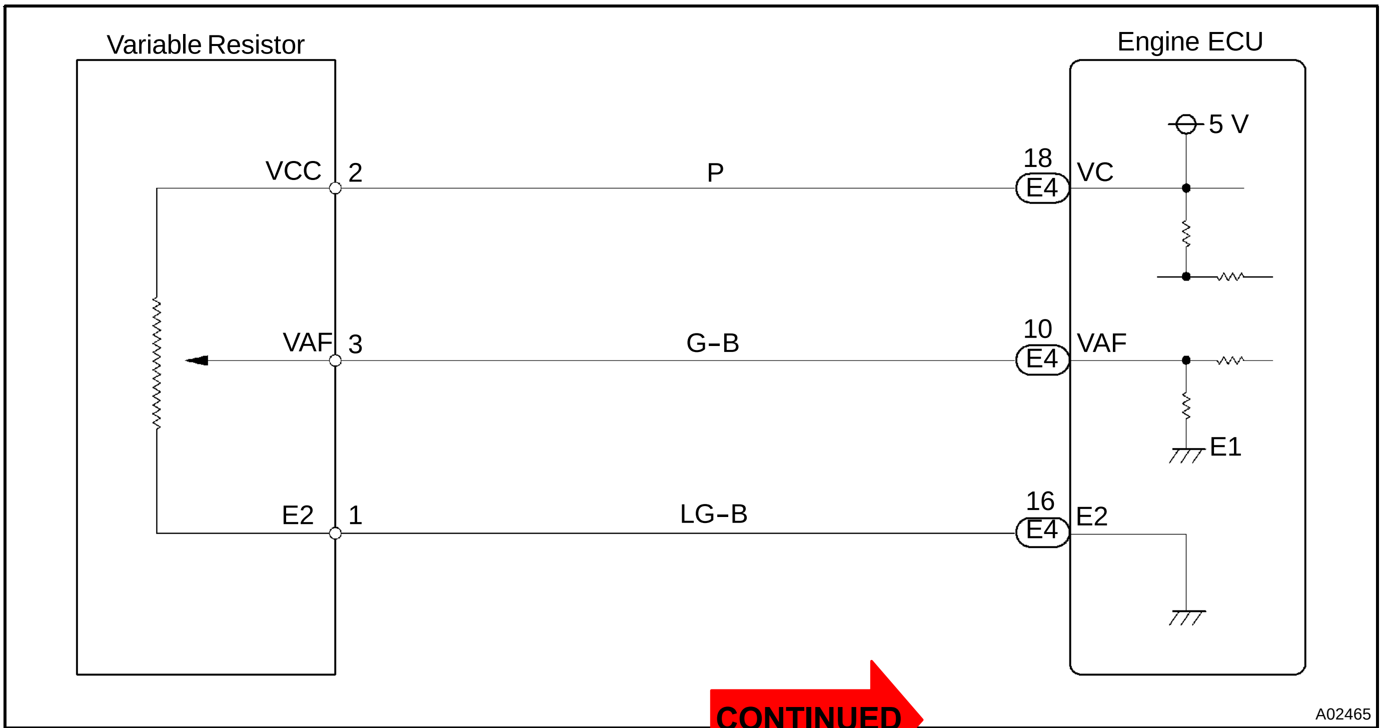
DI1I3-01

Variable Resistor Circuit.

CIRCUIT DESCRIPTION

This resistor is used to change the air-fuel ratio of the air-fuel mixture.
The idle mixture is adjusted using this resistor.
Turning the idle mixture adjusting screw clockwise moves the contacts inside the resistor, raising terminal VAF voltage. Conversely, turning the screw counterclockwise lowers the terminal VAF voltage.
When the terminal VAF voltage rises, the ECU increases the injection volume slightly, making the air-fuel mixture a little richer.

WIRING DIAGRAM



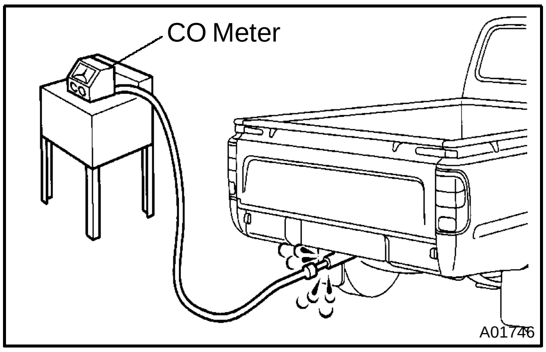
CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

INSPECTION PROCEDURE

NOTICE:
Always use a CO meter when adjusting the idle mixture. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.

1	Check CO concentration.



PREPARATION:
(a) Warm up engine to normal operating temperature.
(b) All accessories switched OFF.
(c) All vacuum lines properly connected.
(d) Transmission in "N" position.
(e) Connect the tachometer.
(f) Ignition timing check correctly.
(g) Idle speed check correctly.
(h) Check that the CO meter is properly calibrated.
(i) Race the engine at 2,500 rpm about 2 minutes.

CHECK:
Insert a tester probe at least 40 cm (1.3 ft) into the tailpipe.
Measure the concentration with 1 – 3 minutes after racing the engine to allow the the concentration to stabilize.

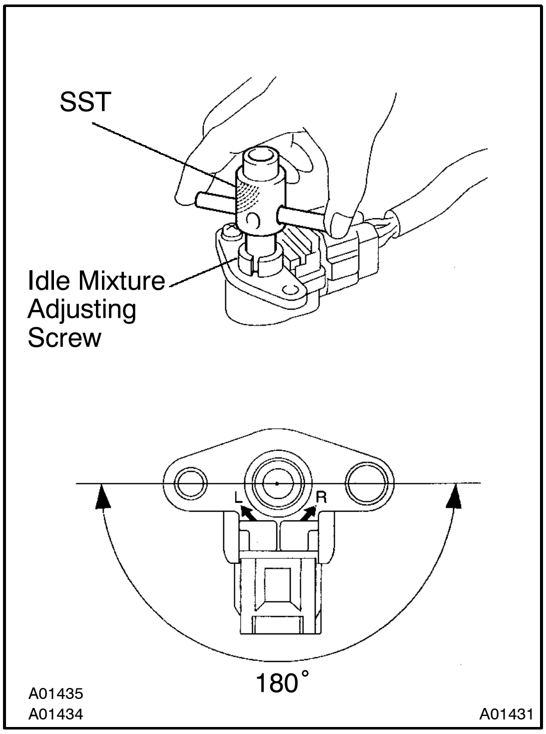
OK:
Idle CO concentration: 1.5 ± 0.5 %

OK → **CO concentration is normal. Proceed to next circuit inspection shown problem symptom tables** **(See page DI-18).**

NG

CONTINUED

2	Adjust CO concentration.



PREPARATION:

Same condition as step 1 of this chart.

CHECK:

Using SST, adjust the mixture by turning the idle mixture adjusting screw in the variable resistor.

SST 09243-00020

RESULT:

OK	CO concentration: 1.5 ± 0.5 %
NG type I	Change in CO concentration
NG type II	No change in CO concentration

HINT:

Always check idle speed after turning the idle mixture adjusting screw. If it is incorrect, readjust idle speed.

Adjustable range of the idle mixture adjust to turn this screw is 180 degrees. Do not turn this screw more than it.

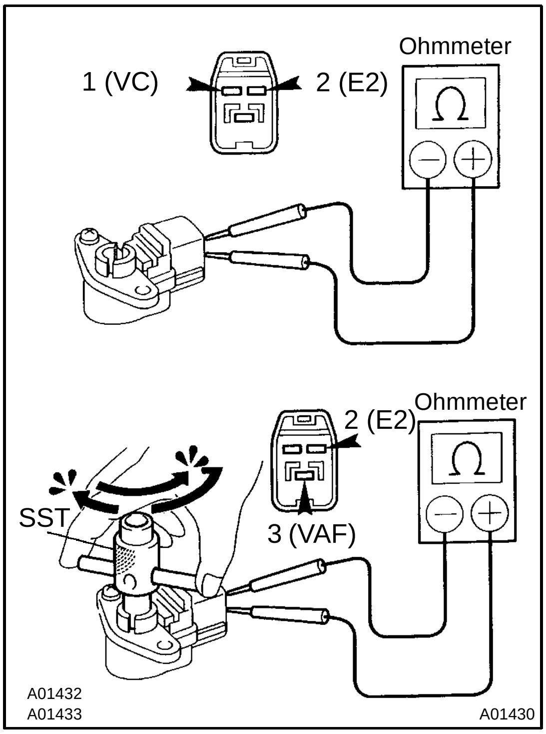
Type I	See step EM-3 and go on troubleshooting.
Type II	Go to step 3.

OK

Adjustment is complete.

CONTINUED

3	Check resistance of variable resistor.



Check Resistance Between 1 and 2:

PREPARATION:

Disconnect the variable resistor connector.

CHECK:

Measure resistance between terminals 1 and 2 of the variable resistor.

OK:

Resistance: 4 – 6 kΩ

Check Resistance Between 2 and 3:

CHECK:

Measure resistance between terminals 2 and 3 when turning the idle mixture adjusting screw fully clockwise and counter-clockwise using SST.

SST 09243 – 00020

OK:

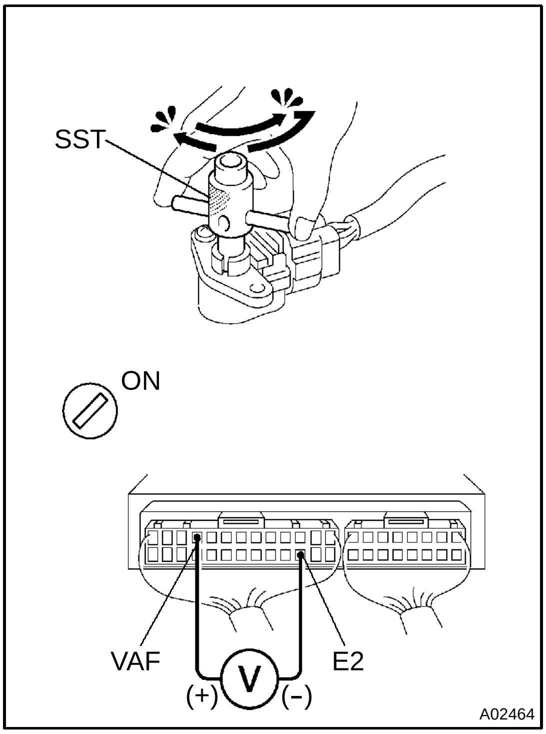
Resistance: Change from about 5 kΩ to 0 kΩ accordingly

NG	Replace variable resister.

OK

CONTINUED

4	Check voltage between terminals VAF and E2 of engine ECU connector.



PREPARATION:

(a) Reconnect the variable resistor connector.

(b) Remove the glove compartment.(See page FI–61)

(c) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals VAF and E2 of engine ECU connector while slowly turning the idle mixture adjusting screw first fully counterclockwise, and then fully clockwise, using SST.

SST 09243 – 00020

OK:

Voltage changes smoothly from 0 V to about 5 V; i.e., does not suddenly jump up to 5 V or down to 0 V.

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

NG ↓

5	Check for open and short in harness and connector between variable resistor and engine ECU (See page IN–21).

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

OK ↓

Check and replace engine ECU.

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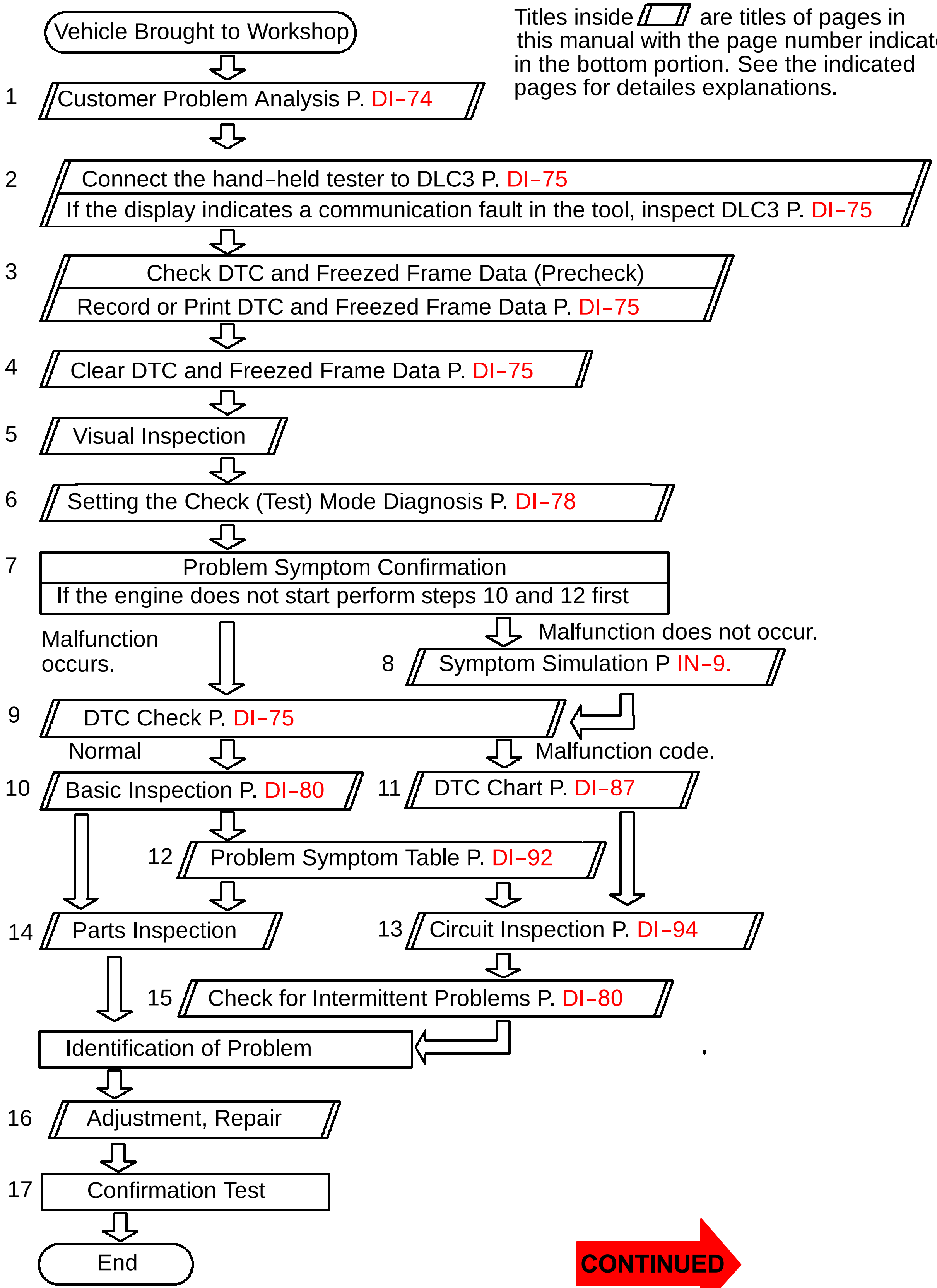
ENGINE (2RZ-FE, 3RZ-FE)

HOW TO PROCEED WITH TROUBLESHOOTING

DI1I4-01

When using hand-held tester, troubleshooting in accordance with the procedure on the following page.

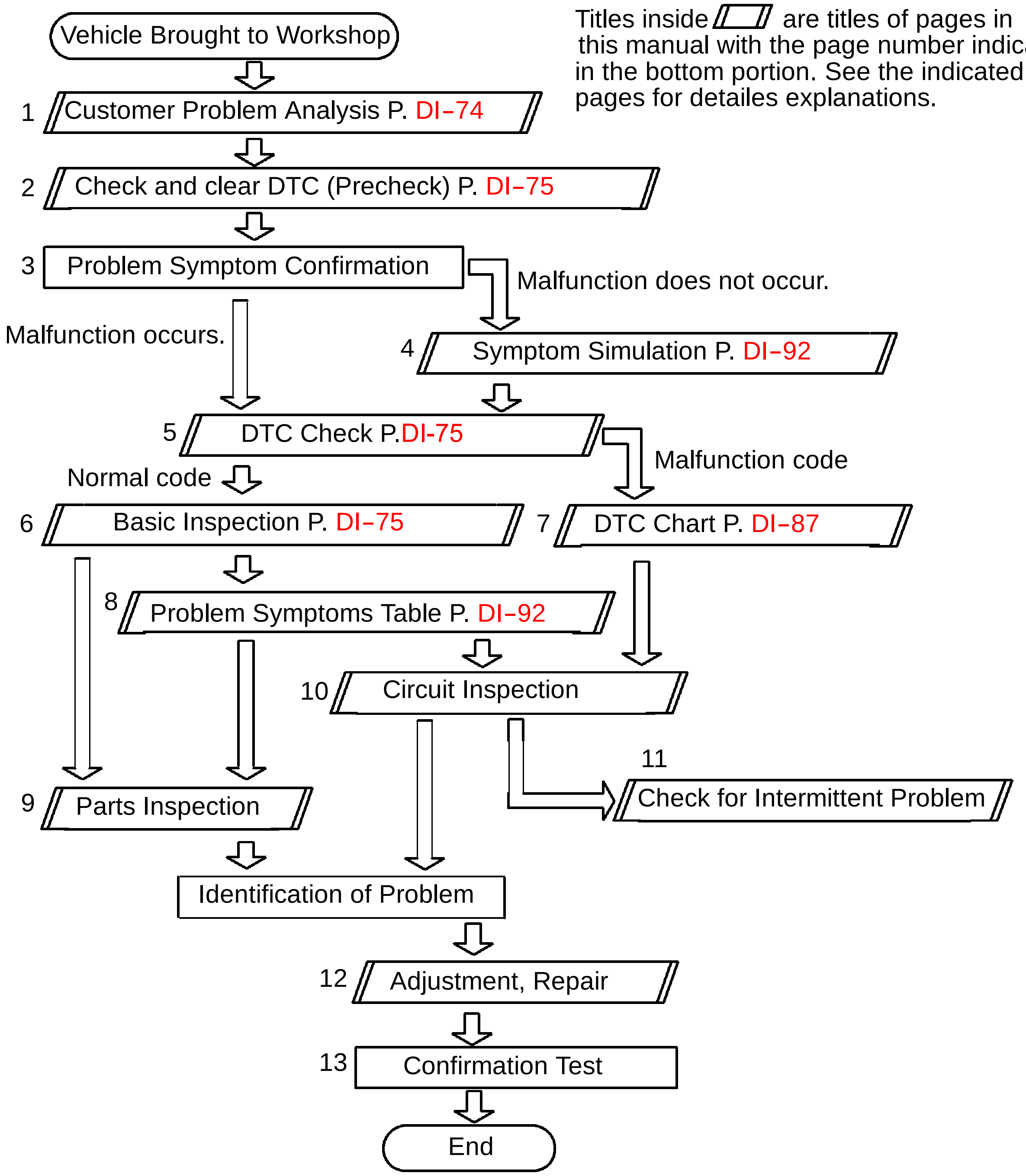
Titles inside ▱ are titles of pages in this manual with the page number indicated in the bottom portion. See the indicated pages for detailes explanations.



CONTINUED

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

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



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DI1I5-01

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

Inspector's Name ____________________

Customer's Name		Model and Model Year	
Driver's Name		Frame No.	
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 Driveaability	☐ 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	

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

Condition of check engine warning light (CHK ENG)		☐ Remains on ☐ Sometimes light up ☐ Does not light up
DTC Inspection	Normal mode (Precheck)	☐ Normal ☐ Malfunction code(s) (code) ☐ Freezed frame data ( )
	Check Mode	☐ Normal ☐ Malfunction code(s) (code) ☐ Freezed frame data ( )

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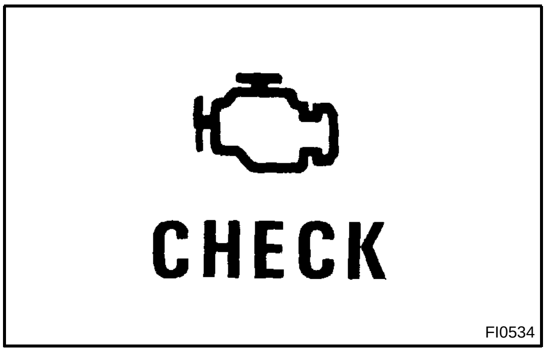


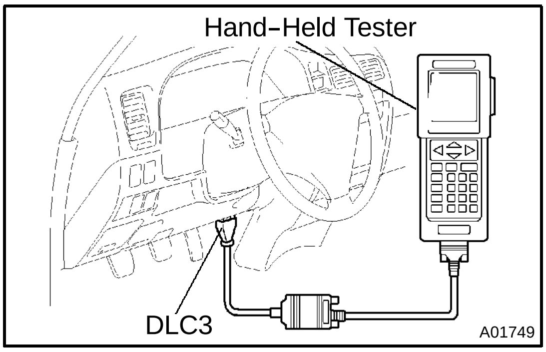
FI0534

PRE-CHECK

1. DIAGNOSIS SYSTEM

(a) Description

- When troubleshooting Multiplex OBD (M-OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the hand-held tester to the vehicle, and read off various data output from the vehicle's ECU.
- The vehicle's on-board computer lights up the check engine warning light (CHK ENG) on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition to the check engine warning light lighting up when a malfunction is detected, the applicable Diagnosis Trouble Code (DTC) are recorded in the ECU memory.
  (See page DI-87)
  If the malfunction has been repaired, the check engine warning light goes off automatially but the DTCs remain recorded in the ECU memory.



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- To check the DTCs, connect the hand-held tester to Data Link Connector 3 (DLC3) on the vehicle. or read the number of blinks of the check engine warning light when TC and CG terminals on the DLC3 are connected. The hand-held tester also enables you to erase the DTCs and activate the several actuaters and check freezed frame data and vaious forms of engine data (For operating instructions, see the hand-held tester instruction book.)
- The diagnosis system operates in normal mode during normal vehicle use. It also has a check (test) mode for technicans to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic to prevent erroneous detection and ensure thorough malfunction detection. By switching the ECU to check (test) mode using hand-held tester when troubleshooting, the techinician can cause the check engine warning (CHK ENG) to light up for a malfunction that is only detected once or momentarily. (Hand-held tester only)
  (See step 3.)

CONTINUED

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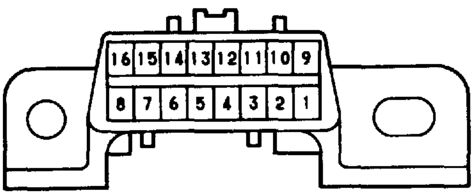
- * 2 trip detection logic
  When a logic malfunction is fist detected, the malfunction is temporaily stored in the ECU memory. If the same malfunction is detected again during the second drive test, this second detection cases the check engine warning (CHK ENG) to light up.
  The 2 trip repeats the same mode for 2 times. (However, the IG switch must be turned OFF between the 1st trip and 2nd trip)
- Freeze frame data:
  Freeze frame data records the engine condition when malfunction is detected.
  Because freeze frame data records the engine conditions (fuel system, calculator load, water temperature, fuel trim, engine speed, vehicle speed, etc.) when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.



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

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

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

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

CONTINUED

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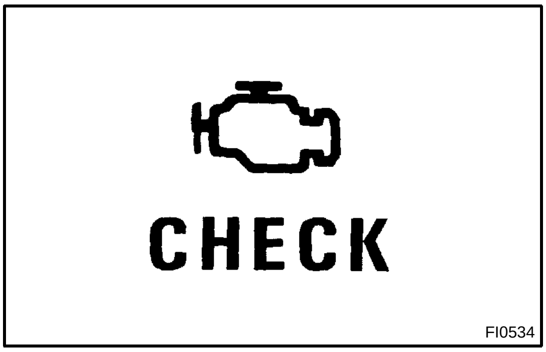
- If communication is still not possible is when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service deparment listed in the tool,s instruction manual.



FI0534

2. INSPECT DIAGNOSIS (Normal Mode)

(a) Check the check engine warning light.

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

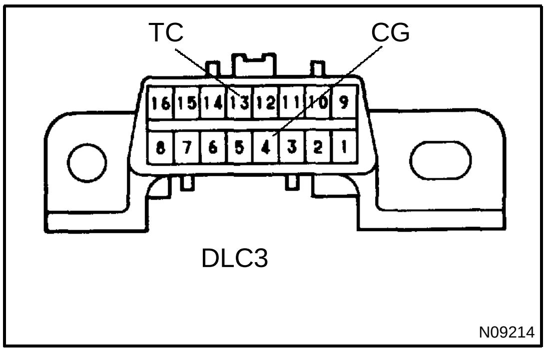
HINT:
If the check engine warning (CHK ENG) does not light up, troubleshoot the combination meter.

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

(b) Check the DTC, using hand-held tester.

NOTICE:
(Hand-held tester only): When the diagnosis system is switched from normal mode to check (test) mode, it erases all DTCs and freezed frame data recorded in normal mode. So before switching modes, always check the DTCs and freezed frame data, and note them down.

(1) Prepare the hand-held tester.
(2) Connect the hand-held tester to DLC3.
(3) Turn the ignition switch ON and switch the hand-held tester main switch ON.
(4) Use the hand-held tester to check the DTCs and freezed frame data; note them down. (For operating instructions, see the hand-held tester,s instruction book.)
(5) See page DI-75 to confirm the details of the DTCs.



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(c) If you have no hand-held tester, perform the following step (1) to (6).

(1) Turn the ignition switch ON.
(2) Using SST, connect between terminals 13 (TC) and 4 (CG) of DLC3.

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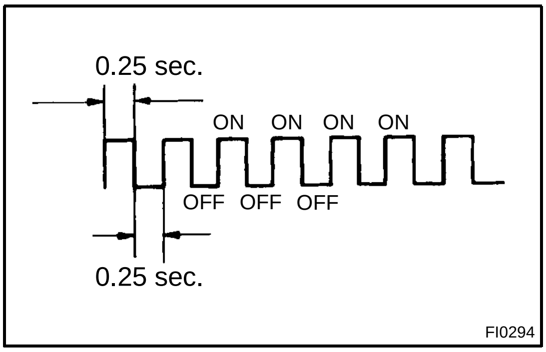
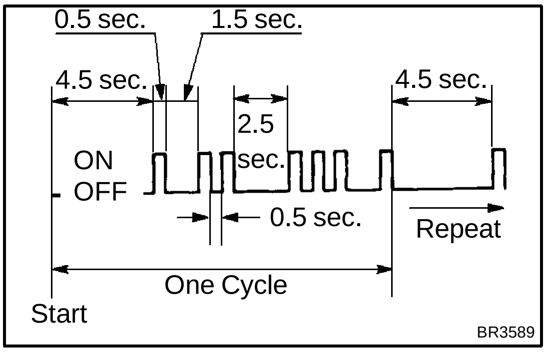


(3) Read the DTC from the check engine warning light (CHK ENG).



(4) As an example, the blinking patterns for codes, normal, 12 and 31 are as shown on the illustration.
(5) Check the details of the malfunction using the DTC chart on page.
(6) After completing the check, disconnect terminals 13 (TC) and 4 (CG) and turn off the display.

HINT:
In the event of 2 or more malfunction cords, indication will begin from the smaller numbered cord and continue in order to the larger.

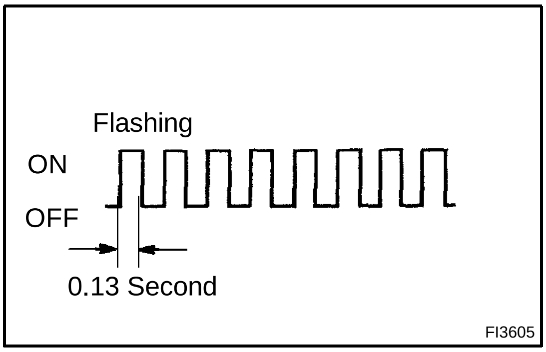
NOTICE:
When simulatiing symptoms without a hand-held tester to check the DTCs, use normal mode. For codes on the DTCs, chart subject to ”2 trip detection logic”, turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again. When the problem has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

3. INSPECT DIAGNOSIS (Check (Test) Mode)

Hand-held tester only:
Compared to the normal mode, the check mode has an increased sensitivity to detect malfunctions.
Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check (test) mode.
(a) Check the DTC.
(1) Initial conditions
- Battery positive voltage 11V or more.
- Throttle valve fully closed.
- Transmission in ”P” or ”N” position.
- Air conditioning switched OFF.

(2) Turn ignition switch OFF.
(3) Prepare the hand-held tester.
(4) Connect the hand-held tester to DLC3 on the at the lower left of the instrument panel.
(5) Turn the ignition switch ON and switch the push the hand-held tester ON.

CONTINUED



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

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

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

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

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

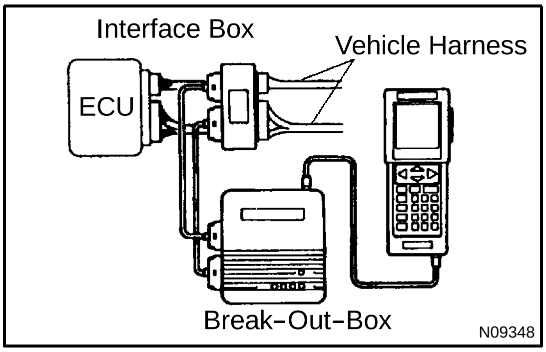
HINT:
Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check (test) mode to normal mode. so all DTCs, etc. are erased.

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

(b) Clear the DTC.
The following actions will erase the DTCs and freezed frame data.

- Operating the hand-held tester to erase the codes. (See the hand-held tester's instruction book for operating in structions.)
- Disconnecting the battery terminals or EFI fuse.

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



(c) Using break-out-box and hand-held tester

(1) Hook up the break-out-box and hand-held tester to the vehicle.

(2) Read the ECU input/output values following the prompts on the tester screen.

HINT:
Hand-held tester has a "Snapshot" function. This records the measured values and is effective in the diagnosis of intermittent problems.
Please refer to the hand-held tester/break-out-box operator,s manual for further details.

CONTINUED

4. FAIL-SAFE CHART

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

DTC No.	Fail-Safe Operation	Fail-Safe Deactivation Conditions
P0100/31	• Ignition timing fixed at 5° BTDC • Injection time fixed Starting - - - - - - - -11.6 msec. CTP switch ON - - - - 3.2 msec. CTP switch OFF - - - - 6.0 msec.	Returned to normal condition
P0110/24	Intake air temp. is fixed at 20°C (68°F)	Returned to normal condition
P0115/22	Water temp. is fixed at 80°(176°F)	Returned to normal condition
P0120/41	VTA is fixed at 0°	The following condition must be repeated at least 2 times consecutively When closed throttle position switch is ON: 0.1 V ≦ VTA and 0.95 V
P0500/42	High RPM for cut is prohibited ISC control prohibited	Returned to normal condition
P1300/14,15 P1310/14,15	Fuel cut	Returned to normal condition

5. CHECK FOR INTERMITTENT PROBLEMS

HAND-HELD TESTER only:

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

(1) Clear the DTC (See step 3.).
(2) Set the check (test) mode (See step 3.).
(3) Perform a simulation test (See page IN-9).
(4) Check the connector and terminal (See page IN-21).
(5) Check the visual check and contact pressure (See page IN-22).
(6) Handle the connector (See page IN-21).

6. BASIC INSPECTION

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

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

NO → **Charge or replace battery.**

CONTINUED

YES

CLICK HERE TO VIEW CHAPTER INDEX

2	Is engine cranked ?

NO → Proceed to page ST-5, ST-15 and continue to troubleshoot.

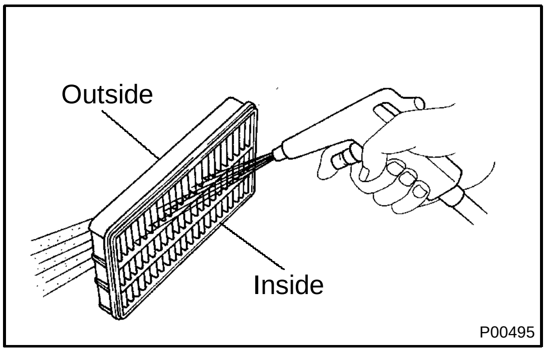
YES

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 excessively dirty or oily.
HINT:
If necessary, clean the filter with compressed air. First blow from inside thoroughly, then blow from outside of filter.

NG → Repair or replace

OK

CONTINUED

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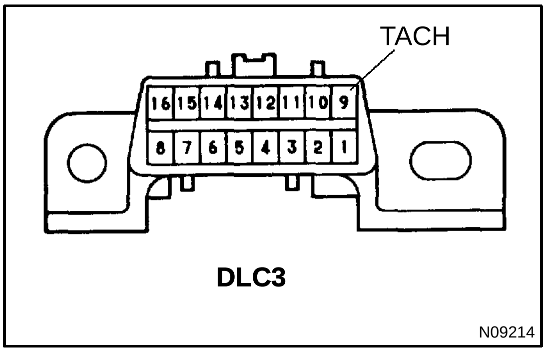
5	**Check engine idle speed.**



PREPARATION:

(a) Warm up engine to normal operating temperature.
(b) Switch off all accessories.
(c) Switch off air conditioning.
(d) Shift transmission into the "N" position.
(e) Connect the hand-held tester to DLC3 on the vehicle.
(f) If you have no hand-held tester, connect tachometer test prove to terminal 9 (TACH) of DLC3.
SST 09843-18020

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

CHECK:

Check the idle speed.

OK:

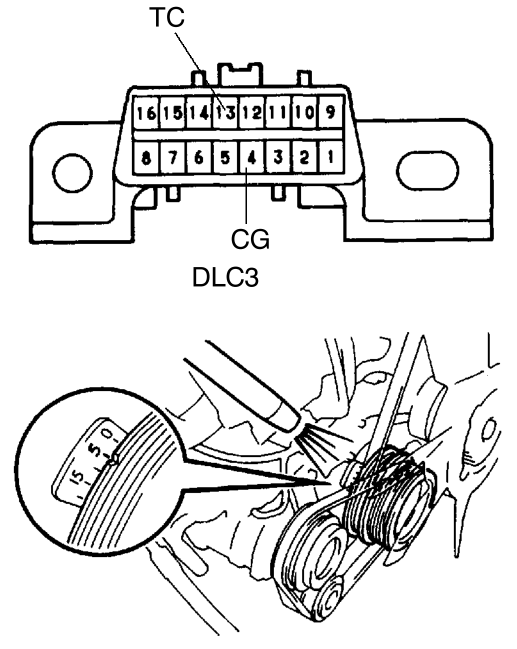
Idle speed: 650 ~ 750 rpm

NG	**Proceed to problem symptoms table on page DI-92.**

OK

CONTINUED

6	Check ignition timing.



N09214
P15946
A02311

PREPARATION:

(a) Warm up engine to normal operating temperature.
(b) Switch off all accessories.
(c) Switch off air conditioning
(d) Shift transmission into the "N" position.
(e) Using SST, connect terminals 13 (TC) and 4 (CG) of DLC3.
SST 09843-18020
(f) Using a timing light, connect the tester to No.1 high-tension cord.

CHECK:

Check ignition timing.

OK:

Ignition timing: 5° BTDC at idle

NG → **Proceed to page IG-1 and continue to troubleshoot.**

OK ↓

Proceed to problem symptoms table on page DI-92.

CONTINUED

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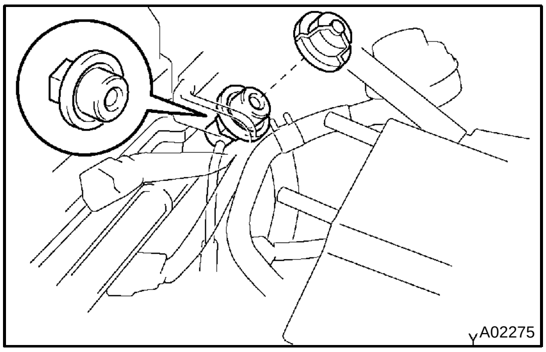
7	Check fuel pressure.



PREPARATION:

(a) Be sure that enough fuel is in the tank.
(b) Turn the ignition switch ON.
(c) Connect the hand-held tester to the DLC3.
(d) Use ACTIVE TEST mode to operate the fuel pump.
(e) If you have no hand-held tester, connect the positive (+) and negative (-) leads from the battery to the fuel pump connector (See page FI-6).

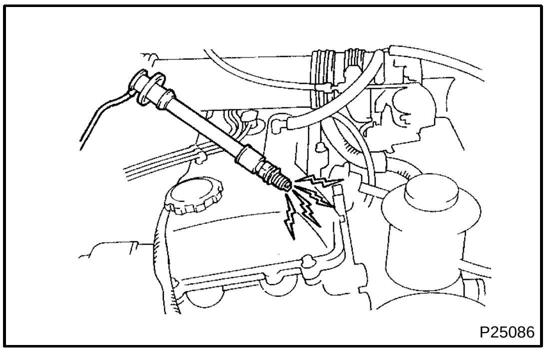
CHECK:

Check that the pulsation damper screw rises up when the fuel pump operates.

NG	Proceed to page FI-6 and continue to troubleshoot.

OK

8	Check for spark.



PREPARATION:

(a) Remove ignition coil.
(b) Remove the spark plug.
(c) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(d) Hold the end about 12.5 mm (0.5 in.) from the ground.
(e) Disconnect the injector connector.

CHECK:

Check if spark occurs while engine is being cranked.

NOTICE:

To prevent excess fuel being injected from the injectors during this test, don't crank the engine for more than 5 ~ 10 seconds at a time.

NG	Proceed to page IG-1 and continue to trouble-shoot.

OK

Proceed to problem symptoms table on page DI-92.

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

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 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 *1	Fuel System Bank 1 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: 15.3 ~ 22.4% Racing without load (2,500rpm): 14.0 ~ 20.2%
WATER 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%
LONG FT #1	Long-term Fuel Trim Bank 1	0 ± 20%
ENGINE SPD	Engine Speed	Idling: 650 ~ 750 rpm
VEHICLE SPD	Vehicle Speed	Vehicle Stopped: 0 km/h (0 mph)
IGN ADVANCE	Ignition Advance: Ignition Timing of Cylinder No. 1	Idling: BTDC 7 ~ 13°
INTAKE AIR	Intake Air Temp. Sensor Value	Equivalent to Ambient Temp.
AIR FLOW	Air Flow Rate Through Mass Air Flow Meter	Idling: 2.7 ~ 3.8 gm/sec. Racing without load (2,500 rpm): 9.2 ~ 13.3 gm/sec.
THROTTLE POS	Voltage Output of Throttle Position Sensor Calculated as a percentage: 0 V → 0%, 5 V → 100%	Throttle Fully Closed: 7 ~ 11% Throttle Fully Open: 65 ~ 75%
O2S B1, S1 *1	Voltage Output of Oxygen Sensor Bank 1, Sensor 1	Idling: 0.1 ~ 0.9 V
O2FT B1, S1 *1	Oxygen Sensor Fuel Trim Bank 1, Sensor 1 (Same as SHORT FT #1)	0 ± 20%
O2S B1, S2 *1	Voltage Output of Oxygen Sensor Bank 1, Sensor 2	Driving (50 km/h, 31 mph): 0.1 ~ 0.9 V

*: 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.

*1 2RZ-FE:

CONTINUED

Hand-held tester display	Measurement Item	Normal Condition*
INJECTOR	Fuel injection time for cylinder No.1	Idling: 2.5 ~ 4.3 ms
ISC DUTY RATIO	Intake Air Control Valve Duty Ratio Opening ratio rotary solenoid type IAC valve	Idling: 24.8 ~ 50.0%
STARTER SIG	Starter Signal	Cranking: ON
CTP SW	Closed Throttle Position Switch Signal	Throttle Fully Closed: ON
A/C SIG	A/C Switch Signal	A/C ON: ON
STOP LIGHT SW	Stop Light Switch Signal	Stop light switch ON: ON
FC IDL	Fuel Cut Idle: Fuel cut when throttle valve fully closed, during deceleration	Fuel cut operating: ON
NSW *2	Neutral start switch signal	P or N position: ON
ELECT LOAD SIG*2	Electrical Load Signal	Taillight switch ON: ON
FC TAU	Fuel Cut TAU: Fuel cut during very light load	Fuel cut operating: ON
CYL#1, CYL#2, CYL#3, CYL#4	Abnormal revolution variation for each cylinder	0%
IGNITION *1	Total number of ignition for every 1,000 revolutions	0 ~ 2,000 rpm
EGRT GAS *1	EGR Gas Temp. Sensor Value	EGR not operating: Temp. between intake air temp. and engine coolant temp.
EGR SYSTEM	EGR System Operating Condition	Idling: OFF
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	Idling: OFF
TOTAL FT B1	Total Fuel Trim Bank 1: Average value for fuel trim system of bank 1	Idling: 0.8 ~ 1.2 V
O2 LR B1, S1 *1	Oxygen Sensor Lean Rich Bank 1, Sensor 1 Response time for oxygen sensor output to switch from lean to rich	Idling after warmed up: 0 ~ 1,000 msec.
O2 RL B1, S1 *1	Oxygen Sensor Rich Lean Bank 1, Sensor 1 Response time for oxygen sensor output to switch from rich to lean	Idling after warmed 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.

*1 2RZ-FE:

*2 A/T only

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DI1I7-01

DIAGNOSTIC TROUBLE CODE CHART

1. 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
P0100/31 (DI-94)	Air Flow Circuit Malfunction	$ Open or short in air flow meter circuit $ Air flow meter $ Engine ECU	f	f
P0110/24 (DI-101)	Intake Air Temp. Circuit Malfunction	$ Open or short in intake air temp. sensor circuit $ Intake air temp. sensor $ Engine ECU	–	f
P0115/22 (DI-107)	Water Temp. Circuit Malfunction	$ Open or short in water temp. sensor circuit $ Water temp. sensor $ Engine ECU	f	f
P0120/41 (DI-113)	Throttle Position Sensor circuit Malfunction	$ Open or short in throttle position sensor circuit $ Throttle position sensor $ Engine ECU	–	f
P0130/21,28 (DI-119)	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	$ Open or short in oxygen sensor circuit $ Oxygen sensor $ Engine ECU	–	f
P0135/21,28 P0141/27,29 (DI-125)	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1) (Bank 1 Sensor 2)	$ Open or short in heater circuit of oxygen sensor $ Oxygen sensor $ Engine ECU	–	f
P0136/27,29 (DI-127)	Oxygen Sensor circuit Malfunction (Bank 1 Sensor 2)	$ Open or short in heated oxygen sensor $ Heated oxygen sensor $ Engine ECU	–	f
P0171/25 (DI-129)	System too Lean (Air- Fuel Ration Lean Malfunction, Bank 1)	$ Air intake (hose loose) $ Fuel line pressure $ Injector blockage $ Open or short in oxygen sensor circuit $ Oxygen sensor malfunction $ Air flow meter $ Water temp. sensor	–	f
P0325/52 (DI-134)	Knock Sensor Circuit Malfunction	$ Open or short in knock sensor circuit $ Knock sensor (looseness) $ Engine ECU	f	f
P0335/12 (DI-137)	Crankshaft Position Sensor Circuit Malfunction	$ Open or short in crankshaft position sensor circuit $ Crankshaft position sensor $ Starter $ Engine ECU	f	f

*1: f · · · Check engine warning light (CHK ENG) lights up

– · · · Check engine warning light (CHK ENG) does not lights up

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DTC No. (See Page)	Detection Item	Trouble Area	CHK ENG *1	Memory
P0340/12 (DI-140)	Camshaft Position Sensor Circuit Malfunction	S Open or short in camshaft position sensor circuit S Camshaft position sensor S Starter S Engine ECU	f	f
P0500/42 (DI-143)	Vehicle Speed Sensor Circuit Malfunction	S Open or short in vehicle speed sensor circuit S Vehicle speed sensor S Combination meter S Engine ECU	f	f
P0505/33 (DI-146)	Idle Control System Malfunction	S ISC valve is stuck or closed S Open or short in ISC valve circuit S Air intake (hose loose) S A/C signal circuit	f	f
P1300/14,15 P1310/14,15 (DI-151)	Igniter Circuit Malfunction	S Open or short in IGF or IGT circuit from igniter to ECU S Ignition S Engine ECU	f	f
P1335/13 (DI-157)	Crankshaft Position Sensor Circuit Malfunction (during idling)	S Open or short in crankshaft position sensor circuit S Crankshaft position sensor S Starter S Engine ECU	-	f

*1: f · · · Check engine warning light (CHK ENG) lights up
– · · · Check engine warning light (CHK ENG) does not lights up

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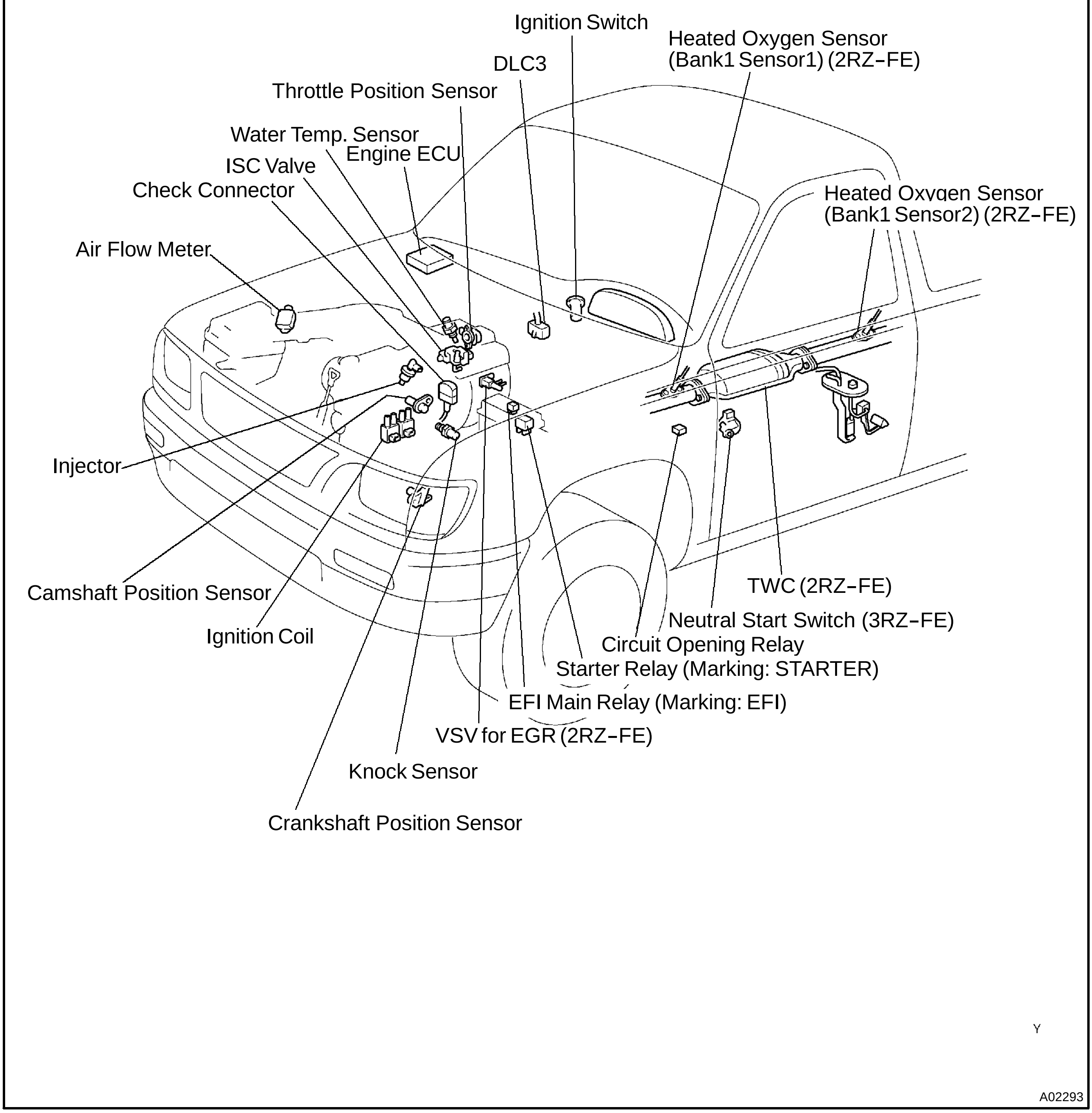
DI1I8-01

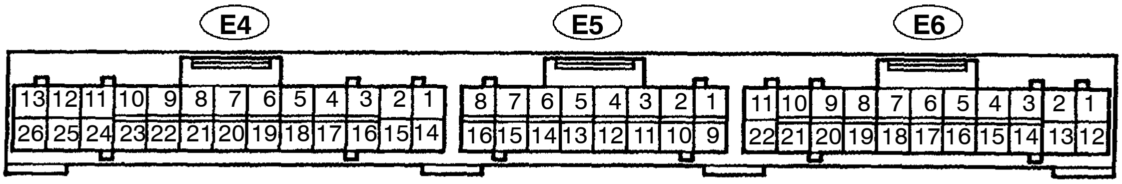
PARTS LOCATION



DI1I9-01

TERMINALS OF ECU

ECM Terminals



P19559

Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
BATT (E6 - 1) - E1 (E4 - 14)	Y ↔ BR	Always	9 ~ 14
+ B (E6 - 12) - E1 (E4 - 14)	R-L ↔ BR	IG switch ON	9 ~ 14
VC (E5 - 1) - E2 (E5 - 9)	G -Y ↔ LG-B	IG switch ON	4.5 ~ 5.5
VTA (E5 - 11) - E2 (E5 - 9)	Y ↔ LG-B	IG switch ON Throttle valve fully closed	0.3 ~ 1.0
		IG switch ON Throttle valve fully open	3.2 ~ 4.9
VG (E5 - 2) - E2 (E5 - 9)	P-L ↔ LG-B	Idling , "P" or "N" Position, A/C switch off	1.1 ~ 1.5
THA (E5 - 3) - E2 (E5 - 9)	Y-G ↔ LG-B	Idling, Intake air temp. 20°C (68° F)	0.5 ~ 3.4
THW (E5 - 4) - E2 (E5 - 9)	G-R ↔ LG-B	Idling, Engine coolant temp. 80°C (176°F)	0.2 ~ 1.0
STA (E6 - 11) - E1 (E4 - 14)	P-R (M/T) ↔ BR V-Y (A/T) ↔ BR	Cranking	6.0 or more
#10 (E4 - 12) - E01 (E4 - 13)	R-L ↔ BR	IG switch ON	9 ~ 14
		Idling	Pulse generation (See page DI-158)
#20 (E4 - 11) - E01 (E4 - 13)	L ↔ BR	IG switch ON	9 ~ 14
		Idling	Pulse generation (See page DI-158)
#30 (E4 - 25) - E01 (E4 - 13)	W ↔ BR	IG switch ON	9 ~ 14
		Idling	Pulse generation (See page DI-158)
#40 (E4 - 24) - E01 (E4 - 13)	R ↔ BR	IG switch ON	9 ~ 14
		Idling	Pulse generation (See page DI-158)
IGT1 (E4 - 20) - E1 (E4 - 14)	B - L ↔ BR	Idling	Pulse generation (See page DI-151)
IGT2 (E4 - 19) - E1 (E4 - 14)	L-W ↔ BR	Idling	Pulse generation (See page DI-151)
IGF (E4 - 16) - E1 (E4 - 14)	B-Y ↔ BR	IG switch ON	Below 2.0
		Idling	Pulse generation (See page DI-151)
SIL (E6 - 16) - E1(E4 - 14)	R ↔ BR	During transmission	Pulse generation (See Pub. No. RM585E)
TAC (E6 - 8) - E1 (E4 - 14)	R-W ↔ BR	Idling	Pulse generation (See Pub. No. RM585E)

CONTINUED

Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
G2⊕ (E4 - 5) - NE⊖ (E4 - 17)	B ↔ G	Idling	Pulse generation (See page DI-137)
NE⊕ (E4 - 4) - NE⊖ (E4 - 17)	R ↔ G	Idling	Pulse generation (See page DI-137)
FC (E6 - 14) - E1 (E4 - 14)	G-Y ↔ BR	IG switch ON	9 ~ 14
EVP (E4 - 8) - E1 (E4 - 14)	B-W ↔ BR	IG switch ON	9 ~ 14
RSC (E4 - 9) - E1 (E4 - 14)	W-L ↔ BR	IG switch ON (Disconnect E4 of ECU connecter)	9 ~ 14
RSO (E4 - 10) - E1 (E4 - 14)	B-R ↔ BR	IG switch ON (Disconnect E4 of ECU connecter)	9 ~ 14
OX1*1 (E5 - 6) - E1 (E4 - 14)	B ↔ BR	Maintain engine speed at 2,500 rpm for 2 min. after warning up	Pulse generation (See page DI-119)
OX2*1 (E5 - 5) - E1 (E4 - 14)	R ↔ BR	Maintain engine speed at 2,500 rpm for 2 min. after warning up	Pulse generation (See page DI-119)
HT1*1 (E5 - 8) - E1 (E4 - 14)	G-B ↔ BR	Idling	Below 3.0
		IG switch ON	9 ~ 14
HT2*1 (E4 - 14) - E1 (E4 - 14)	R-W ↔ BR	Idling	Below 3.0
		IG switch ON	9 ~ 14
KNK (E5 - 13) - E1 (E4 - 14)	GR ↔ BR	Idling	Pulse generation (See page DI-134)
NSW*2 (E4 - 1) - E1 (E4 - 14)	↔	IG switch ON (Other shift position in "P", "N" position)	9 ~ 14
		IG switch ON (Shift position in "P", "N" position)	0 ~ 3.0
SPD (E6 - 9) - E1 (E4 - 14)	G-O ↔ BR	IG switch ON (Rotate driving wheel slowly)	Pulse generation (See page DI-143)
TC (E6 - 15) - E1 (E4 - 14)	V ↔ BR	IG switch ON	9 ~ 14
W (E6 - 5) - E1 (E4 - 14)	V-G ↔ BR	Idling	Below 3.0
		IG switch ON	9 ~ 14

*1: 2RZ-FE only
*2: 3RZ-FE only

DI1IA-01

PROBLEM SYMPTOMS TABLE

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

Symptom	Suspect Area	See page
Engine does not crank (does not start)	1. Starter and starter relay 2. Neutral start switch circuit	ST-1 DI-167
No initial combustion (Dies not start)	1. ECU power source circuit 2. Ignition circuit 3. Fuel pump control circuit 3. Injector circuit	DI-170 DI-151 DI-174 DI-158
No complete combustion (Does not start)	1. Fuel pump control circuit 2. Ignition circuit 3. Injector circuit	DI-174 DI-151 DI-158
Engine cranks normally (Difficult to start)	1. Starter signal circuit 2. ISC valve circuit 3. Fuel pump control circuit 4. Ignition coil (w/ igniter) 5. Spark plug 6. compression 7. Injector circuit	DI-162 DI-146 DI-174 IG-1 IG-1 EM-7 DI-158
Cold engine (Difficult to start)	1.Starter signal circuit 2. ISC valve circuit 3. Fuel pump control circuit 4. Injector circuit 5. Ignition coil (w/ igniter) 6. Spark plug	DI-162 DI-146 DI-174 DI-158 IG-1 IG-1
Hot engine (Difficuil to start)	1. Starter signal circuit 2. ISC valve circuit 3. Fuel pump control circuit 4. Injector circuit 5. Ignition coil (w/ igniter) 6. Spark plug	DI-162 DI-146 DI-174 DI-158 IG-1 IG-1
Incorrect first idle (Poor idling)	1. ISC valve circuit	DI-146
High engine idle speed (Poor idling)	1. ISC valve circuit 2. ECU power source circuit 3. Neutral start switch circuit 4. Back up power source circuit	DI-146 DI-170 DI-167 DI-165
Low engine idle speed (Poor idling)	1. ISC valve circuit 2. Neutral start switch circuit 3. Fuel pump control circuit 4. Injector circuit 5. Air flow meter circuit 6. Back up power source circuit	DI-146 DI-167 DI-174 DI-158 DI-94 DI-165
Rough idling (Poor idling)	1. ISC valve circuit 2. Air flow meter circuit 3. Injector circuit 4. EGR system 5. Variable resistor circuit *1 6. Ignition circuit 7. Compression 8. Fuel pump control circuit 9. Back up power source circuit	DI-146 DI-94 DI-158 DI-178 DI-183 DI-151 EM-7 DI-174 DI-165

CONTINUED

Hunting (Poor idling)	1. ISC valve circuit 2. Air flow meter circuit 3. ECU power source circuit 4. Fuel pump control circuit	DI-146 DI-94 DI-170 DI-174
Hesitation/Poor acceleration (Poor driveability)	1. Air flow meter circuit 2. Injector circuit 3. Fuel pump control circuit 4. Variable resistor circuit *1 5. Ignition circuit 6. A/T faulty	DI-94 DI-158 DI-174 DI-183 DI-151 -
Muffler explosion, after fire (Poor driveability)	1. Ignition coil (w/ igniter) 2. Spark plug 3. Injector circuit	IG-1 IG-1 DI-158
Surging (Poor drefveability)	1. Fuel pump control circuit 2. Variable resistor circuit *1 3. Spark plug 4. Injector circuit	DI-174 DI-183 IG-1 DI-158
Engine stall (Soon after starting)	1. Fuel pump control circuit 2. Air flow meter circuit 3. ISC valve circuit	DI-174 DI-94 DI-146
Engine stall (After accelerator pedal depressed)	1. Air flow meter circuit	DI-94
Engine stall (After accelerator pedal releaseda)	1. Injector circuit 2. ISC valve circuit 3. Engine ECU	DI-158 DI-146 DI-170
Engine stall (When shifting N to D)	1. Neutral start switch circuit 2. ISC valve circuit	DI-167 DI-146

*1: Only for 3RZ–FE

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CONTINUED

DIAGNOSTICS – ENGINE (2RZ-FE, 3RZ-FE)

CONTINUED

DIAGNOSTICS – ENGINE (2RZ-FE, 3RZ-FE)

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DI1IB-01

CIRCUIT INSPECTION

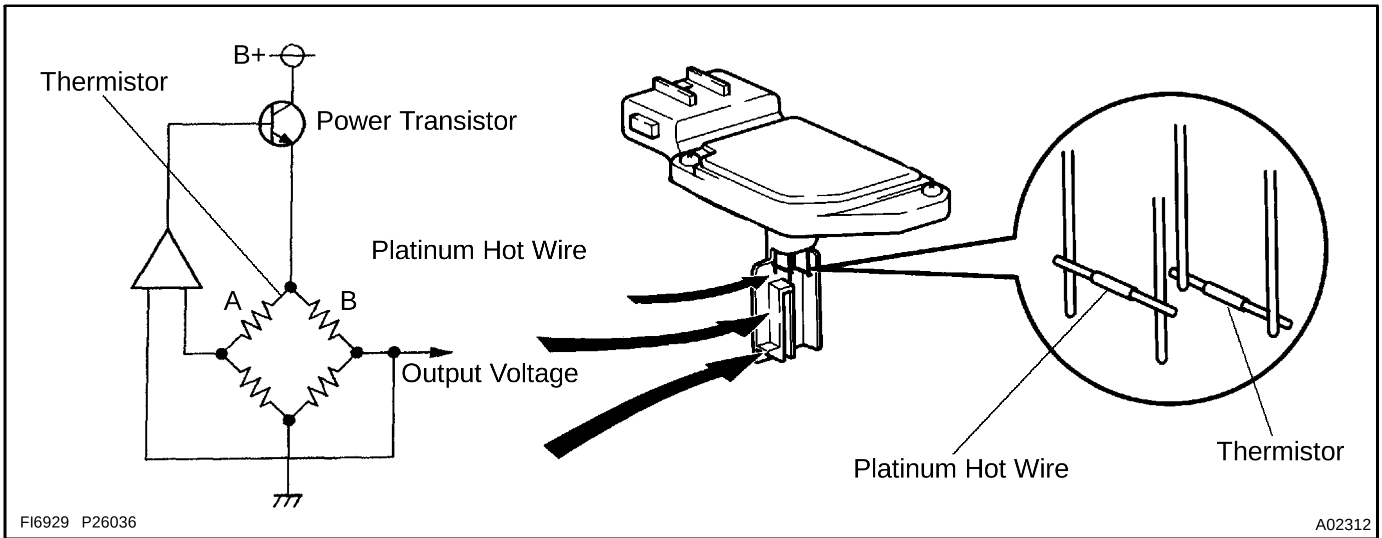
DTC	P0100/31	Air Flow Circuit Malfunction

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 temp.

The hot wire is maintained at the set temp. by controlling the current flow through the hot wire. This current flow is then measured as the output voltage of the air flow meter.

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



DTC No.	DTC Detecting Condition	Trouble Area
P0100/31	Open or short in air flow meter circuit for 3 sec. engine speed or more 3,000 rpm	• Open or short in air flow meter circuit • Air flow meter • Engine ECU

If the engine ECU detects DTC "P0100/31" it operates the fail safe function, keeping the ignition timing and injection volume constant and marking it possible to drive the vehicle.

HINT:

After confirming DTC "P0100/31" use the hand-held tester to confirm the air flow ratio from "CURRENT DATA".

Mass Air Flow Value (gm/sec.)	Malfunction
Approx. 0	• Air flow meter power source circuit open • VG circuit open or short
271.0 or more	• E2G circuit open

CONTINUED

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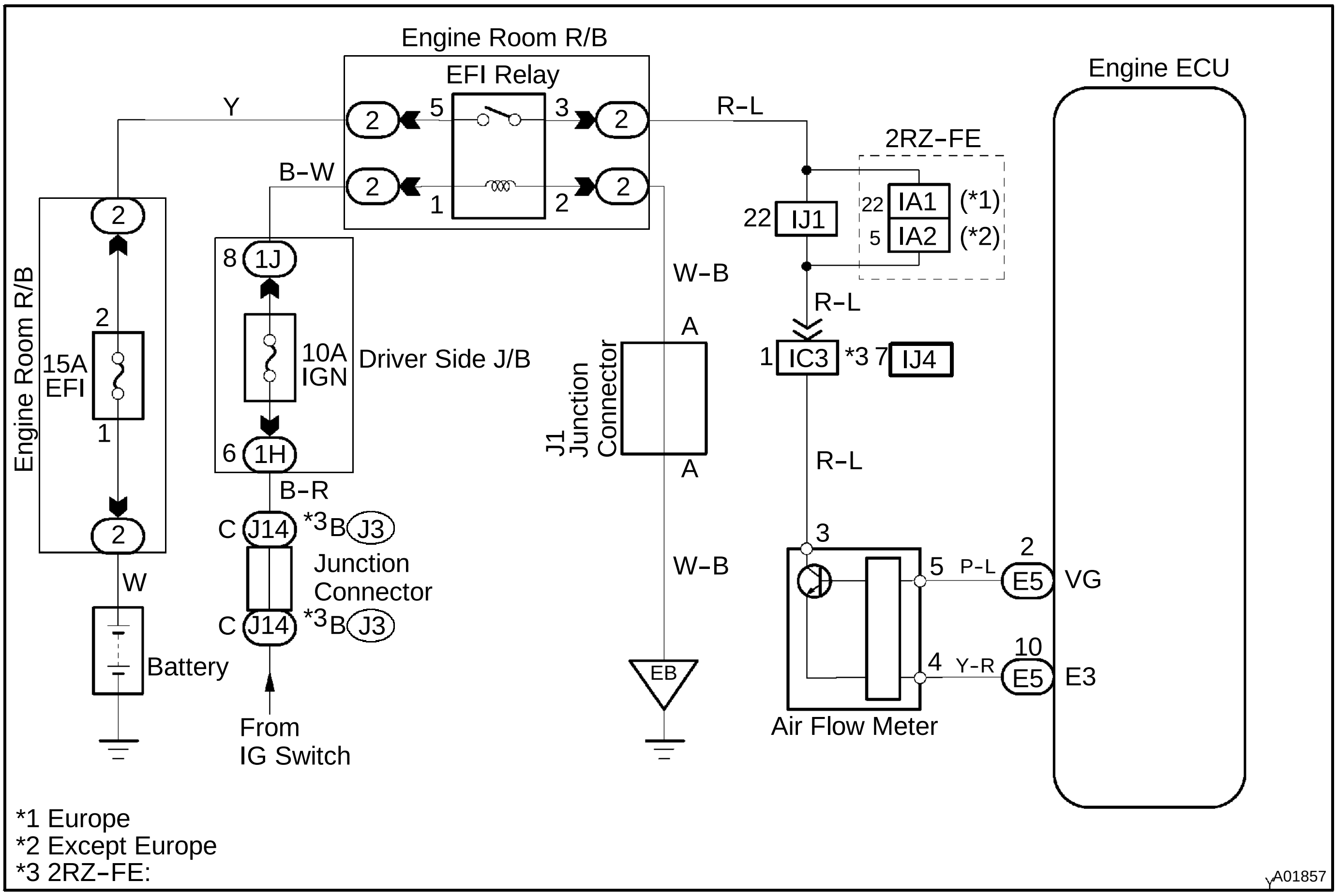
WIRING DIAGRAM



INSPECTION PROCEDURE

CONTINUED

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

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When using hand-held tester

1	Connect the hand-held tester, and read value of air flow rate.

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

CHECK:
Read air flow rate hand-held tester.

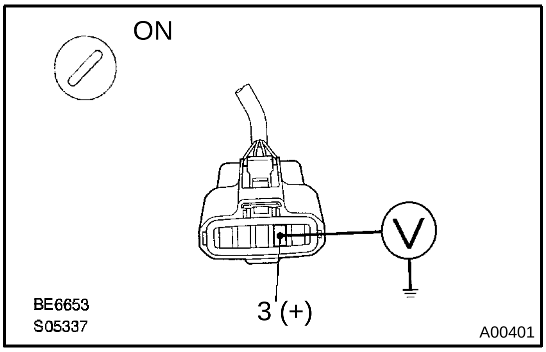
RESULT:

	Type I	Type II
Air flow rate (gm/sec.)	0.0 gm/sec.	271.0 gm/sec. or more

Type I

Type II → Go to step 5.

2	Check voltage of air flow meter power source.



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

CHECK:
Measure voltage between terminal 3 of 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-21).**

OK

CONTINUED

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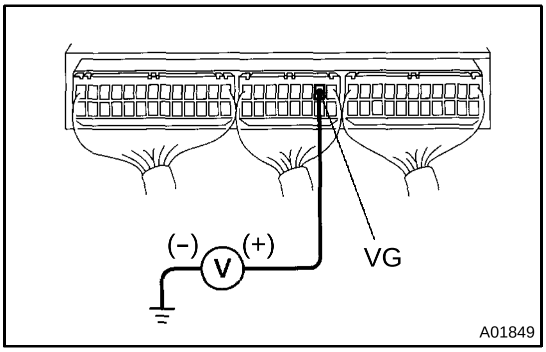
3 Check voltage between terminals VG of engine ECU connector and body ground.



PREPARATION:

(a) Remove the glove compartment (See page FI-61).

(b) Start the engine.

CHECK:

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

OK:

Voltage:
1.1 ~ 1.5 V (P or N position and A/C switch OFF)

OK → **Check and replace engine ECU** **(See page IN-21).**

NG ↓

4 Check for open and short in harness and connector between air flow meter and engine ECU (See page IN-21).

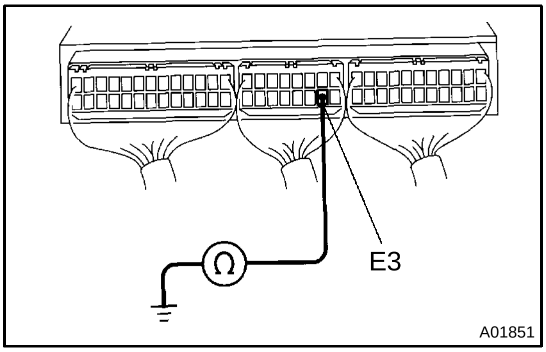
NG → **Repair or replace harness or connector.**

OK ↓

Replace air flow meter.

CONTINUED

5	Check continuity between terminal E3 of engine ECU connector and body ground.



PREPARATION:
Remove the glove compartment (See page FI-61).

CHECK:
Check continuity between terminal E3 of engine ECU connector and body ground.

OK:
Continuity (1 Ω or less)

NG → **Check and replace engine ECU** **(See page IN-21).**

OK

6	Check for open in harness and connector between air flow meter and engine ECU (See page IN-21).

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

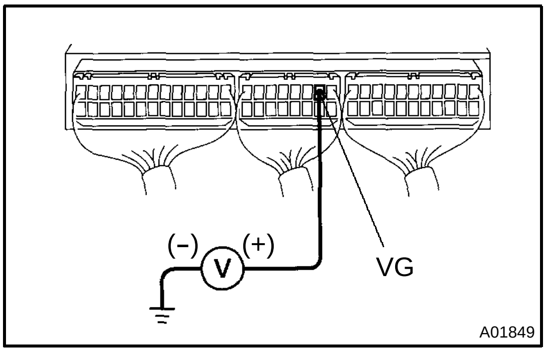
OK

Replace air flow meter.

CONTINUED

When not using hand–held tester

1	Check voltage between terminal VG of engine ECU and ground.



PREPARATION:
Remove the glove compartment (See page FI–61).

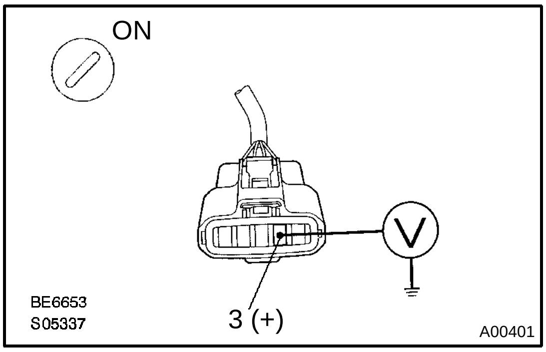
CHECK:
Measure voltage between terminal VG of engine ECU and body ground while engine is idling.

OK:
Voltage: 1.1 – 1.5 V
(”P” or ”N” position and A/C switch OFF)

OK → **Check and replace engine ECU** **(See page IN–21)**

OK ↓

2	Check voltage of air flow meter power source



PREPARATION:
Disconnect the air flow meter connecter
Turn the ignition switch ON.

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

OK:
Voltage: 9 – 14 V

NG → **Check for open in harness and connecter between EFI main relay (Marking: EFI) and air flow meter** **(See page IN–21)**

OK ↓

CONTINUED

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3	Check for open in harness and connector between air flow meter and engine ECU (See page IN–21).

NG → Repair or replace harness or connector.

OK

Replace air flow meter.

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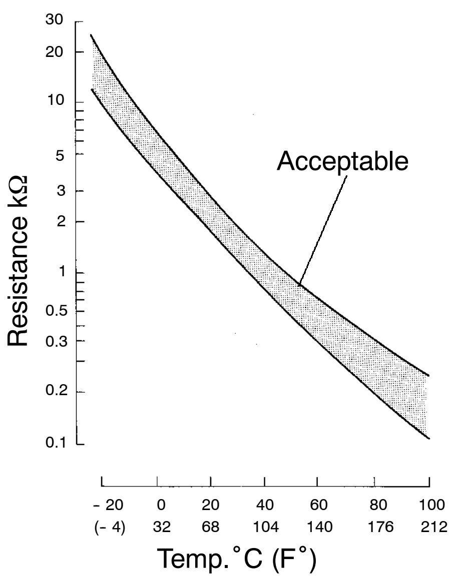
DTC P0110/24 Intake Air Temp. Circuit Malfunction

(fig.1)



FI4741

CIRCUIT DESCRIPTION

The intake air temp. sensor is built into the air flow meter and sensors the intake air temp.
A thermistor built in the sensor changes the resistance value according to the intake air temp. The lower the intake air temp. the greater the thermistor resistance value, and the higher the intake air temp. the lower the thermistor resistance value (See fig.1).
The air intake temp. sensor is connected to the engine ECU (See below). The 5V power source voltage in the ECU is applied to the intake air temp. sensor from the terminal THA via a resistor R.
That is the resistor R and the intake air temp. sensor are connected in series. When the resistance value of the intake air temp. sensor changes in accordance with changes in the intake air temp. the potential at terminal THA also changes. Based on this signal, the engine ECU increases the fuel injection volume to improve driveability during cold engine operation.
If the engine ECU detects the DTC "P0110/24", it operates the fail safe function in which the intake air temp. is assumed to be 20˚C (68˚F).

DTC No.	DTC Detecting Condition	Trouble Area
P0110/24	Open or short in intake air temp. sensor circuit for 0.5 sec or more	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • Engine ECU

HINT:
After confirming DTC P110/24 use the hand-held tester to confirm the intake air temp. from "CURRENT DATA".

Temp. Displayed	Malfunction
- 40˚C (- 40˚F)	Open circuit
140˚C (284˚F) or more	Short circuit

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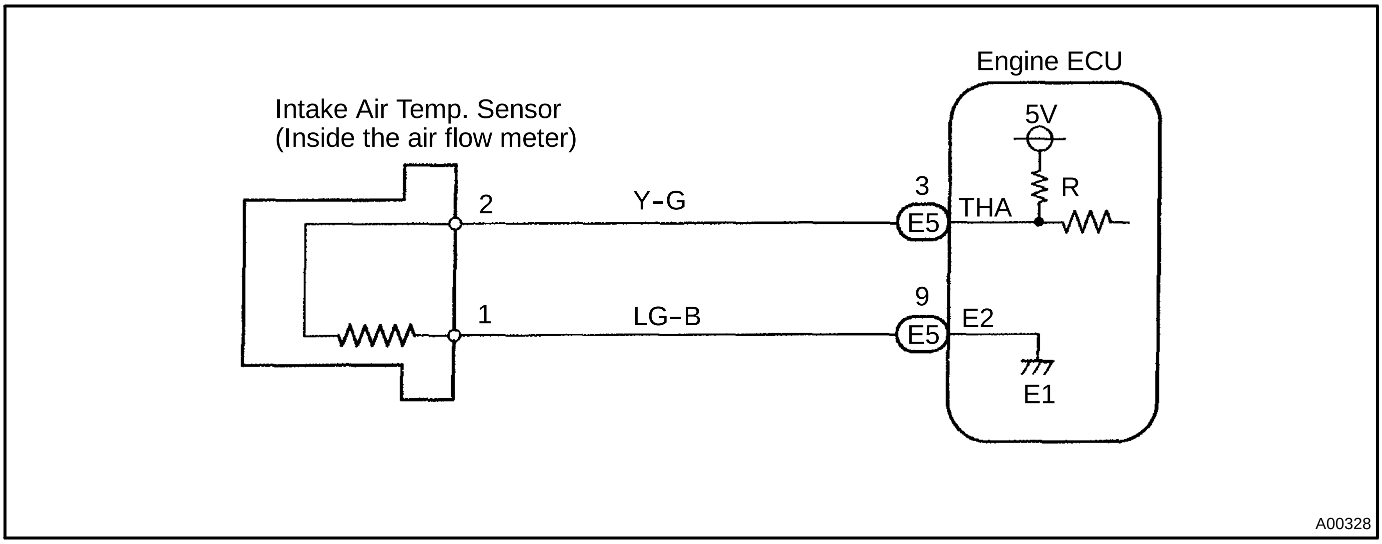
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read freed frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.
- If DTC "P0110/24" (Intake Air Temp. Circuit Malfunction), "P0115/22" (Water Temp. Circuit Malfunction), "P0120/41" (Throttle Position Sensor Circuit Malfunction) are output simultaneously, E2 (Sensor Ground) may be open.

CONTINUED

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When using hand-held tester

1	Connect the hand-held tester, and read value of intake air temp.

PREPARATION:
(a) Connect the hand-held tester to DLC3.
(b) Turn ignition switch ON and push the hand-held tester main switch ON.

CHECK:
Read temp. value on the hand-held tester.

OK:
Same as actual intake air temp.

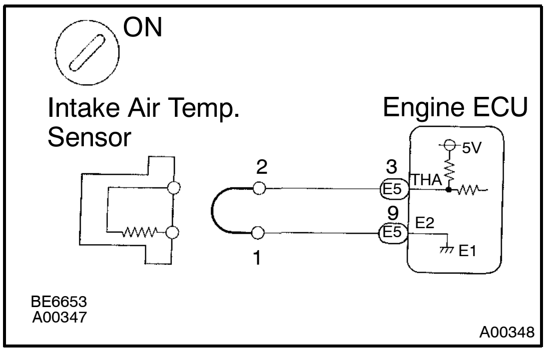
HINT:
- If there is open circuit,hand-held tester indicates - 40°C (- 40°F).
- If there is short circuit, hand-held tester indicates 140°C (284°F) or more.

NG → -40°C (-40°F) Go to step 2.
140°C (284°F) Go to step 4.

OK

Check for intermittent problem
(See page DI-80)

2	Check for open in harness or engine ECU



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

CHECK:
Read temp. value on the hand-held tester.

OK:
Temp. value: 140°C (284°F) or more

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

CONTINUED

OK

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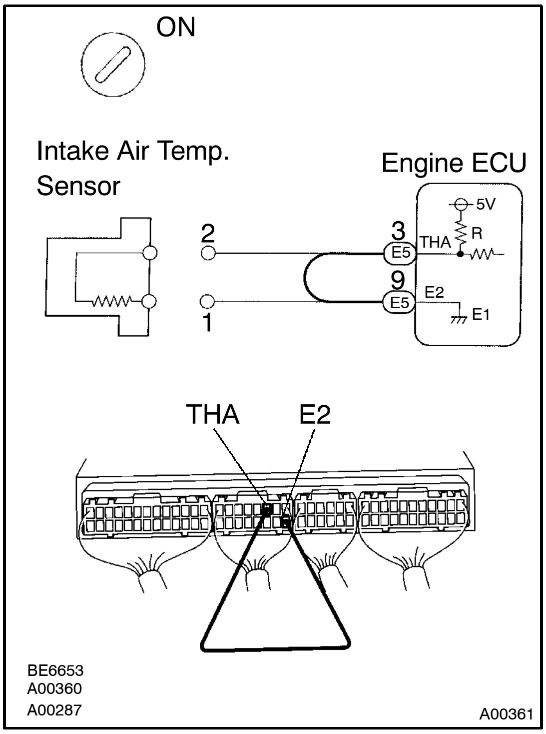
3	Check for open in harness or engine ECU.



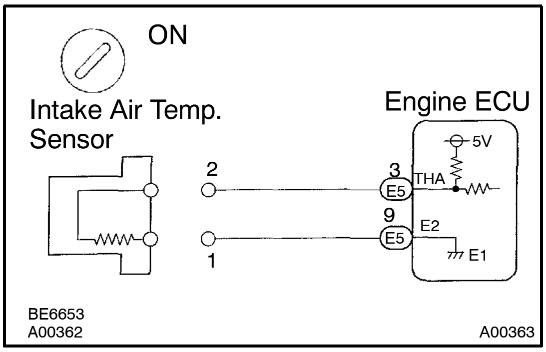
PREPARATION:
(a) Remove the glove compartment (See page FI-61).
(b) Connect between terminals THA and E2 of engine ECU E5 connector.
HINT:
Air flow meter connector is disconnected.
Before checking, do a visual and contact pressure check for the engine ECU connector (See page IN-22).
(c) Turn ignition switch ON.
CHECK:
Read temp. value on the hand-held tester.
OK:
Temp. value: 140°C (284°F) or more

OK → **Open in harness between terminals E2 or THA repair or replace harness.**

NG ↓

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

4	Check for short in harness and engine ECU. (See page IN-21)



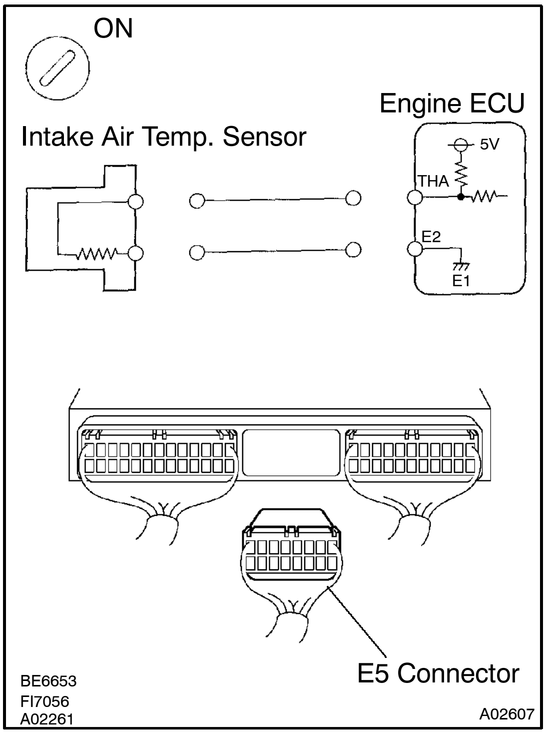
PREPARATION:
(a) Disconnect the air flow meter connector.
(b) Turn ignition switch ON.
CHECK:
Read temp. value on the hand-held tester.
OK:
Temp. value: - 40°C (- 40°F)

OK → **Replace intake air temp. sensor.**

NG ↓

CONTINUED

5	Check for short in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment (See page FI-61).

(b) Disconnect the E5 connector of engine ECU.

HINT:

Intake air temp. sensor connector is disconnected.

(c) Turn ignition switch ON.

CHECK:

Read temp. value on the OBD II scan tool or hand-held tester.

OK:

Temp. value: - 40°C (- 40°F)

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

NG ↓

Check and replace engine ECU **(See page IN-21).**

CONTINUED

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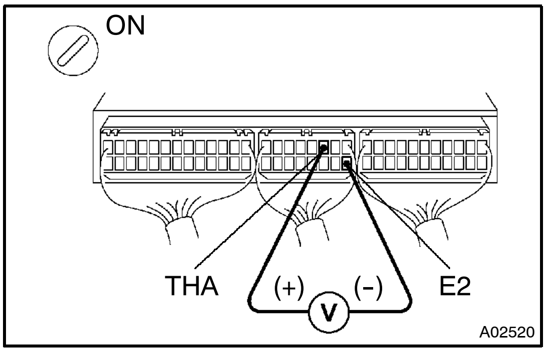
When not using hand-held tester

1	Check voltage between terminals THA and E2 of engine ECU connecter



PREPARATION:

(a) Remove glove compartment.
(See page FI-61)

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminals THA and E2 of engine ECU connector

Intake air temp. °C (°F)	Voltage V
20 (68)	0.5 ~ 3.4
60 (140)	0.2 ~ 1.0

OK:

OK → **Check for intermittent problem**
(See page DI-80)

NG ↓

2	Check air flow meter (See page FI-29).

NG → **Replace air flow meter**

OK ↓

3	Check for open and short in harness and connector between engine ECU and air flow meter. (See page IN-21)

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

OK ↓

Check and replace engine ECU.

DTC P0115/22 Water Temp. Circuit Malfunction

CIRCUIT DESCRIPTION

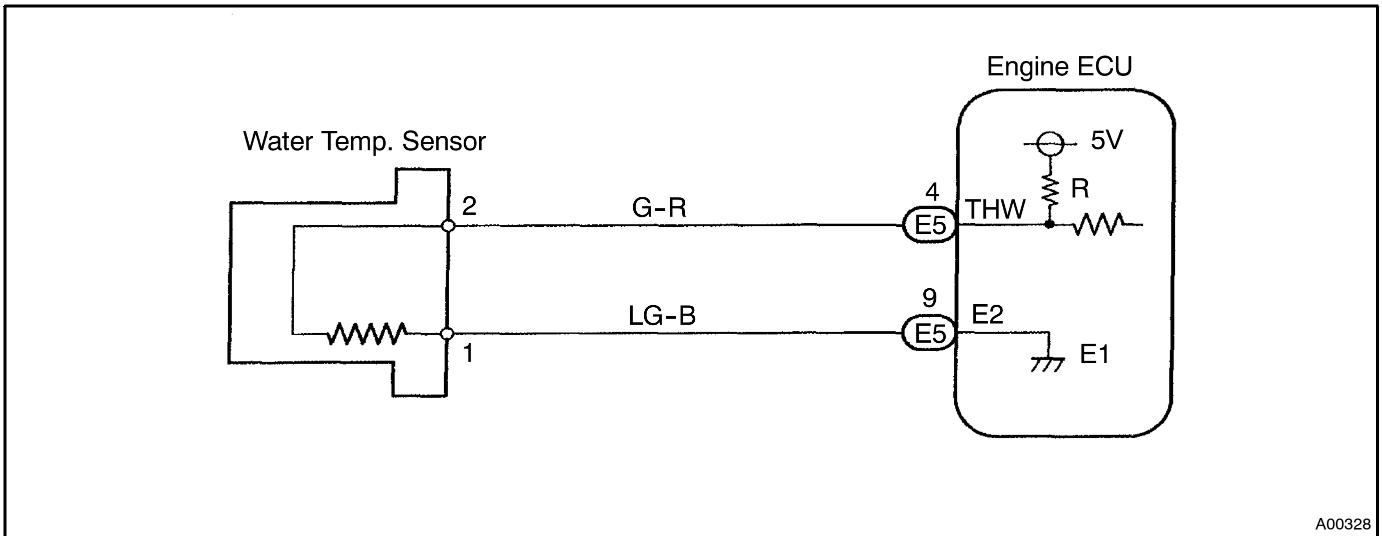
A thermistor built into the water temp. sensor changes the resistance value according to the water temp.
The structure of the sensor and connection to the engine ECU is the same as in the air flow meter temp. circuit
malfunction shown on page DI-101.

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

HINT:
After confirming DTC P0115/22 use the hand-held tester to confirm the water temp. from CURRENT DATA.

Temp. Displayed	Malfunction
- 40°C (- 40°F)	Open circuit
140°C (284°F) or more	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read freed frame data using hand-held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air-fuel ratio lean or rich, etc. at the time of the malfunction.
- If DTC "P0110/24" (Intake Air Temp. Circuit Malfunction), "P0115/22" (Water Temp. Circuit Malfunction), "P0120/41" (Throttle Position Sensor Circuit Malfunction) are output simultaneously, E2 (Sensor Ground) may be open.

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When using hand-held tester

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

PREPARATION:

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

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

CHECK:

Read temp. value on the hand-held tester.

OK:

Same as actual water temp.

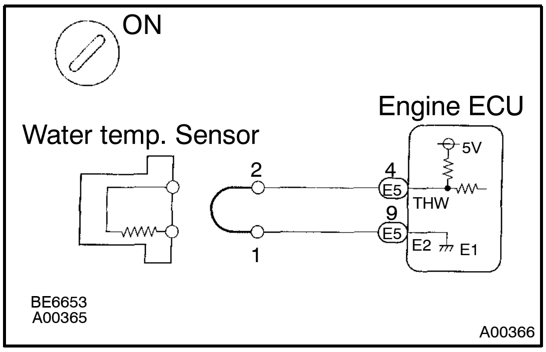
HINT:

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

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

OK ↓

2	Check for short in harness or engine ECU.



PREPARATION:

(a) Disconnect the water temp. sensor connector.

(b) Connect sensor wire harness terminals together.

(c) Turn ignition switch ON.

CHECK:

Read temp. value on the hand-held tester.

OK:

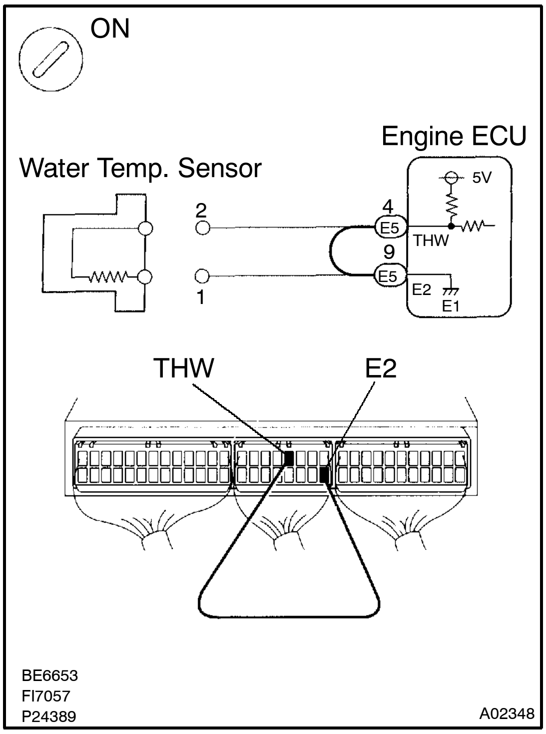
Temp. value: 140°C (284°F) or more

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

NG ↓

CONTINUED

3 Check for open in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment (See page FI-61).

(b) Connect between terminals THW and E2 of engine ECU connector.

HINT:
Water temp. sensor connector is disconnected. Before checking, do a visual and contact pressure check for the engine ECU connector (See page IN-22).

(c) Turn ignition switch ON.

CHECK:
Read temp. value on the hand-held tester.

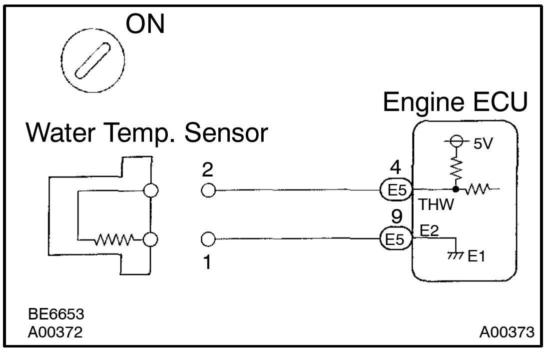
OK:
Temp. value: 140°C (284°F) or more

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

NG

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

4 Check for short in harness or engine ECU.



PREPARATION:

(a) Disconnect the water temp. sensor connector.

(b) Turn ignition switch ON.

CHECK:
Read temp. value on the hand-held tester.

OK:
Temp. value: – 40°C (– 40°F)

OK	**Replace water temp. sensor.**

NG

CONTINUED

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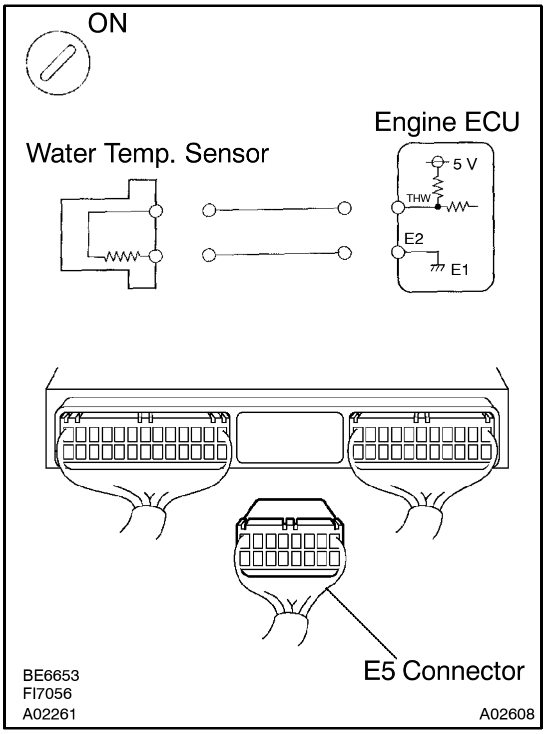
5	Check for short in harness or engine ECU.



PREPARATION:

(a) Remove the glove compartment (See page FI-61).

(b) Disconnect the E5 connector of Engine ECU.

HINT:

Water temp. sensor connector is disconnected.

(c) Turn ignition switch ON.

CHECK:

Read temp. value on the hand-held tester.

OK:

Temp. value: – 40°C (– 40°F)

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

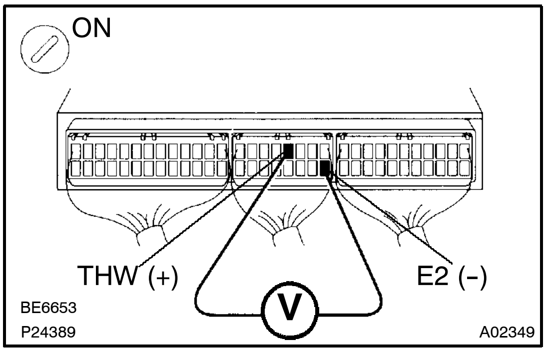
NG

Check and replace Engine ECU **(See page IN-21).**

CONTINUED

When not using hand-held tester

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



PREPARATION:

(a) Remove glove compartment. (See page FI-61)

(b) Turn the ignition switch ON

CHECK:

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

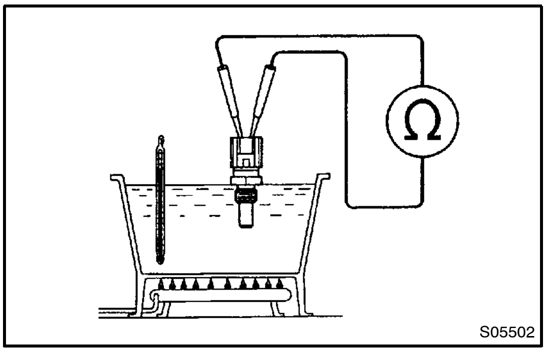
OK:

Water Temp. °C (°F)	Voltage V
20 (68) (Engine is cool)	0.5 ~ 3.4
80 (176) (Engine is hot)	0.2 ~ 1.0

OK → **Check for intermittent problems** **(See page DI-80).**

NG

2 Check water temp. sensor.



PREPARATION:

(a) Disconnect the water temp. sensor connecter.

CHECK:

Measure resistance between terminals.

OK:

Resistance is within Acceptable Zone on chart.

Water Temp. °C (°F)	Resistance kΩ
20 (68) (Engine is cool)	2 ~ 3
80 (176) Engine is hot)	0.2 ~ 0.4

NG → **Replace water temp. sensor**

NG

CONTINUED

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3	Check for open and short in harness and connector between engine ECU and water temp. sensor (See page IN–21).

NG → Repair or replace harness or connector

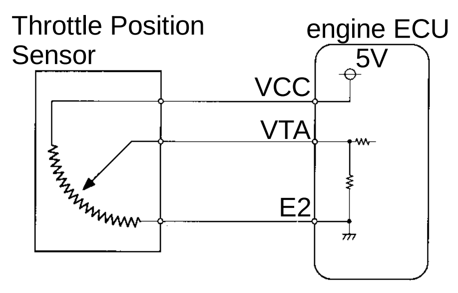
NG

Check and replace Engine ECU
(See page IN–21).

DI1IE–01

DTC P0120/41 Throttle Position Sensor/Switch Circuit Malfunction

CIRCUIT DESCRIPTION



P24296

The throttle position sensor is mounted in the throttle body and detects the throttle valve opening angle.
When the throttle valve is fully closed, a voltage of approximately 0.7 V is applied to terminal VTA of the engine ECU. The voltage applied to the terminals VTA of the engine ECU increases in proportion to the opening angle of the throttle valve and becomes approximately 3.5 ~ 5.0 V when the throttle valve is fully opened. The engine ECU judges the vehicle driving conditions from these signals input from terminal VTA, uses them as one of the conditititions for deciding the air–fuel ratio correction, power inctease correction and fuel–cut control etc..

DTC No.	DTC Detecting Condition	Trouble Area
P0120/41	Open or short in throttle position sensor circuit for 0.5 sec. or more	• Open or short in throttle position sensor • Throttle position senor • Engine ECU

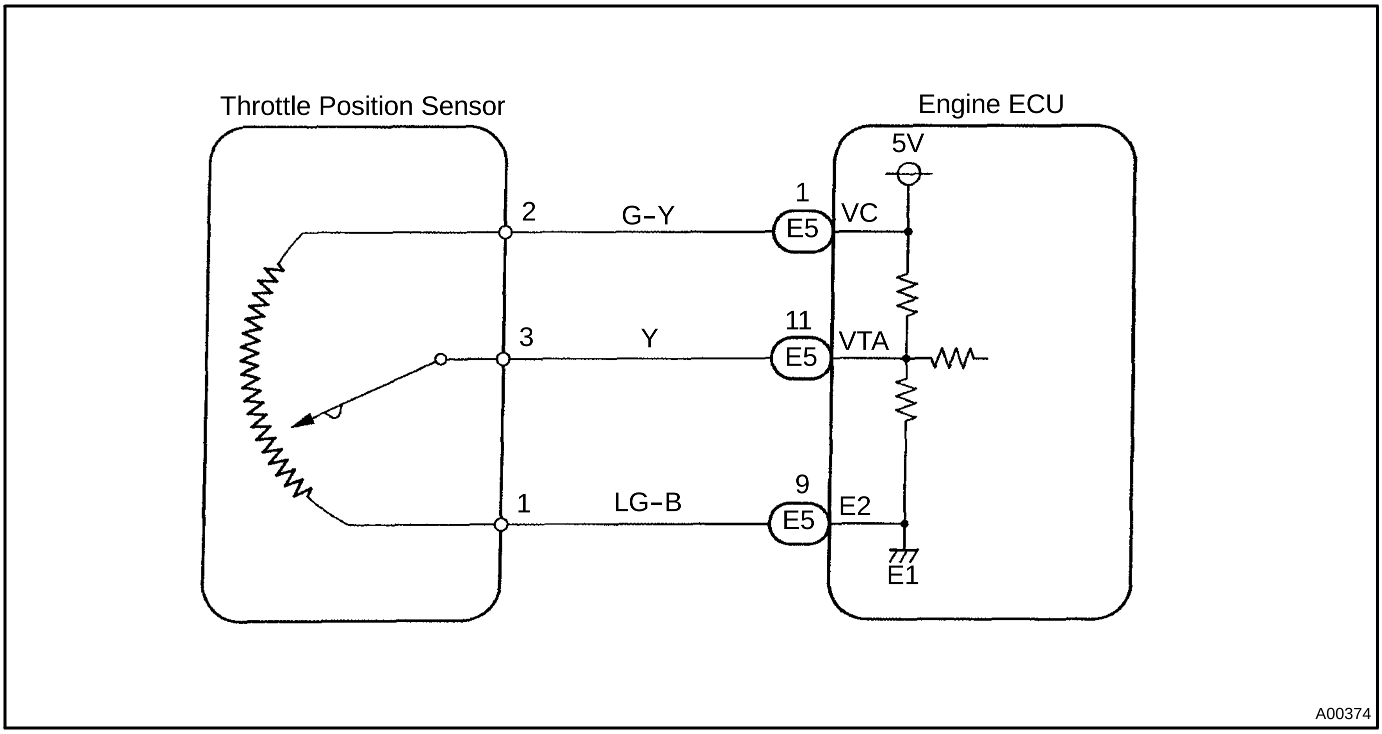
HINT:

- 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		Trouble Area
Throttle valve fully closed	Throttle valve fully open	
0 %	0 %	VC line open VTA line open or short
Approx. 100 %	Approx. 100 %	E2 line open

CONTINUED

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

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

CONTINUED

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When using hand–held tester

1 Connect the hand–held tester and read the throttle valve opening percentage.

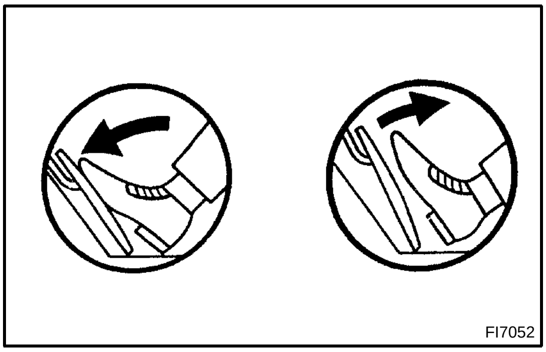
PREPARATION:

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

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

CHECK:

Read the throttle valve opening percentage.



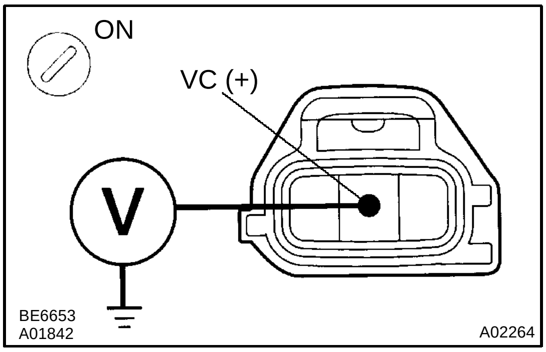
OK:

Throttle valve	Throttle valve opening position expressed as percentage
Fully open	Approx. 70 %
Fully closed	Approx. 10 %

OK → **Check for intermittent problems** **(See page DI–80).**

NG ↓

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



PREPARATION:

(a) Disconnect the throttle position sensor connector.

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminals VC of wire harness side connector and body ground.

OK:

Voltage 4.5 ~ 5.5 V

NG → **Go to step 5.**

OK ↓

CONTINUED

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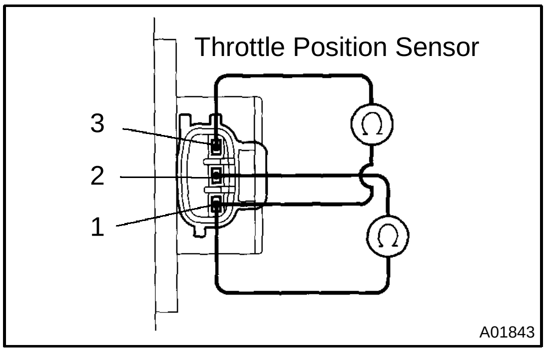
3 Check throttle position sensor.



PREPARATION:
Disconnect the throttle position sensor connector.

CHECK:
Measure resistance between terminals 1, 3 and 2 of the throttle position sensor.

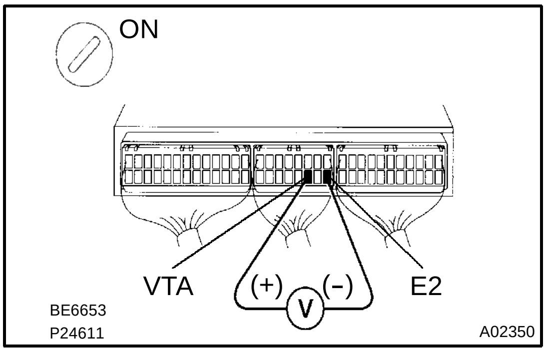
OK:

Terminals	Throttle valve	Resistance kΩ
1 ~ 2	—	2.5 ~ 5.9
1 ~ 3	Fully closed	0.2 ~ 5.7
	Fully open	2.0 ~ 10.2

NG → **Replace throttle position sensor.**

OK

4 Check voltage between terminals VTA and E2 of engine ECU connector.



PREPARATION:
(a) Remove the glove compartment (See page FI-61).
(b) Turn ignition switch ON.

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

OK:

Throttle valve	Voltage
Fully closed	0.3 ~ 1.0 V
Fully open	2.7 ~ 5.2 V

NG → **Check for open and short in harness and connector between engine ECU and throttle position sensor (VTA line) (See page IN-21).**

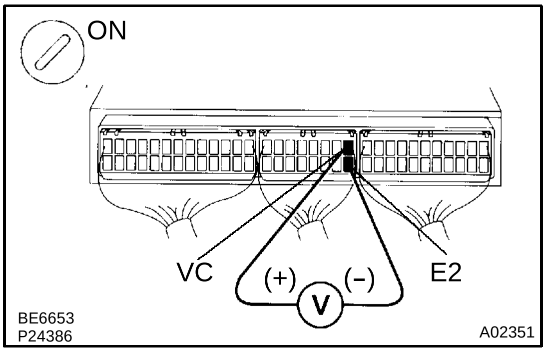
OK

Check and replace engine ECU (See page IN-21).

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

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



PREPARATION:
(a) Remove the glove compartment (See page FI–61).
(b) Turn ignition switch ON.

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

OK:
Voltage 4.5 ~ 5.5 V

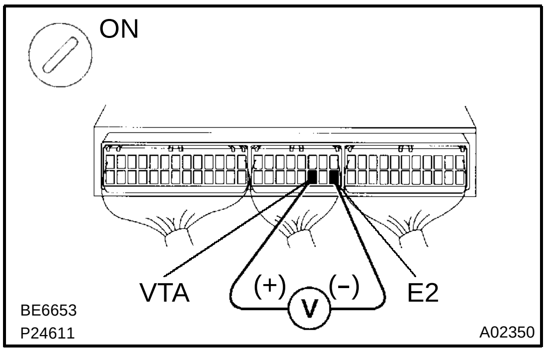
NG → **Check and replace engine ECU** **(See page IN–21).**

OK

Check for open in harness and connector between engine ECU and sensor (VC line) **(See page IN–21).**

When not using hand-held tester

1	Check voltage between terminals VTA and E2 of engine ECU.



PREPARATION:
(a) Remove glove compartment. (See page FI–61)
(b) Turn ignition switch ON.

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

OK:

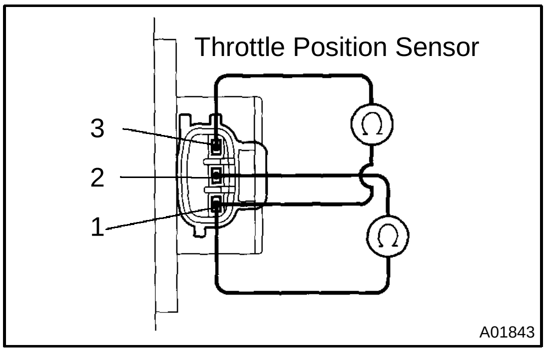
Throttle valve	Voltage V
Fully open	0.3 – 1.0
Fully closed	2.7 – 5.2

OK → **Check for intermittent problems** **(See page DI–80).**

NG

CONTINUED

2	Check throttle position sensor.



PREPARATION:
Disconnect the throttle position sensor connector.

CHECK:
Measure resistance between terminals 1, 3 and 2 of throttle position sensor

OK:

terminals	Throttle valve	Resistance kΩ
1 – 1	–	2.5 ~ 5.9
2 – 3	Fully closed	0.2 ~ 5.7
	Fully open	2.0 ~ 10.2

NG → **Replace throttle position sensor**

OK

3	Check for open and short in harness and connector between engine ECU and throttle position sensor (VC, VTA, E2 line)(See page IN–21)

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

OK

Check and replace engine ECU
(See page IN–21).

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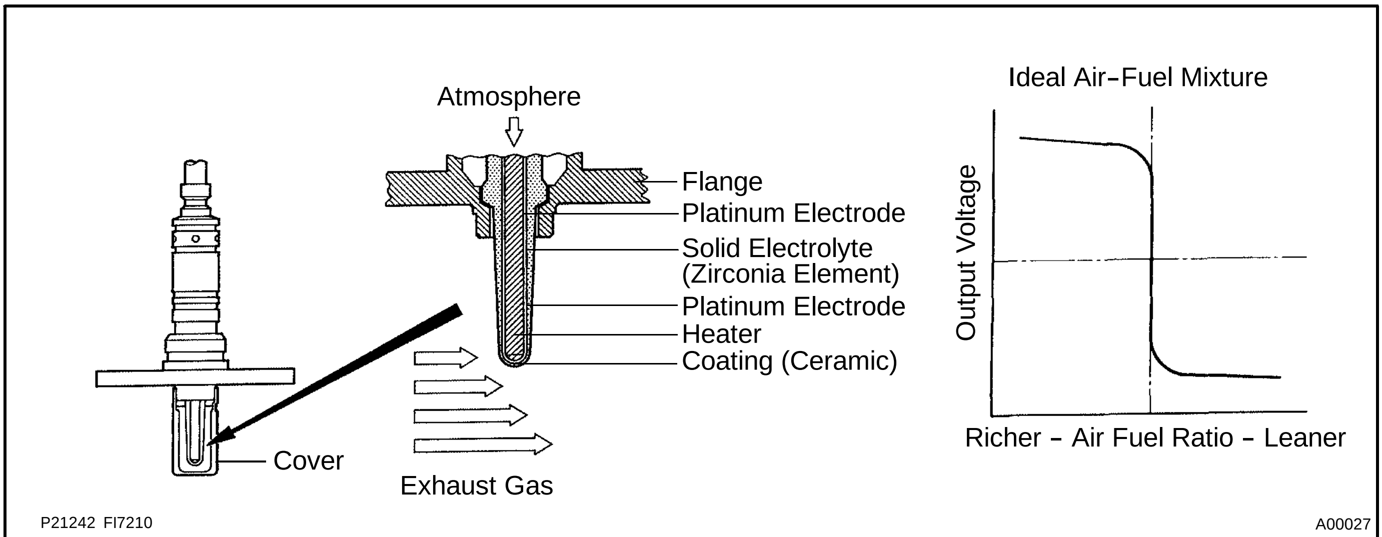
DI1IF-01

DTC	P0130/21, 28	Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1) (2RZ-FE).

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, but for the most efficient use of the three-way catalytic converter, the air-fuel ratio must be precisely controlled so that it is always close to the stoichiometric air-fuel ratio.
The oxygen sensor has the characteristic where by its output voltage changes suddenly in the vicinity of the stoichiometric air-fuel ratio. This characteristic is used to detect the oxygen concentration in the exhaust gas and provide feedback to the computer for control of the air-fuel ratio.
When the air-fuel ratio becomes LEAN, the oxygen concentration in the exhaust increases and the oxygen sensor informs the engine ECU of the LEAN condition (small electromotive force: 0 V).
When the air-fuel ratio is RICHER than the stoichiometric air-fuel ratio the oxygen concentration in the exhaust gas in reduced and the oxygen sensor informs the engine ECU of the RICH condition (large electromotive force: 1V). The engine ECU judges by the electromotive force from the oxygen sensor whether the air-fuel ratio is RICH or LEAN and controls the injection time accordingly. However, if malfunction of the oxygen sensor causes output of abnormal electromotive force, the engine ECU is unable to perform accurate air-fuel ratio control.
The main heated oxygen sensors include a heater which heats the zirconia element. The heater is controlled by the engine ECU. When the intake air volume is low (the temp. of the exhaust gas is low) current flows to the heater to heat the sensor for accurate oxygen concentration detection.



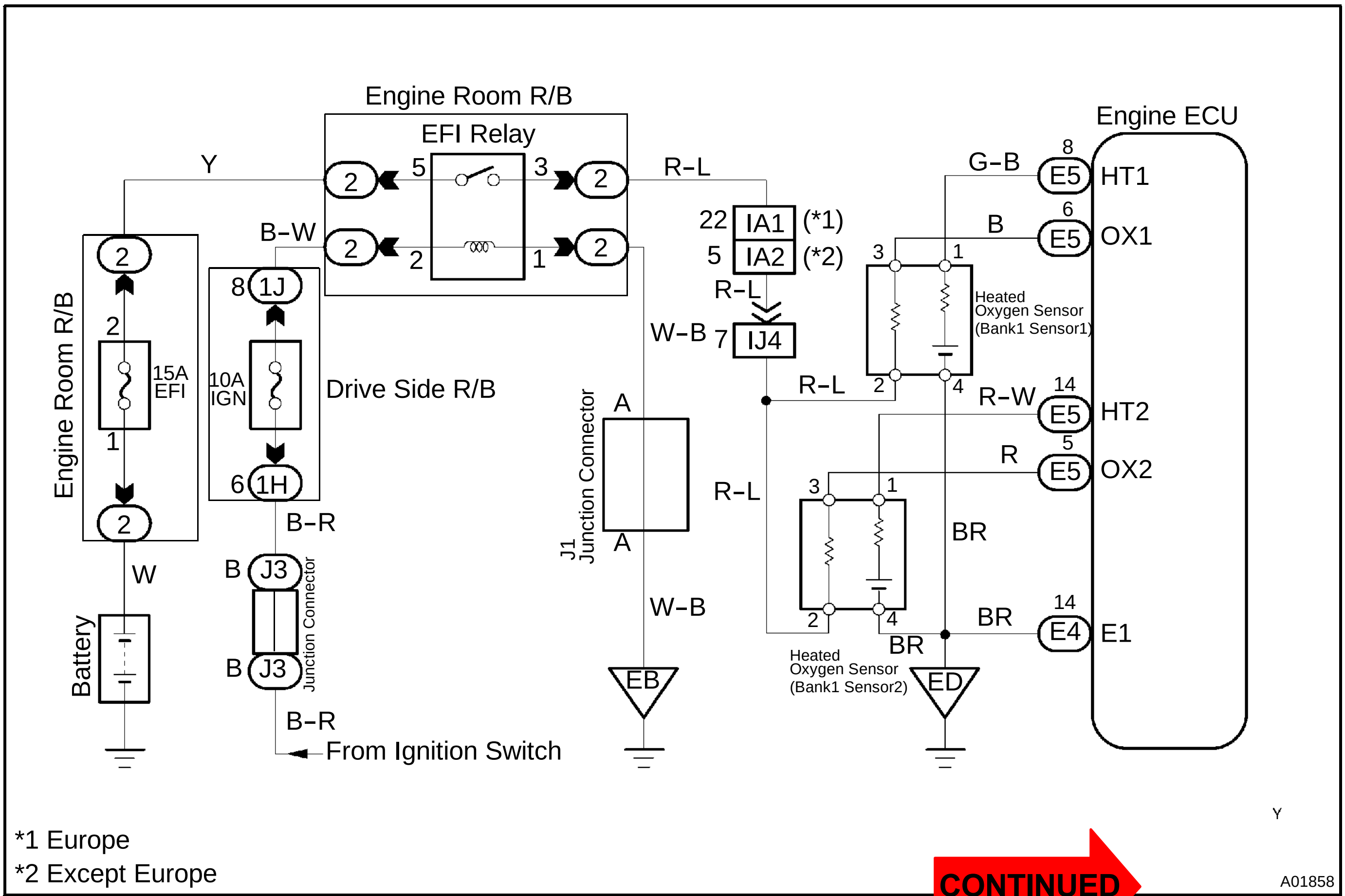
DTC No.	DTC Detecting Condition	Trouble Area
P0130/21, 28	At normal driving speed below 100km/h (60 mph) and engine speed is above 1,500 rpm amplitude of oxygen sensor signal is reduced to between 0.35 - 0.70 V continuosly for 60 sec. or more.(2 trip detection logic)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor • Engine ECU

CONTINUED

HINT:

- Bank 1 refers to the bank that includes cylinder No.1.
- Sensor 1 is the oxygen sensor of front side.
- The heated oxygen sensor's output voltage and the short–term fuel trim value can be read using the hand–held tester.
- If voltage output of heated oxygen sensor is 0 V, heated oxygen sensor circuit sensor circuit may be open or short.

WIRING DIAGRAM



*1 Europe
*2 Except Europe

CONTINUED

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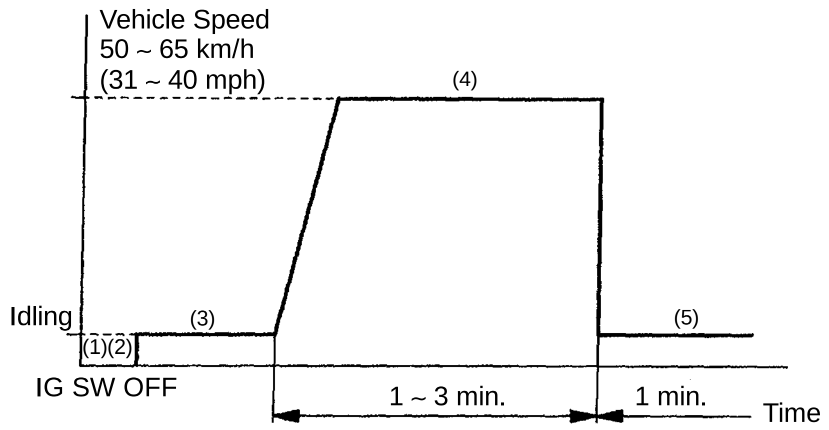
CONFIRMATION DRIVING PATTERN



(1) Connect the hand–held tester to the DLC3.
(2) Switch the hand–held tester from normal mode to check (test) mode (See page DI–77).
(3) Start the engine and warm it up with all accessory switches OFF.
(4) Drive the vehicle at 50 ~ 65 km/h (31 ~ 40 mph) for 1 ~ 3 min. to warm up the heated oxygen sensor.
(5) Let the engine idle for 1 min.

HINT:
- If you have no hand–held tester, do step (1) to (5) again.
- If a malfunction exists, the check engine warning (CHK ENG) will light up during step (5).

NOTICE:
If the conditions in this test are not strictly followed, detection of the malfunction will not be possible. If you do not have a hand–held tester, turn the ignition switch OFF after performing steps (3) to (5), them perform steps (3) to (5) again.

CONTINUED

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INSPECTION PROCEDURE

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

When using hand–held tester

1	Check for heated oxygen sensor data.

PREPARATION:
(a) Connect the hand–held tester to the DLC3.
(b) Warm up engine to normal operating temp.

CHECK:
Read the heated oxygen sensor output voltage and short–term fuel trim.

RESULT:

Pattern	Heated oxygen sensor output voltage	Short–term fuel trim
1	Lean condition (Changes at 0.7 V or less)	Changes at about + 20 %
2	RIch condition (Changes at 0.35 V or more)	Changes at about – 20 %
3	Except 1 and 2	

1, 2 → Check fuel trim system (See page DI–129).

3 ↓

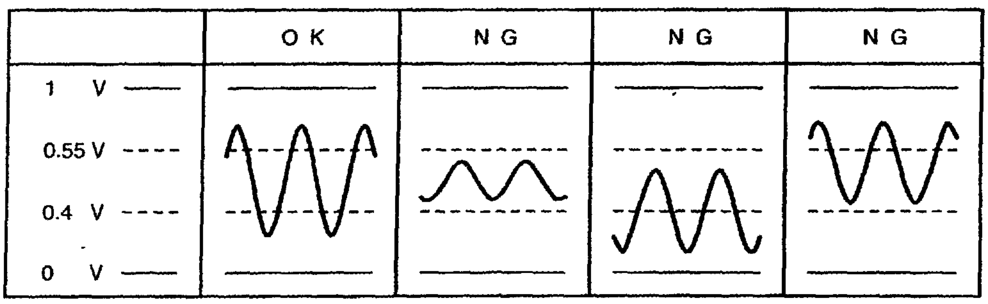
2	Check the output voltage of heated oxygen sensor during idling.

PREPARATION:
Warm up the heated oxygen sensor the engine at 2,500 rpm for approx. 90 sec.

CHECK:
Use the hand–held tester read the output voltage of the heated oxygen sensor during idling.

OK:

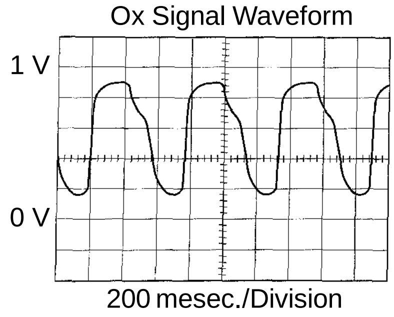
Heated oxygen sensor output voltage:
Alternates repeatedly between approx. 0.35 V and 0.7 V .



P18349

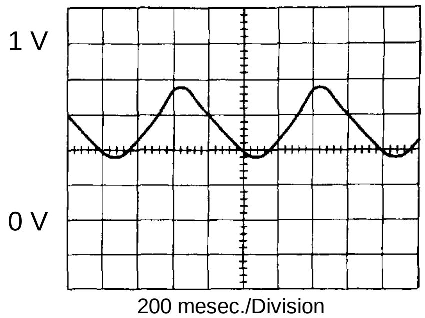
CONTINUED

Refernce INSPECTION USING OSCILLOSCOPE



S With the engine racing (4,000 rpm) measure waveform between terminals OX1 and E1 of engine ECU.

HINT:
The correct wavefrom is as shown oscillating between approx. 0.1 V and 0.9 V.



If the oxygen sensor has deteriorated, the amplitude of the voltage will be reduced as shown on the left.

OK → **Perform confirmation driving pattern.**

NG ↓

3	Check for open and short in harness and connector between engine ECU and heated oxygen sensor (See page IN–21)

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

NG ↓

Replace heated oxygen sensor.

CONTINUED

When not using hand-held tester

1	Are these any other codes (besides code P0130/21,28) being output.

YES → Go to referents DTC chart (See page DI-119)

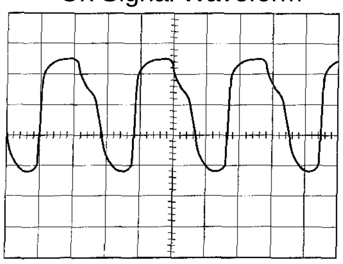
NO

Replace heated oxygen sensor.

Refernce INSPECTION USING OSCILLOSCOPE

Ox Signal Waveform

1 V



0 V

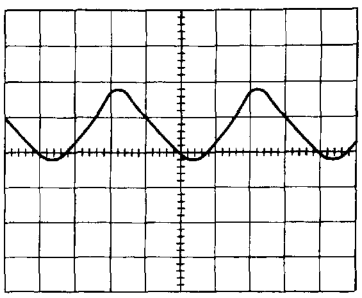
200 mesec./Division

FI6514

- With the engine racing (4,000 rpm) measure waveform between terminals OX1 and E1 of engine ECU.

HINT:
The correct wavefrom is as shown oscillating between approx. 0.1 V and 0.9 V.

1 V



0 V

200 mesec./Division

A02542

If the oxygen sensor has deteriorated, the amplitude of the voltage will be reduced as shown on the left.

DI1IG–01

DTC	P0135/21,28	Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)(2RZ–FE)

DTC	P0141/27,29	Heated Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)(2RZ–FE)

CIRCUIT DESCRIPTION

Refer to DTC P0130/21,28 (Oxygen Sensor circuit Malfunction (Bank1)) on page DI–119.

DTC No.	DTC Detecting Condition	Trouble Area
P0135/21,28 P0141/27,29	Open or short in heater circuit of oxygen sensor for 0.5. or more	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • Engine ECU

HINT:

- Sensor 1 refers to the sensor closer to the engine body.
- Sensor 2 refers to the sensor farther away from the engine body.

WIRING DIAGRAM

Refer to DTC P0130/21,28 (Oxygen Sensor Circuit Malfunction) on page DI–119.

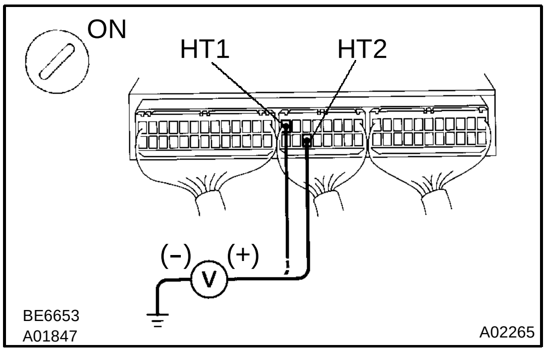
INSPECTION PROCEDURE

HINT:

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

CONTINUED

1	**Check voltage between terminals HT1, HT2 of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment (See page FI-61).

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminals HT1, HT2 engine ECU connector and body ground.

HINT:

- Connect terminal HT1 to bank 1 sensor 1(Fr 02 sensor).
- Connect terminal HT2 to bank 1 sensor 2(Rr 02 sensor).

OK:

Voltage: 9 ~ 14 V

OK	**Check and replace engine ECU** **(See page IN-21).**

NG

2	**Check resistance of heated oxygen sensor heater (See page FI-59).**

NG	**Replace heated oxygen sensor.**

OK

Check and repair harness or connector between EFI main relay (Marking: EFI) and heated oxygen sensor and engine ECU. (See page IN-21).

DTC	P0136/27,29	Heated Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2) (2RZ-FE)

CIRCUIT DESCRIPTION

Refer to DTC P0130/21,28 (Oxygen Sensor Circuit Malfunction (Bank1) on page DI-119.

DTC No.	DDTC Detecting Condition	Trouble Area
P0136/27,29	Oxygen sensor (sensor 1) signal is 0.45 V or more and oxygen sensor (Bank 2) signal is 0.45 V or less under conditions (a) and (b): (2 trip detection logic) (a) Water temp.: 80°C (176°F) or more (b) Accelerator pedal: Full depressed for 2 sec. or more	• Open or short in heated oxygen sensor • Heated oxygen sensor • Engine ECU

HINT:
Sensor 2 refers to the sensor farther away from the engine body.

WIRING DIAGRAM

Refer to DTC P0130/21, 28 (Oxygen Sensor circuit Malfunction) on page DI-119.

INSPECTION PROCEDURE

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

When using hand-held tester

1	Are there any other codes (besides DTC P0136/27,29) being output?

YES → **Go to relevant DTC chart.**

NO

2	Check for open and short in harness and connector between engine ECU and heated oxygen sensor (See page IN-21).

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

OK

CONTINUED

3	Check the output voltage of heated oxygen sensor (bank 1 sensor 2).

PREPARATION:

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

(b) Warm up engine to normal operating temp.

CHECK:

Read voltage output of heated oxygen sensor (bank 1 sensor 2) when engine suddenly raced.

HINT:

Perform quick racing to 4,000 rpm 3 min. using accelerator pedal.

OK:

Heated oxygen sensor output voltage: Alternates from 0.4 V or less to 0.5 V or more.

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

NG

Replace heated oxygen sensor (bank 1 sensor 2).

When not using hand–held tester

1	Are these any other codes (besides code DTC P0136/27,29) being output.

YES → **Go to relerant DTC chart.**

NO

Replace heated oxygen sensor (bank 1 sensor 2).

CLICK HERE TO VIEW CHAPTER INDEX

DTC	P0171/25	System too Lean (Fuel Trim)

CIRCUIT DESCRIPTION

Fuel trim refers to the feedback compensation value compared against 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 heated oxygen sensor indicates whether the air-fuel ratio is RICH or LEAN compared to the ideal theoretical value, triggering a reduction in fuel volume if the air-fuel ratio is rich, and an increase in fuel volume if it is lean.
Long-term fuel trim is overall fuel compensation carried out long-term to compensate for continual deviation of the short-term fuel trim form the central value due to individual engine differences, wear over time and changes in the usage environment.
If both the short-term fuel trim and long-term fuel trim are LEAN or RICH beyond a certain value, it is detected as a malfunction and the check engine warning (CHK ENG) lights up.

DTC No.	DTC Detecting Condition	Trouble Area
P0171/25	Oxygen sensor voltage is 0.45 V or less (lean) for 90 sec. under conditions (a) and (b), (c): (2 trip detection logic) (a) Water temp: 70°C (158°F) or more (b) Engine speed: 1,500 rpm or more (c) Vehicle speed: 100 km/h or less	• Air intake (hose loose) • Fuel line pressure • Injector blockage • Open or short in oxygen sensor circuit • Oxygen sensor malfunction • Air flow meter • Water temp. sensor

HINT:
- If the total of the short-term fuel trim value and long-term fuel trim value is within ± 25 %, the system is functioning normally.

INSPECTION PROCEDURE

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

When using hand-held tester

1	Check air induction system (See page FI-1).

NG → **Repair or replace.**

OK

CONTINUED

2 Check for heated oxygen sensor data.

PREPARATION:

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

(b) Warm up engine to normal operating temp.

CHECK:

Read the heated oxygen sensor output voltage and short–term fuel trim.

HINT:

Read the values for the same bank.

RESULT:

Pattern	Heated oxygen sensor output voltage	Short–term fuel trim
1	Lean condition (Changes at 0.55 V or less)	Changes at about + 20 %
2	RIch condition (Changes at 0.4 V or more)	Changes at about – 20 %
3	Except 1 and 2	

3 → **Check for heated oxygen sensor** **(See page FI–59).**

1, 2

3 Check fuel pressure (See page FI–14).

NG → **Check and repair fuel pump, pressure regulator, fuel pipe line and filter** **(See page FI–1).**

OK

4 Check injector injection (See page FI–20).

NG → **Replace injector.**

OK

CONTINUED

5	Check air flow meter and water temp. sensor (See page FI–29).

NG → Repair or replace.

OK

6	Check for spark and ignition (See page IG–1).

NG → Repair or replace.

OK

Check and replace engine ECU
(See page IN–21).

When not using hand–held tester

1	Check air induction system (See page FI–1).

NG → Repair or replace.

OK

2	Check fuel pressure (See page FI–14).

NG → Check and repair fuel pump, fuel pipe line and filter (See page FI–1)

OK

CONTINUED

3	Check injector injection (See page FI-20).

NG → Replace injector.

OK

4	Check air flow meter (See page FI-29).

NG → Repair or replace.

OK

5	Check water temp. sensor (See page FI-55).

NG → Repair or replace.

OK

6	Check for spark and ignition (See page IG-1).

NG → Repair or replace.

OK

CONTINUED

7	Does malfunction disappear when a good oxygen sensor installed.

YES → Replace oxygen sensor.

NO

Check and replace engine ECU
(See page IN–21).

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DI1IJ-01

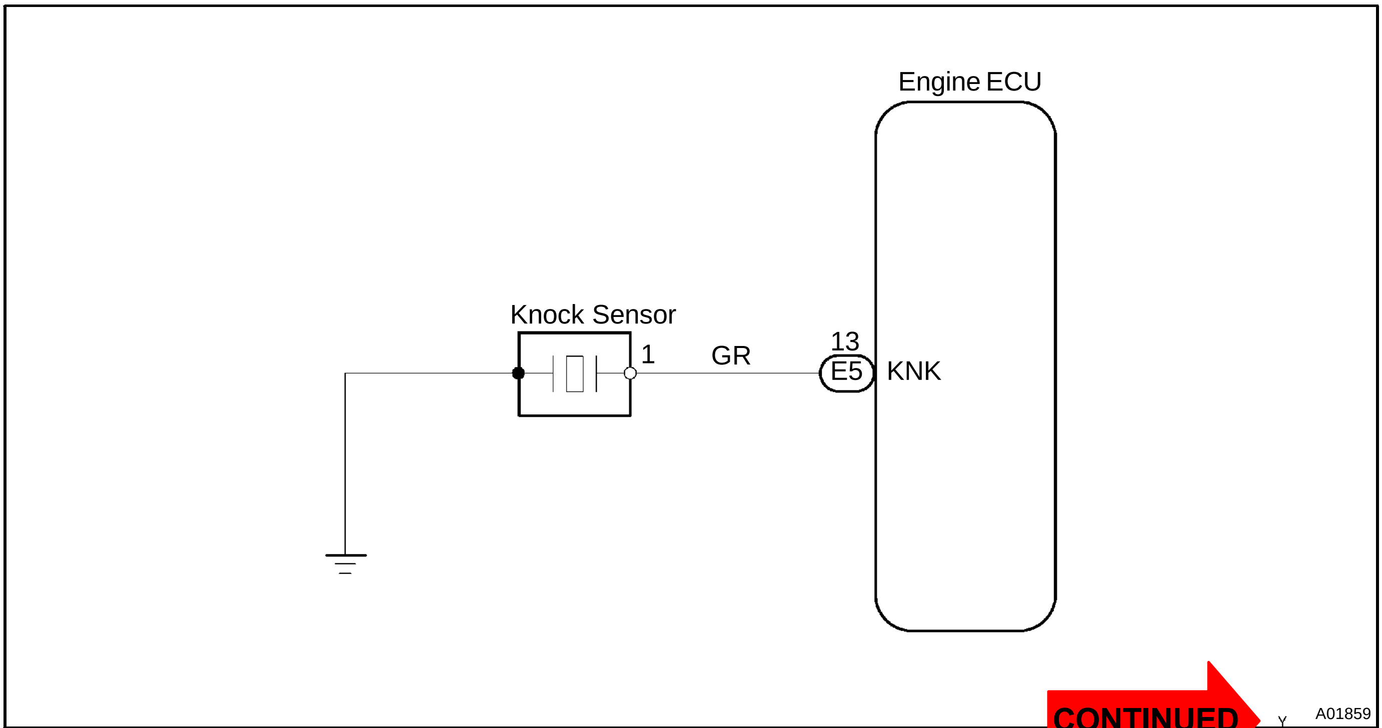
DTC	P0325/52	Knock Sensor Circuit Malfunction

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. If 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 1,700 rpm and 5,200 rpm	• Open or short in knock sensor circuit • Knock sensor (looseness) • Engine ECU

WIRING DIAGRAM

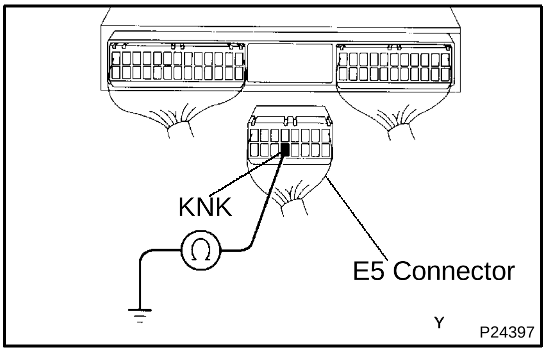


CONTINUED

INSPECTION PROCEDURE

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

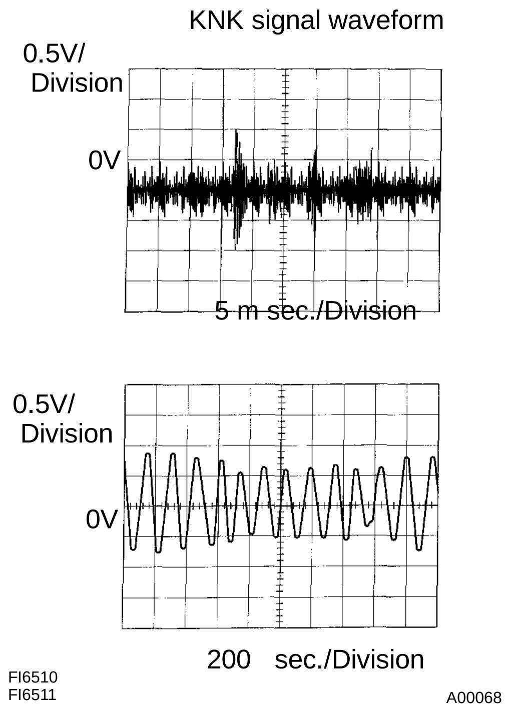
1 Check continuity between terminal KNK of engine ECU connector and body ground.



PREPARATION:
(a) Remove the glove compartment (See page FI–61).
(b) Disconnect the E5 connector of engine ECU.

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

OK:
Resistance: 1 MΩ or higher



Reference: INSPECTION USING OSCILLOSCOPE
- With the engine racing (4,000 rpm) measure between terminal KNK of engine ECU and body ground.

HINT:
The correct waveform is as shown.

- Spread the time on the horizontal axis, and confirm that period of the wave is 151 μ sec.
  (Normal mode vibration frequency of knock sensor: 6.6 kHz).

HINT:
If normal mode vibration frequency is not 6.6 kHz the sensor is malfunctioning.

OK → Go to step 3 .

NG

CONTINUED

2	Check knock sensor (See page FI-58).

NG → Replace knock sensor.

OK

3	Check for open and short in harness and connector between engine ECU and knock sensor (See page IN-21).

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-21).

DI1IK–01

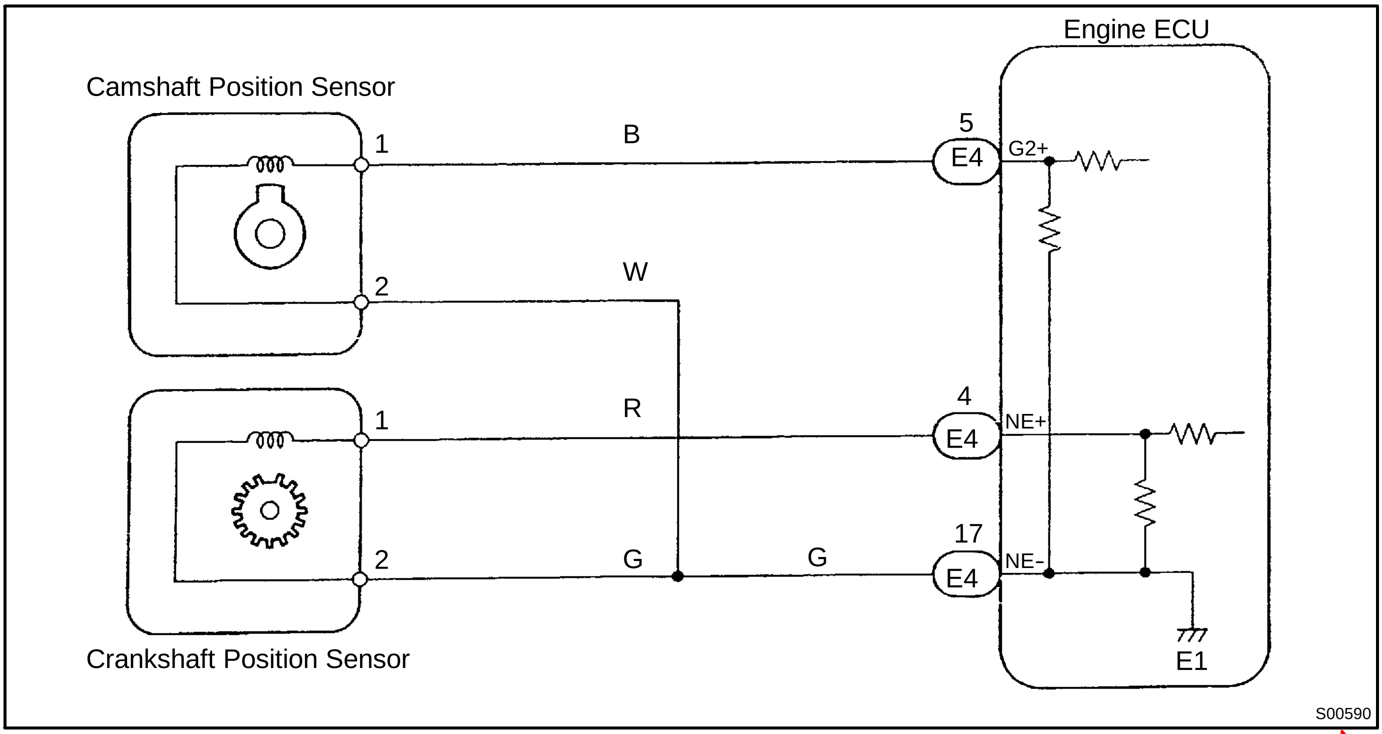
DTC	P0335/12	Crankshaft Position Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

Crankshaft position sensor (NE signal) consist of a signal plate and pick up coil.
The NE signal plate has 34 teeth and is mounted on the crankshaft. The NE signal sensor generates 34 signals of every engine revolution. The engine ECU detects the standard crankshaft angle based on the G2+ signals, and the actual crankshaft angle the engine speed by the NE signals.

DTC No.	DTC Detecting Condition	Trouble Area
P0335/12	No crankshaft position sensor signal to engine ECU during cranking	$ Open or short in crankshaft position sensor circuit. $ Crankshaft position sensor $ Starter $ Engine ECU

WIRING DIAGRAM



CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX
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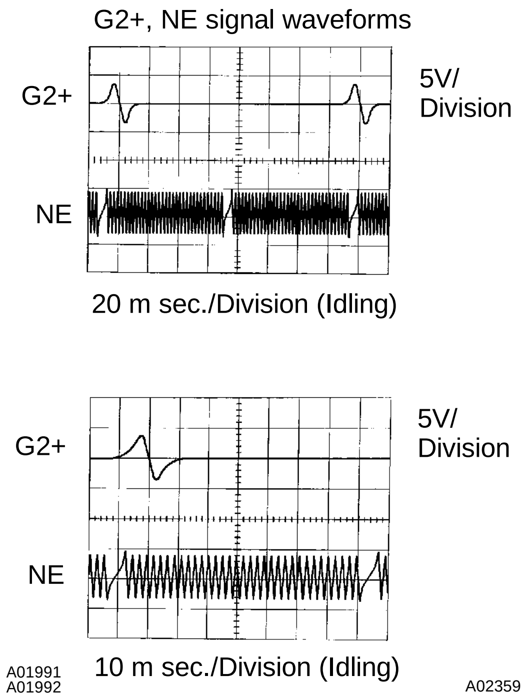
INSPECTION PROCEDURE

HINT:
- Read freed frame data using hand-held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air-fuel ratio lean or rich, etc. at the time of the malfunction.
- Perfrom troubleshooting of DTC P0335/12 first. If no trouble is found, troubleshoot the following mechanical system.

1	Check resistance of crankshaft position sensor (See page IG-12).



Reference: INSPECTION USING OSCILLOSCOPE
During cranking or idling, check between terminals G2+ and NE-, NE+ and NE- of engine ECU
HINT:
The correct waveforms are as shown.

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-21).

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

CONTINUED

OK

3	Inspect sensor installation and teeth of signal plate.

NG → Tighten the sensor. Replace signal plate.

OK ↓

Check and replace engine ECU
(See page IN–21).

DTC	P0340/12	Camshaft Position Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

Camshaft position sensor (G2+ signal) consist of a signal plate and pick up coil. The G2+ signal plate has one tooth on its outer circumference and is mounted on the camshaft.
When the camshafts rotate, the protrusion on the signal plate and the air gap on the pick up coil change, causing fluctuations in the magnetic field and generating an electromotive force in the pick up 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+ signals 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 in NE– circuit+	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Starter • Engine ECU

WIRING DIAGRAM

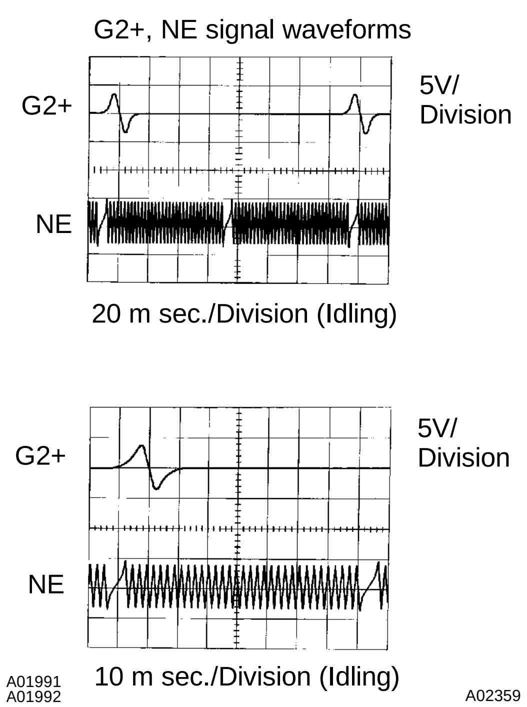
Refer to DTC P0335/12 on page DI–137 for the WIRING DIAGRAM.

CONTINUED

INSPECTION PROCEDURE

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

1	**Check resistance of camshaft position sensor (Signal generator)** **(See page IG–8).**



Reference: INSPECTION USING OSCILLOSCOPE
During cranking or idling, check between terminals G2+ and NE–, NE+ and NE– of engine ECU
HINT:
The correct waveform are as shown.

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–21).**

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

CONTINUED

OK

CLICK HERE TO VIEW CHAPTER INDEX

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3	Inspect sensor installation.

NG → Tighten the sensor.

OK

Check and replace engine ECU
(See page IN–21).

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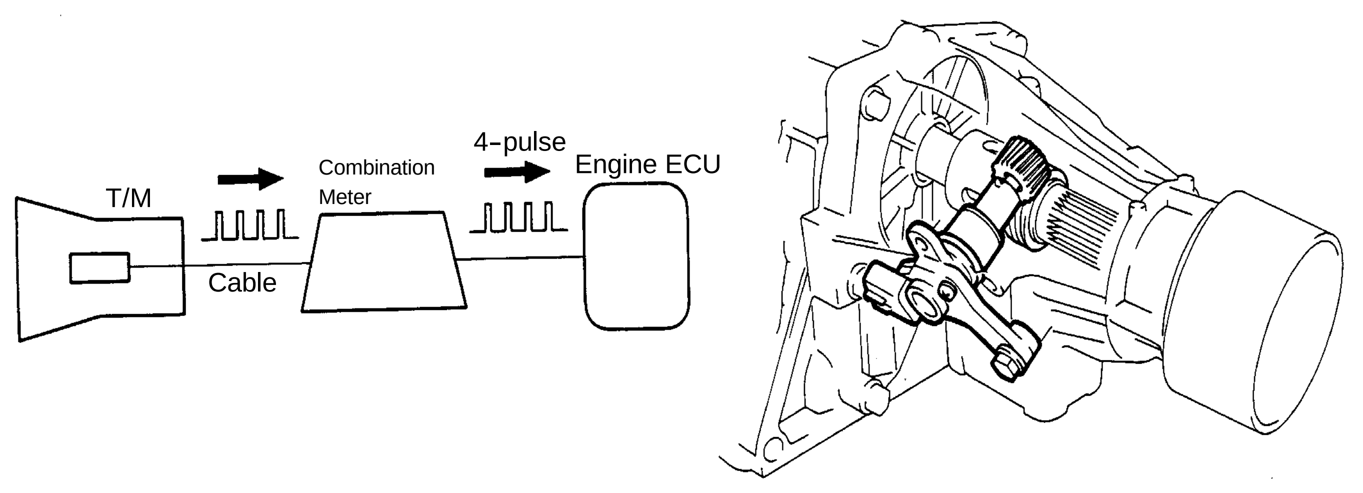
DI1IM-01

DTC	P0500/42	Vehicle Speed Sensor Malfunction

CIRCUIT DESCRIPTION

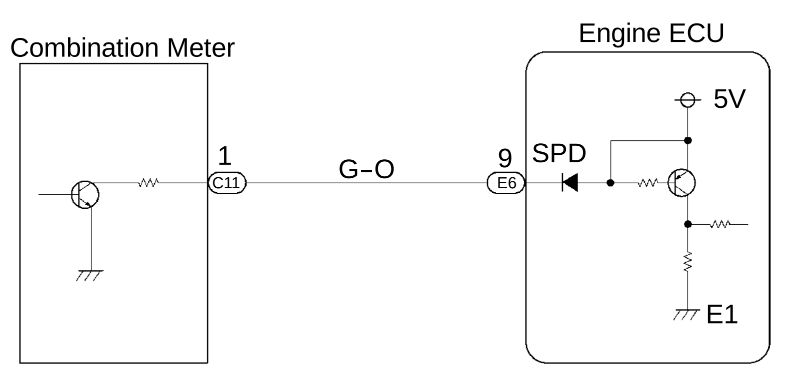
The vehicle speed sensor outputs a 4-pulse signal for every revolution of the rotor shaft, which is rotated by the transmission output shaft via the driven gear. After this signal is converted into a more precise rectangular waveform by the waveform shaping circuit inside the combination meter, it is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



A00433

DTC No.	DTC Detecting Condition	Trouble Area
P0500/42	No vehicle speed sensor signal to engine ECU during vehicle driving	• Combination meter • Open or short in vehicle speed sensor circuit • Engine ECU • Vehicle speed sensor

WIRING DIAGRAM



A02283

CONTINUED

INSPECTION PROCEDURE

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

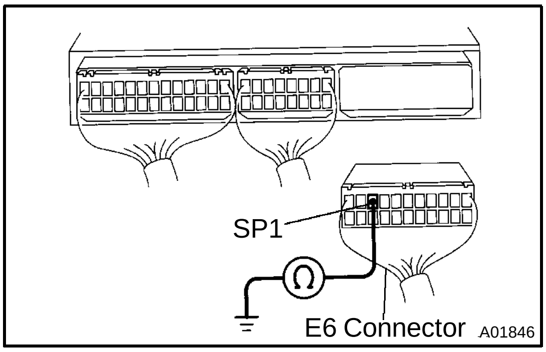
1	Check operation of speedometer.

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** **(See Pub. No. RM585E)**

OK

2	Check for short in harness and connector between terminal SPD of engine ECU and body ground.



PREPARATION:
(a) Remove the glove compartment (See page FI–61).
(b) Disconnect the E6 engine ECU connector.

CHECK:
Check continuity between terminal SPD of engine ECU and body ground.

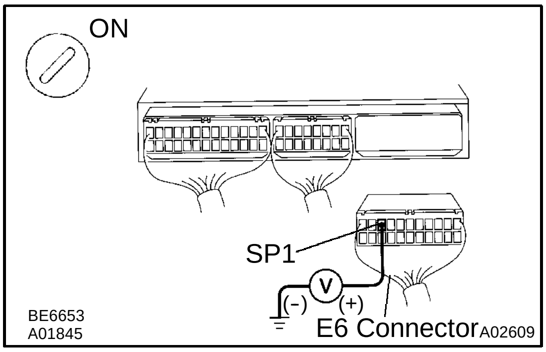
OK:
NO continuity (1MΩ. or higher)

NG → **Check and repair harness or connector.**

OK

CONTINUED

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



PREPARATION:

(a) Remove the glove compartment (See page FI–61).

(b) Disconnect the E6 engine ECU connector.

(c) Turn the ignition switch ON.

CHECK:

Measure voltage between terminal SPD of engine ECU and body ground

OK:

Voltage: 9 – 14 V

NG → **Check for open in harness and connector between J/B and engine ECU****(See page IN–21)**

OK ↓

4	Check for open in harness and connector between J/B and combination meter (See page IN–21)

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

OK ↓

Check and replace engine ECU
(See page IN–21).

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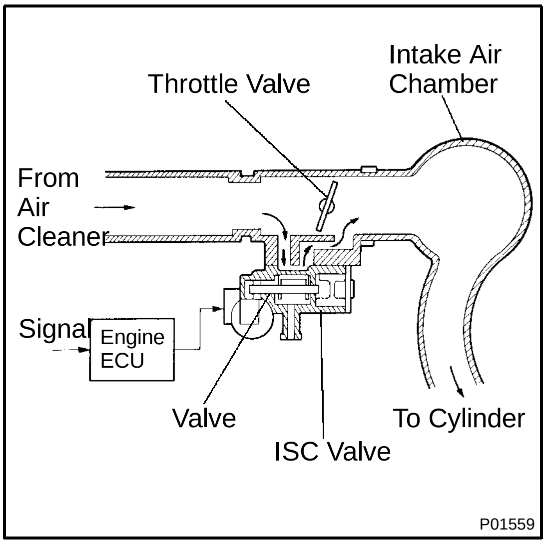
DI1IN-01

DTC	P0505/33	Idle Control System Malfunction

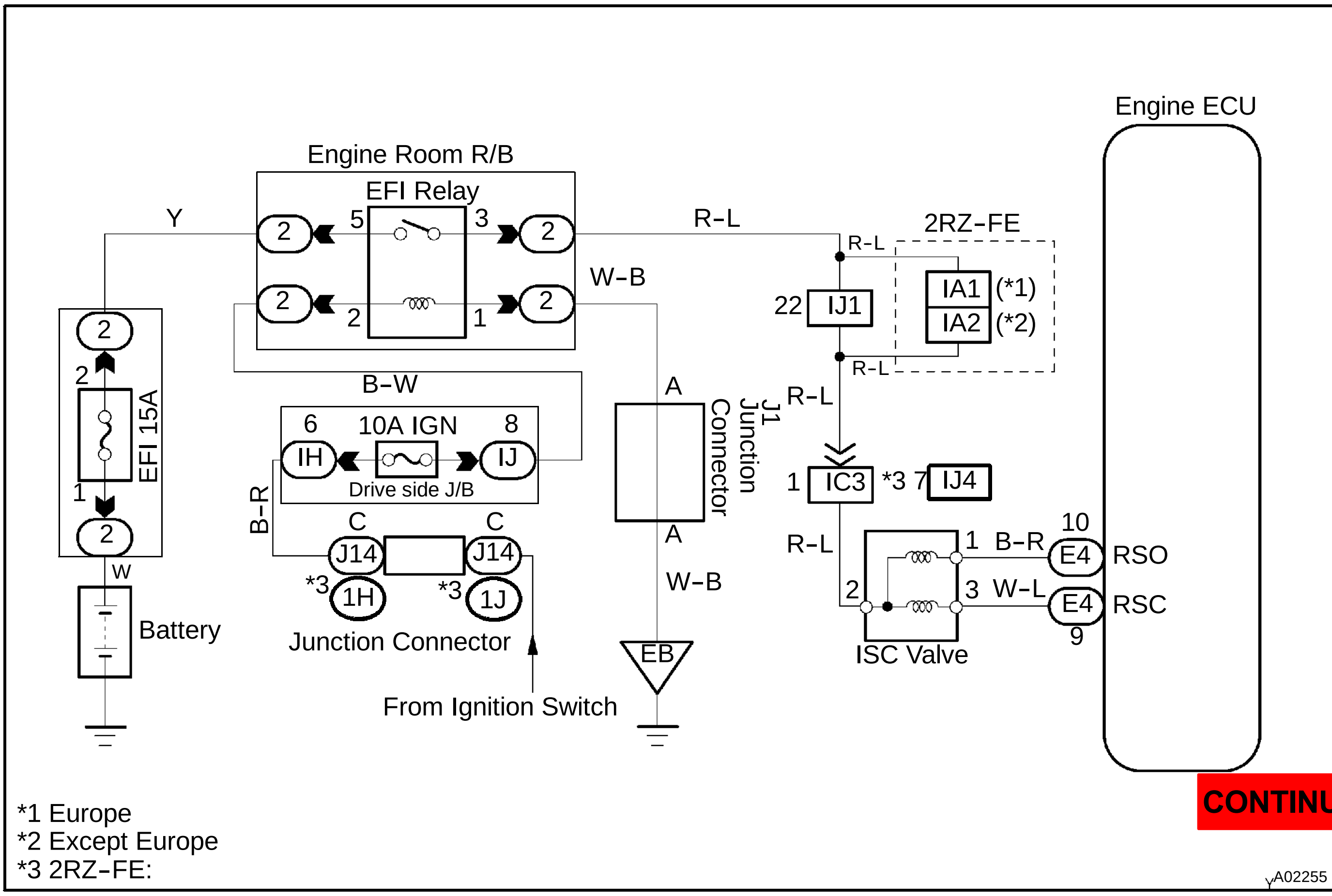
CIRCUIT DESCRIPTION



The rotary solenoid type ISC valve is located in front of the intake air chamber and intake air bypassing the throttle valve is directed to the ISC valve through a passage.
In this way the intake air volume bypassing the throttle valve is regulated, controlling the engine speed.
The engine ECU operates only the ISC valve to perform idle-up and provide feedback for the target idling speed.

DTC No.	DTC Detecting Condition	Trouble Area
P0505/33	Open or short in ISC valve circuit.	• Open or short in ISC valve circuit • ISC valve • Engine ECU

WIRING DIAGRAM



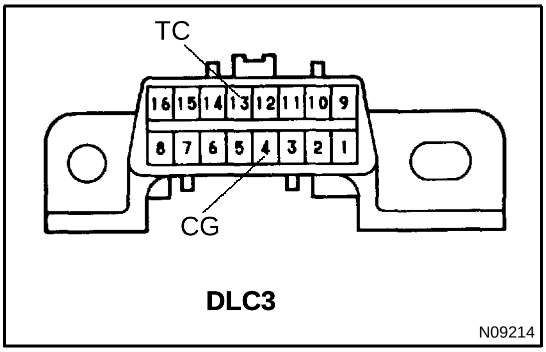
CONTINUED

INSPECTION PROCEDURE

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

When using hand–held tester

1	Check engine idle speed.



PREPARATION:
(a) Warm up engine to normal operating temp.
(b) Switch off all accessories.
(c) Switch off air conditioning.
(d) Shift transmission into ”N” or neutral position.
(e) Connect hand–held tester to DLC3 on the vehicle.
(f) Using SST connect terminals 13(TC) and 4(CG) of the DLC3.
SST 09843 – 18020

CHECK:
Check the difference of engine speed between the ones less than 5 sec. and more than 5 sec. after connecting terminals B(TC) and 4(CG) of the DLC3.
HINT:
Read the values for the same bank.

OK:
Difference of engine speed: More than 100 rpm

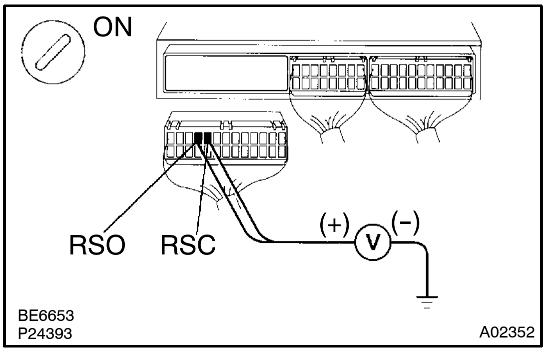
OK → **Check for intermittent problems** **(See page DI–80).**

NG

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

2	**Check voltage between terminals RSO, RSC of engine ECU connector and body ground.**



PREPARATION:

(a) Remove glove compartment. (See page FI-61).

(b) Disconnect the E4 connector of engine ECU.

(c) Turn ignition switch ON.

CHECK:

Measure voltage between terminals RSO, RSC of engine ECU connector and body ground,

OK:

Voltage: 9 ~ 14 V

OK → **Go to step 4.**

NG

3	**Check ISC valve (See page FI-48).**

NG → **Replace ISC valve.**

OK

Check for open and short in harness and connector between E/G Room J/B and ISC valve, ISC valve and ECU (See page IN-21).

4	**Check operation of the ISC valve (See page FI-48).**

NG → **Repair or replace ISC valve.**

CONTINUED

OK

CLICK HERE TO VIEW CHAPTER INDEX

5	Check the blockage of ISC valve and the passage to bypass the throttle valve.

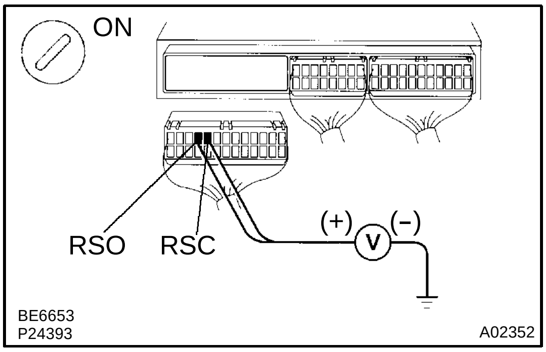
NG → **Repair or replace ISC valve.**

OK

Check and replace engine ECU **(See page IN–21).**

When not using hand–held tester

1	Check voltage between terminals RSO, RSC of engine ECU and body ground.



PREPARATION:

(a) Remove glove compartment. **(See page FI – 61).**

(b) Disconnect the E4 connector of engine ECU.

(c) Turn ignition switch ON.

CHECK:

Measure voltage between terminals RSO, RSC of engine ECU connector and body ground,

OK:

Voltage: 9 ~ 14 V

OK → **Go to step 5.**

NG

2	Check ISC valve.

NG → **Replace ISC valve.**

OK

Check for open and short in harness and connector between J/B and ISC valve and engine ECU **(See page IN–21).**

CONTINUED

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3	Check operation of the ISC valve.

NG → Replace ISC valve.

OK

4	Check the blockage of ISC valve and the passage to bypass the throttle valve.

NG → Repair or replace ISC valve.

OK

Check and replace engine ECU
(See page IN–21).

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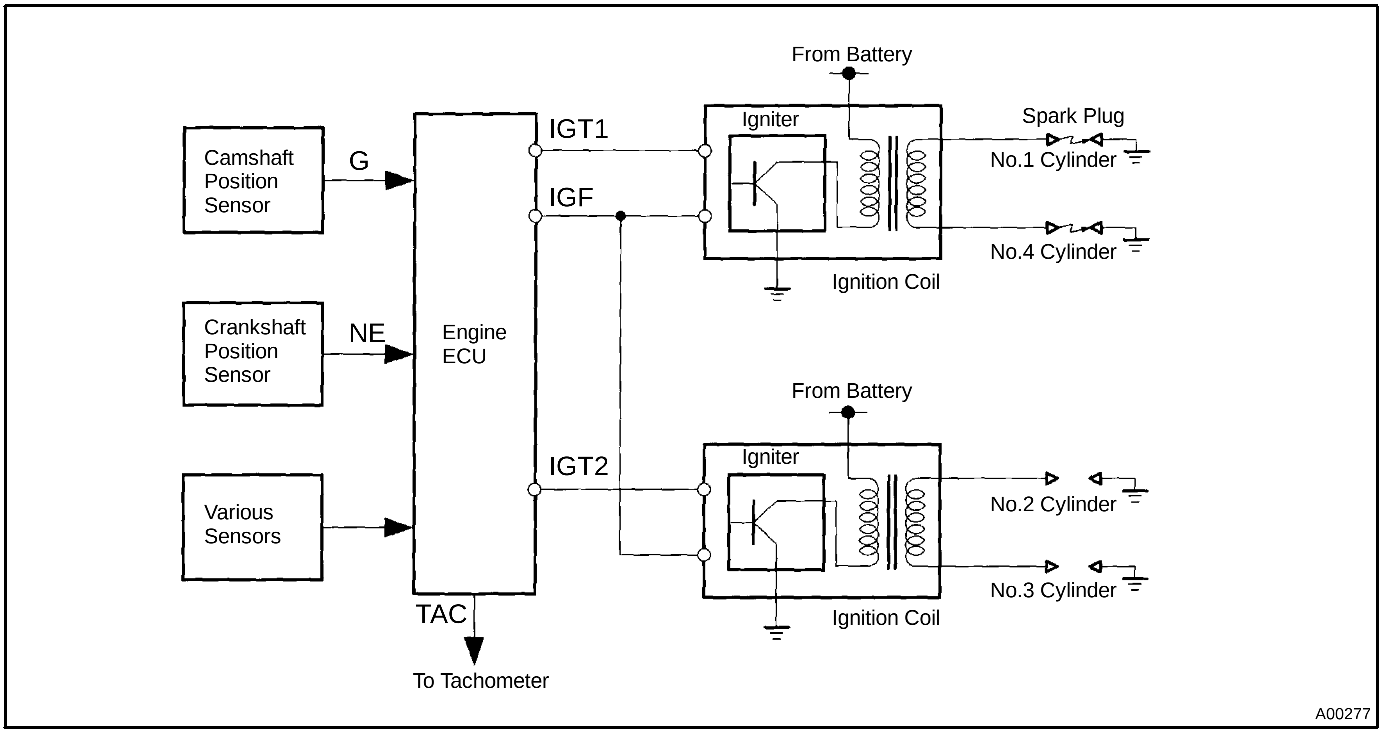
DI1IO–01

DTC	P1300/14,15	Ignition Circuit Malfunction (Bank 1)

DTC	P1310/14,15	Ignition Circuit Malfunction (Bank 2)

CIRCUIT DESCRIPTION

A 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 1 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 2 spark plugs. The sparks of the 2 spark plugs pass simultaneously from the center electrode to the ground electrode.
The engine ECU determines ignition timing and outputs the ignition signals (IGT) for each cylinder. Based on IGT signals, the power transistors in the igniter cuts off the current to the primary coil in the ignition coil is supplied simultaneously to the 2 spark plugs via the high–tension cords that are connected to the both ends of the secondary coil. 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
P1300/14,15 P1310/14,15	No IGF signal to engine ECU while engine is running	• Open or short in IGF or IGT circuit from ignition coil to engine ECU. • Ignition coil • engine ECU

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

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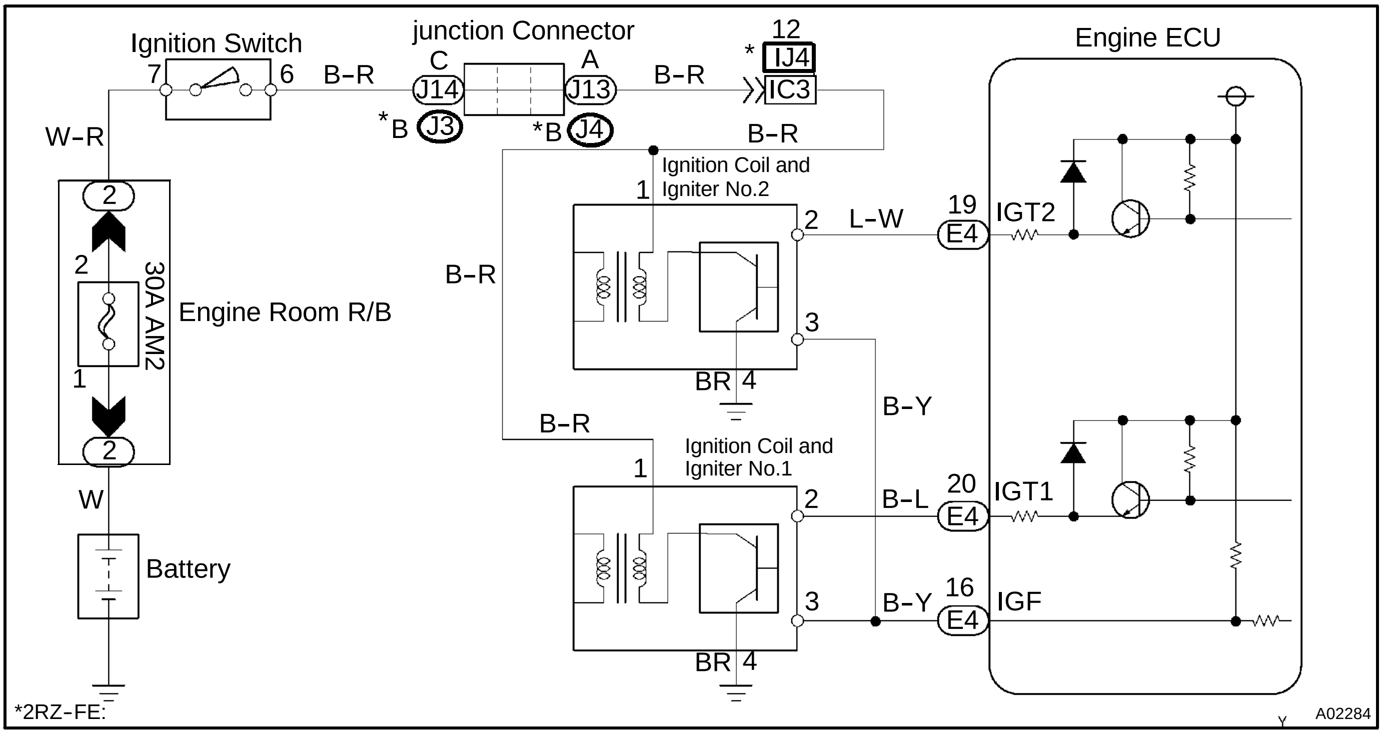
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freed frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.
DTC P1300/14,15 is for the ignition circuit of No.1 and No.4 cylinders.
DTC P1310/14,15 is for the ignition circuit of No.2 and No.3 cylinders.

1	**Check spark plug and spark (See page IG–1).**

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–21).**

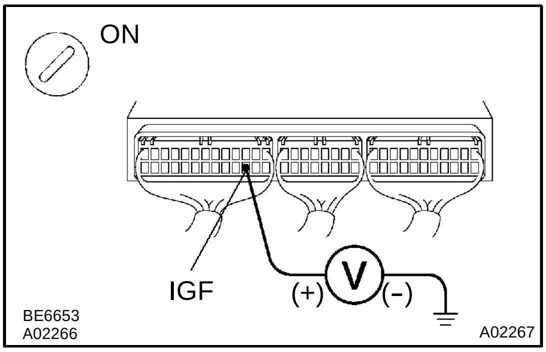
NG → **Repair or replace harness or connector.**

OK

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

3	Disconnect ignition coil (w/ igniter) connector and check voltage between terminal IGF of engine ECU connector and body ground.



PREPARATION:

(a) Disconnect the ignition coil (w/ igniter) connector.

(b) Remove the glove compartment.

(c) Turn ignition switch ON.

CHECK:

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

OK:

Voltage: 4.5 ~ 5.5 V

OK → **Replace ignition coil (w/ igniter).**

NG ↓

Check and replace ECU **(See page IN–21).**

4	Check for open and short in harness and connector in IGT1 and IGT2 signal circuit between engine ECU and ignition coil (w/ igniter) (See page IN–21).

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

OK ↓

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

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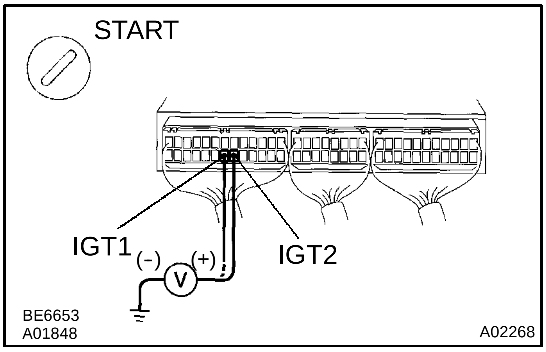
5 Check voltage between terminals IGT1 and IGT2 of engine ECU connector and body ground.



PREPARATION:

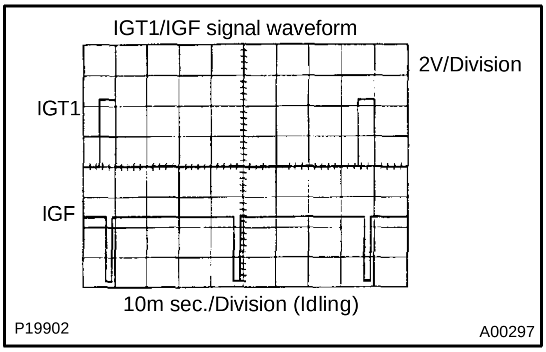
Remove the grove compartment.

CHECK:

Measure voltage between terminals IGT1 and IGT2 of engine ECU connector and body ground when engine is cranked.

OK:

Voltage: More than 0.1 V and less than 4.5 V



Reference: INSPECTION USING OSCILLOSCOPE

During idling, check waveform between terminals IGT1 and E1 of engine ECU.

HINT:

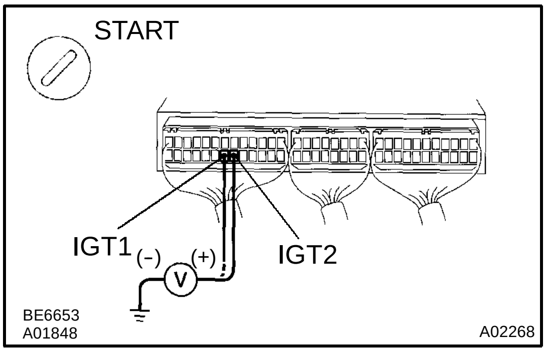
The correct waveform are as shown.

IGT2 signal waveform is same as the IGT1 signal waveform.

NG → **Check and replace engine ECU** **(See page IN-21).**

OK ↓

6 Disconnect ignition coil (w/ igniter) connector and check voltage between terminals IGT1 and IGT2 of engine ECU connector and body ground.



PREPARATION:

(a) Disconnect the ignition coil (w/ igniter) connector.

(b) Remove the glove compartment.

CHECK:

Measure voltage between terminals IGT1 and IGT2 of engine ECU connector and body ground when engine is cranked.

OK:

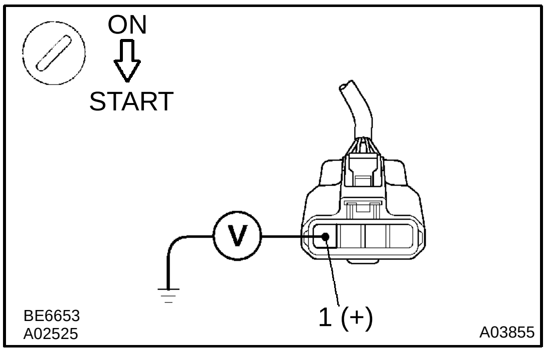
Voltage: More than 0.1 V and less than 4.5 V

NG → **Check and replace engine ECU** **(See page IN-21).**

OK ↓

CONTINUED

7	**Check ignition coil (w/ igniter) power source circuit.**



PREPARATION:

Disconnect the ignition coil (w/ igniter) with igniter connector.

CHECK:

Measure voltage between terminal 1 of ignition coil (w/ igniter)connector and body ground, when ignition switch is turned to "ON" and "STA" position.

OK:

Voltage: 9 ~ 14 V

NG → **Repair ignition coil (w/ igniter) power source circuit.**

OK

8	**Check for open and short in harness and connector between ignition switch and ignition coil (w/ igniter)** **(See page IN-21).**

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

OK

9	**Check ignition coil (w/ igniter)** **(See page IN-21).**

NG → **Replace ignition coil (w/ igniter).**

OK

CONTINUED

10	Check EFI main relay (Marking: EFI) (See page IN–21).

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

OK

Replace ignition coil (w/ igniter).

CLICK HERE TO VIEW CHAPTER INDEX

DI1IP–01

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

CIRCUIT DESCRIPTION

Refer to DTC P0335/12 (Crankshaft Position Sensor Circuit Malfunction) on page DI–137.

DTC No.	DTC Detecting Condition	Trouble Area
P1335/13	No crankshaft position sensor signal to engine ECU with engine speed 1,000 rpm or more	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Starter • Engine ECU

WIRING DIAGRAM

Refer to DTC P0335/12 (Crankshaft Position Sensor Circuit Malfunction) on page DI–137 for the WIRING DIAGRAM.

INSPECTION PROCEDURE

HINT:
Read freed frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.
Refer to DTC P0335/12 (Crankshaft Position Sensor Circuit Malfunction) on page DI–137.

CONTINUED

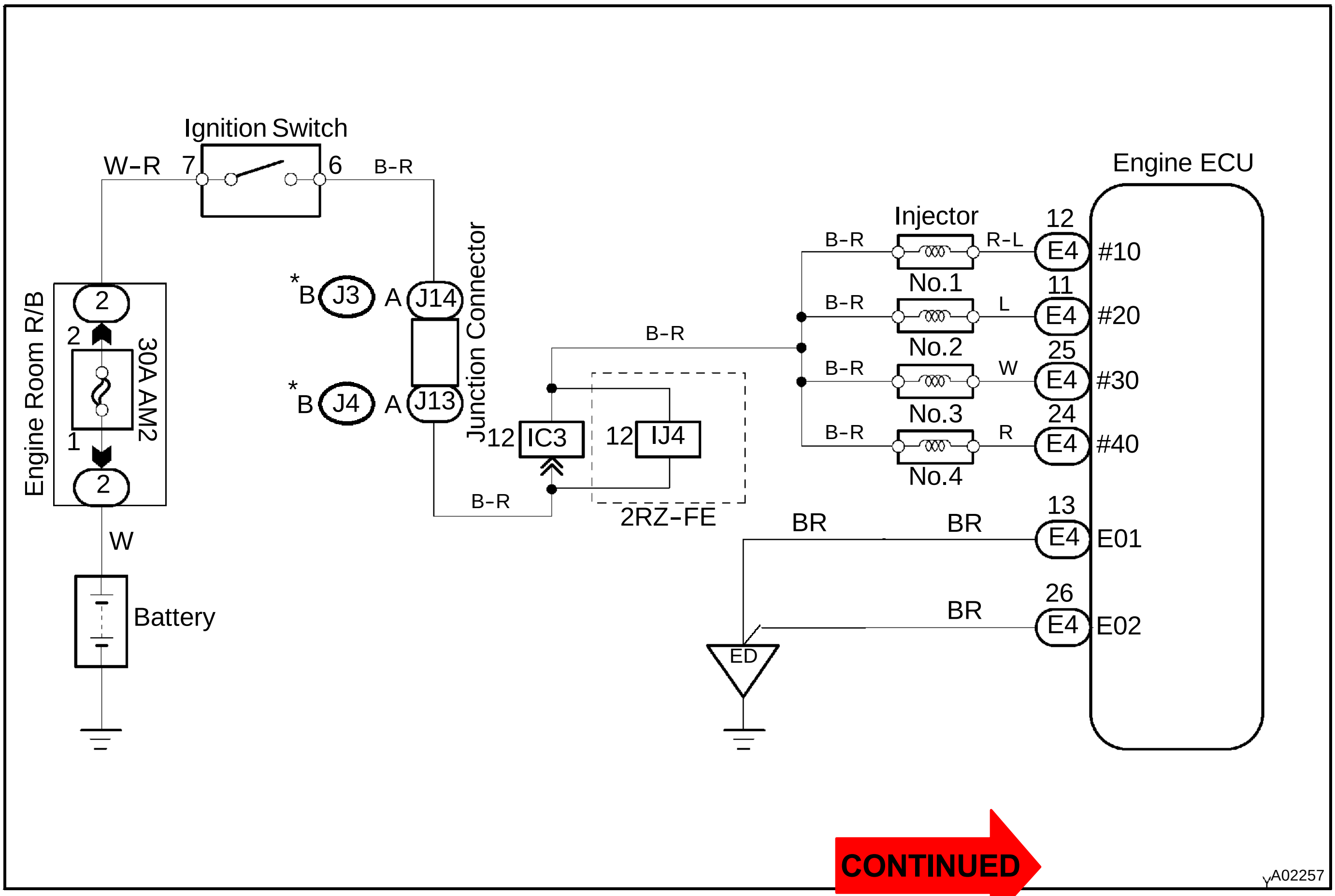
DI1IQ-01

Injector Circuit

CIRCUIT DESCRIPTION

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

WIRING DIAGRAM



CONTINUED

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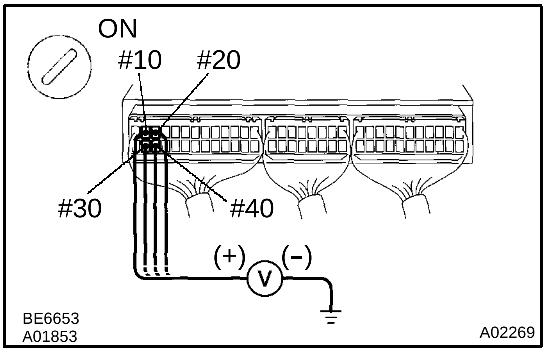
INSPECTION PROCEDURE

1	Check voltage between terminals #10 ~ 40 of engine ECU and body ground.



PREPARATION:

(a) Remove glove compartment (See page FI–61).

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminals #10 ~ #40 of engine ECU and body ground.

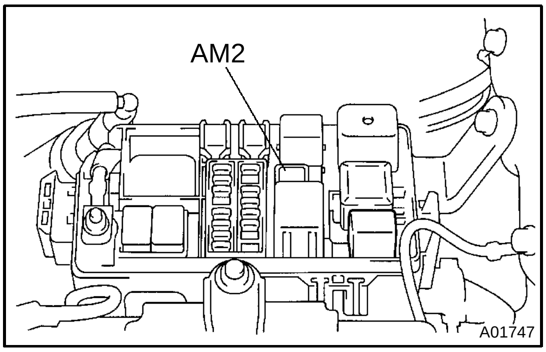
OK:

Voltage: 9 – 14 V

OK → **Go to step 4.**

NG ↓

2	Check AM2 fuse.



PREPARATION:

Remove AM2 fuse from J/B No.2.

CHECK:

Check continuity of AM2 fuse.

OK:

Continuity

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

OK ↓

CONTINUED

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3	Check resistance of injectors (See page FI–20).

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, E02 of engine ECU connector and body ground (See page IN–21).

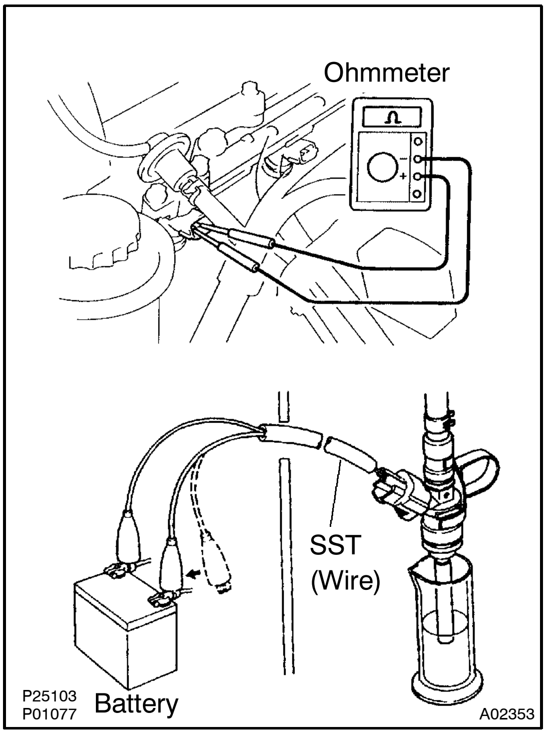
NG → Repair or replace harness or connector.

OK

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

5 Check injectors.



PREPARATION:

Disconnect injector connector (See page FI-61).

CHECK:

Measure resistance of injector.

OK:

Resistance: Approx. 13.4 ~ 14.2 Ω at 20°C (68°F)

CHECK:

Check injection volume of injector (See page FI-20).

OK:

- **Injection Volume**
  2RZ-FE:
  64 ~ 78 cm^3/15 sec.
  (4.0 ~ 4.8 cu in./15 sec.)
  Difference between each injector:
  Less than 14 cm^3 (0.3 cu in.)
  3RZ-FE:
  72 ~ 86 cm^3/15 sec.
  (4.4 ~ 5.2 cu in./15 sec.)
  Difference between each injector:
  Less than 14 cm^3 (0.3 cu in.)
- **Leakage**
  Fuel drop: 1 drop or less per 3 minutes

NG → **Replace injector.**

OK

Proceed to next circuit inspection shown on problem symptoms table **(See page DI-92).**

CONTINUED

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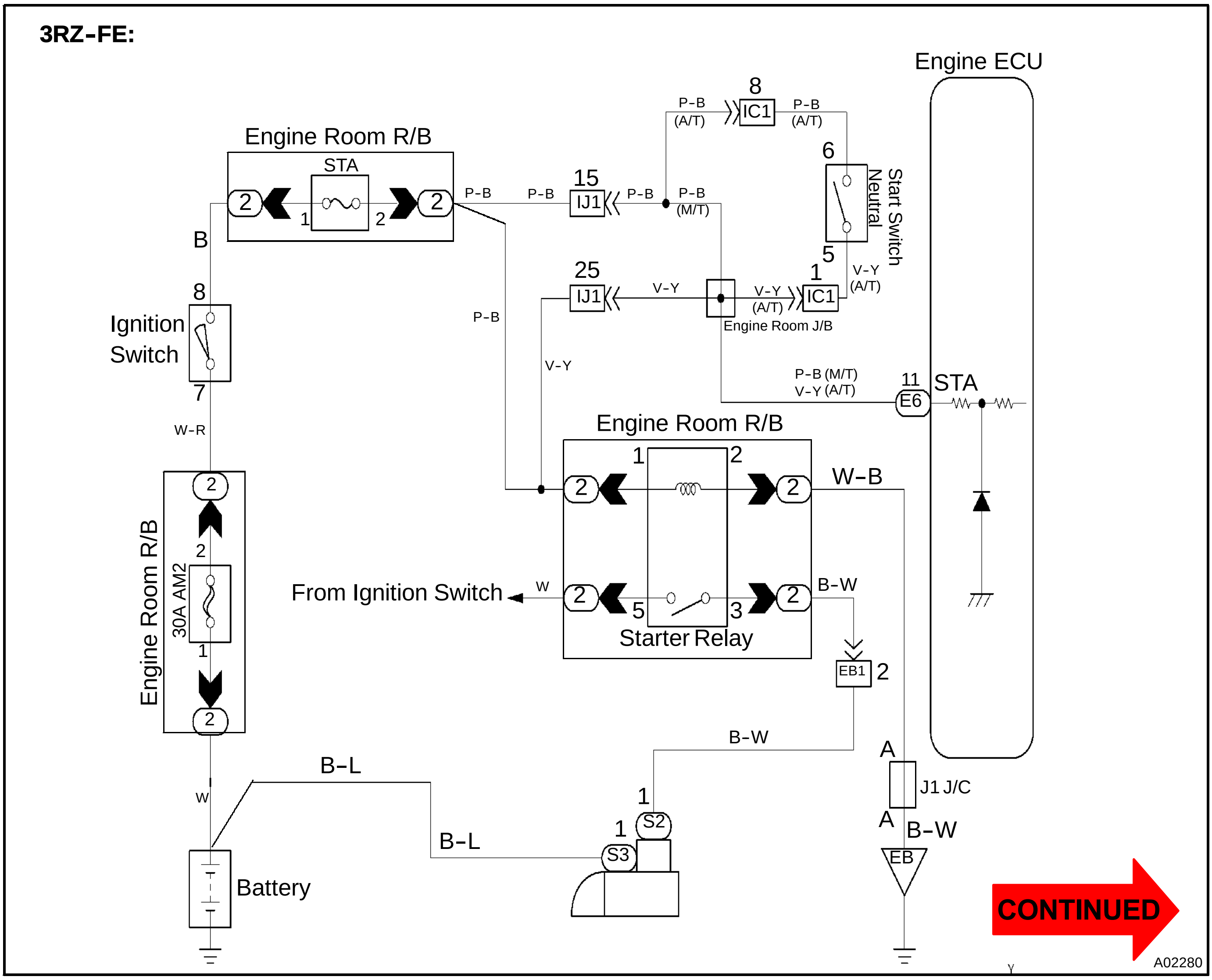
DI1IR–01

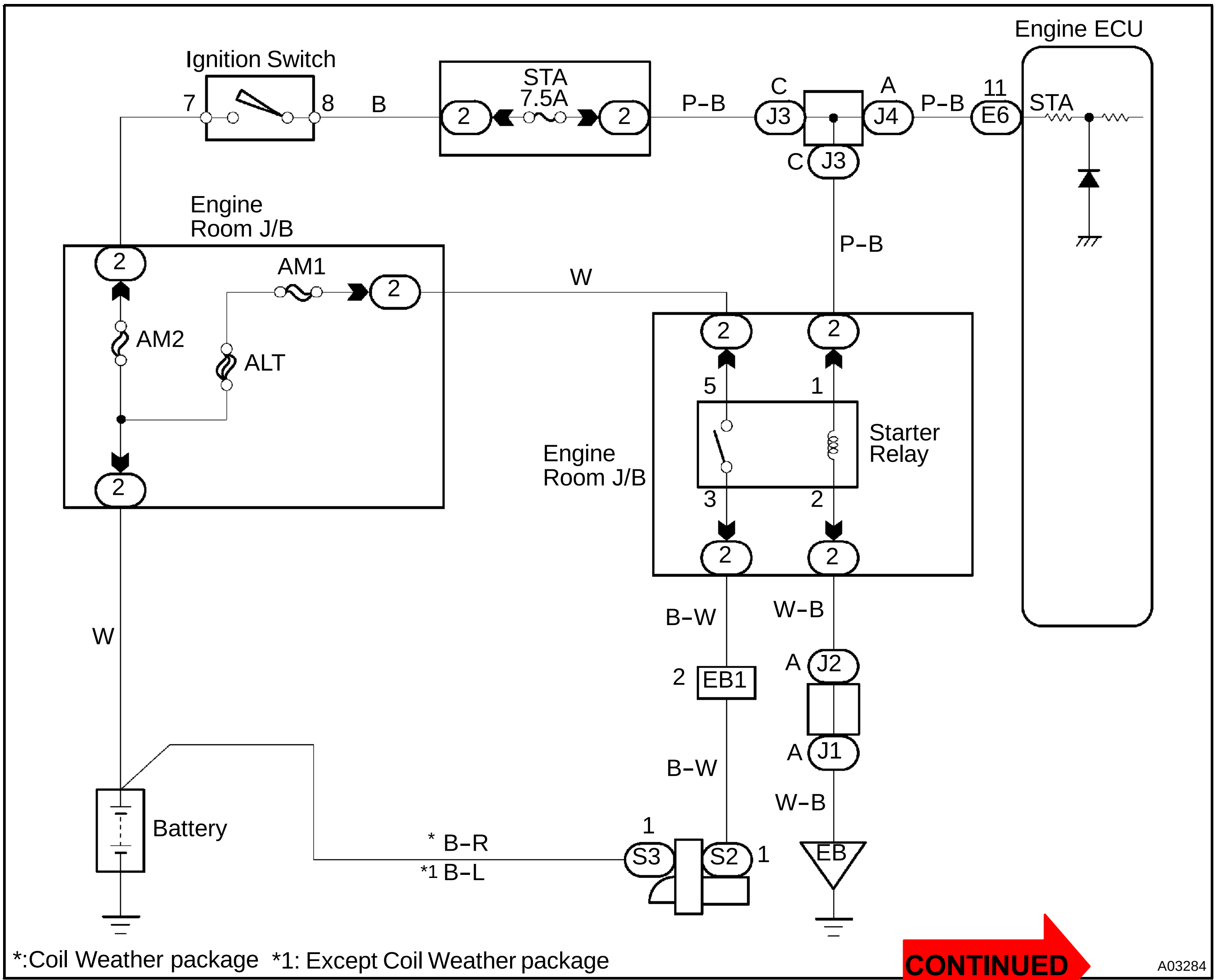
Starter Signal Circuit

CIRCUIT DESCRIPTION

When the engine is cranked, the intake air flow is slow, so fuel vaporization is poor. A rich mixture is therefore necessary in order to achieve good startability. While the engine is being cranked, the battery 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




Engine ECU
Ignition Switch
7
8
B
STA
7.5A
2
2
P–B
C
J3
A
J4
P–B
11
E6
STA
C
J3
Engine
Room J/B
AM1
2
2
W
P–B
AM2
ALT
2
2
5
1
Starter
Relay
Engine
Room J/B
3
2
2
2
2
B–W
W–B
W
2
EB1
A
J2
A
J1
B–W
W–B
Battery
1
* B–R
*1 B–L
S3
S2
1
EB
*:Coil Weather package *1: Except Coil Weather package
A03284

CONTINUED

INSPECTION PROCEDURE

HINT:This diagnostic chart is based on the premise that engine is cranked normally. If the engine is not cranked, proceed to the problem symptoms table (See page DI–92)

1	**Check the starter signal.**

Using hand–held tester:

PREPARATION:

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

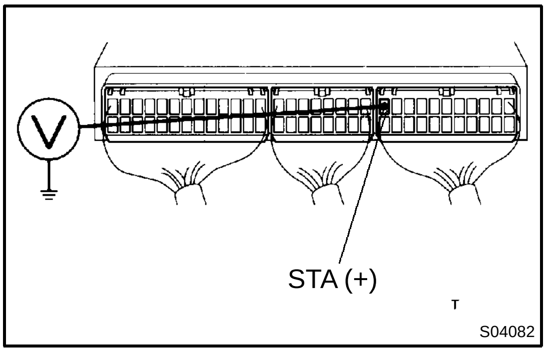
(b) Turn the ignition switch ON and hand–held tester main switch ON.

CHECK:

Read the starter signal on the hand–held tester during cranking.

OK:

Starter signal: ON



When not using hand–held tester:

PREPARATION:

Remove glove compartment (see page FI–61).

CHECK:

Measure voltage between terminal STA of engine ECU connector and body ground during cranking.

OK:

Voltage: 6.0 V or more

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–92).**

NG ↓

2	**Check for open in harness and connector between engine ECU and starter replay (See page IN–21).**

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

OK ↓

Check and replace engine ECU (See page IN–21).

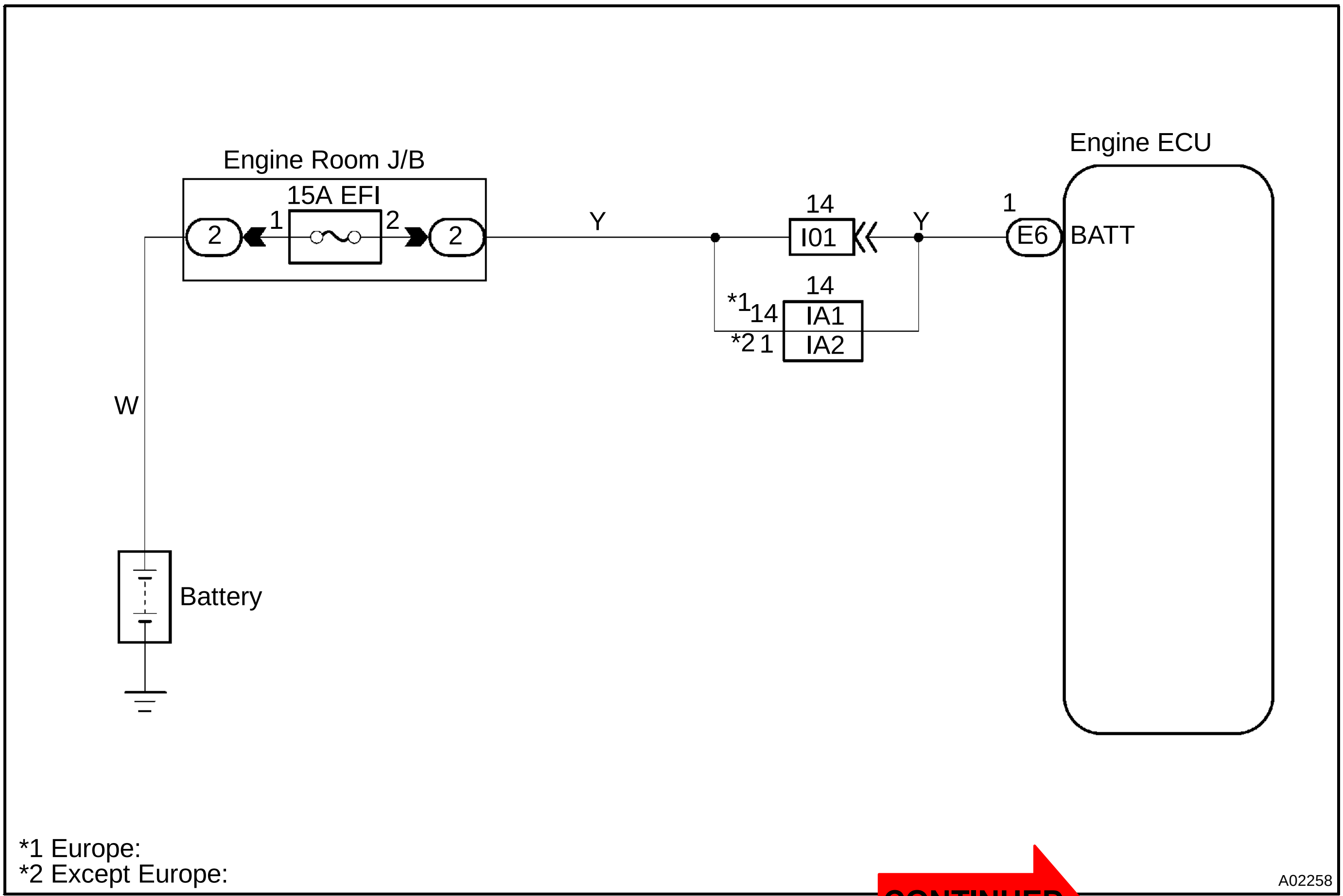
DI1IS–01

Back Up Power Source Circuit

CIRCUIT DESCRIPTION

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

WIRING DIAGRAM

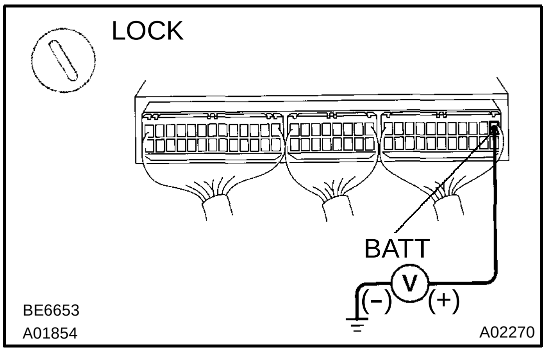


CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

INSPECTION PROCEDURE

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



PREPARATION:
Remove glove compartment (See page FI-61).

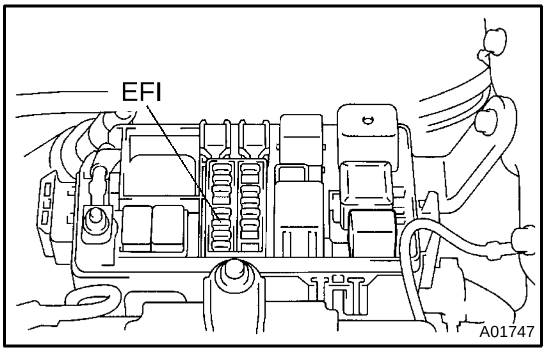
CHECK:
Measure voltage between terminal BATT of engine ECU connector and body ground.

OK:
Voltage: 9 – 14V

OK → **Check and replace engine ECU** **(See page IN-21).**

NG

2	Check EFI fuse.



PREPARATION:
Remove EFI fuse from J/B No.2.

CHECK:
Check continuity of EFI fuse..

OK:
Continuity

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

OK

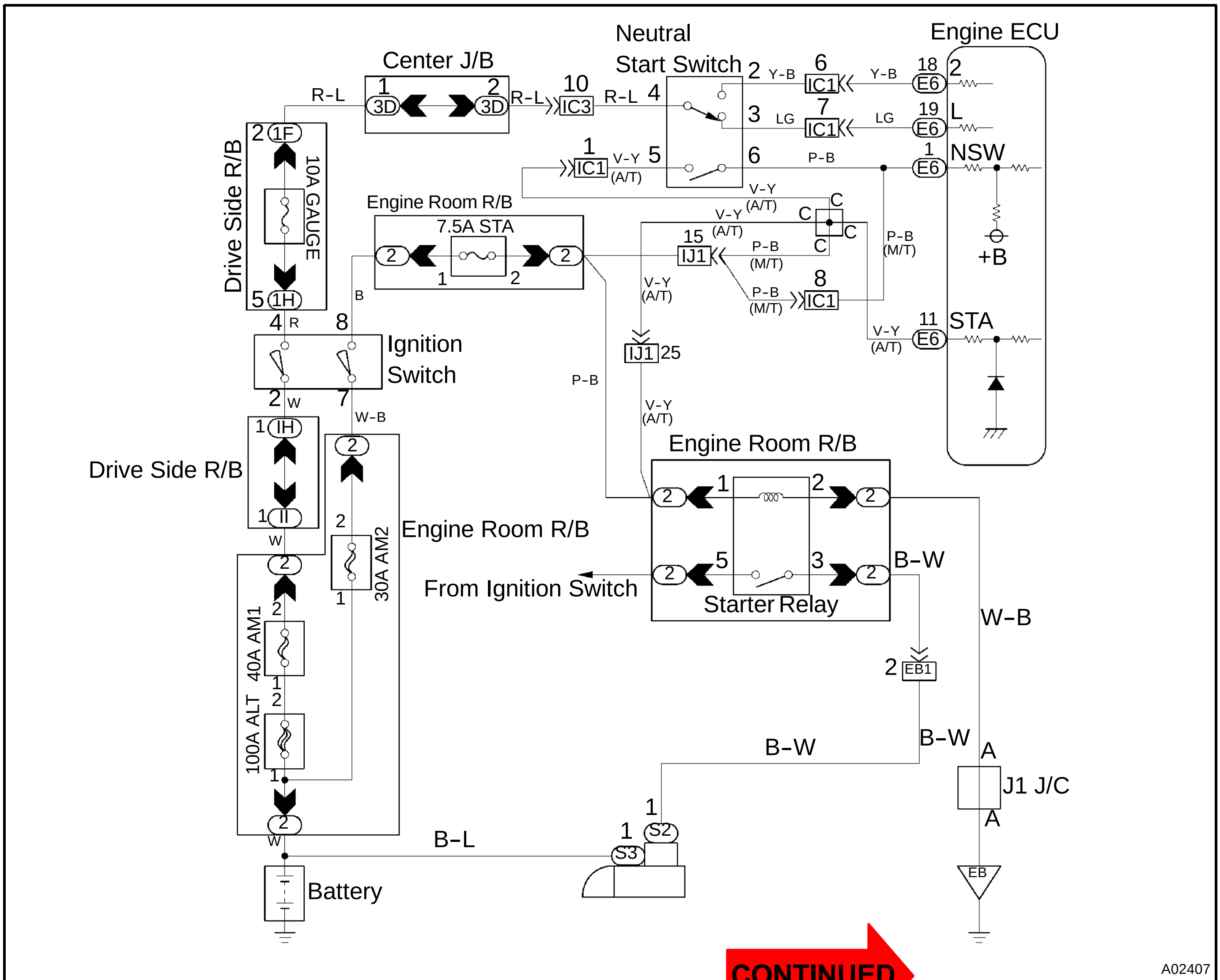
Check and repair harness or connector between battery, EFI fuse and engine ECU.

Neutral Start Switch Circuit (3RZ–FE).

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 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, 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



CONTINUED

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INSPECTION PROCEDURE

1	Check , 2, L and NSW signals.

When using hand-held tester:

PREPARATION:

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

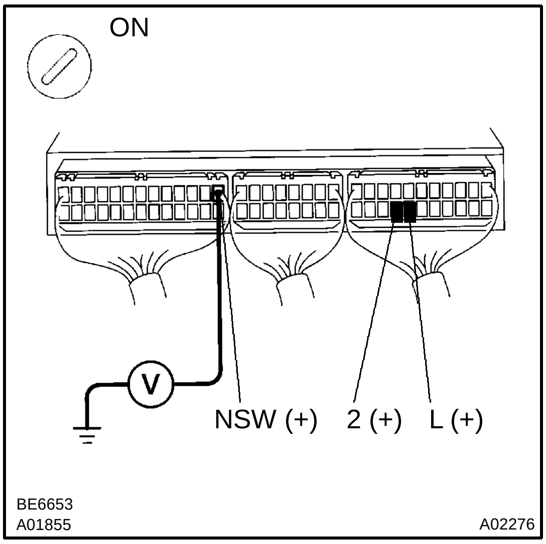
(b) Turn the ignition switch ON and hand-held tester main switch ON.

CHECK:

Shift the shift lever to the P, N, 2, or positions, and read the NSW, 2 and L signal on the hand-held tester.

OK:

Shift position	Signal
P, N	NSW 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 the terminals NSW, 2, L of engine ECU and 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	0V	Below 1V	Below 1V	Below 1V
D	Below 1V	7.5 ~ 14V	Below 1V	Below 1V
2	Below 1V	7.5 ~ 14V	7.5 ~ 14V	Below 1V
L	Below 1V	7.5 ~ 14V	Below 1V	7.5 ~ 14V

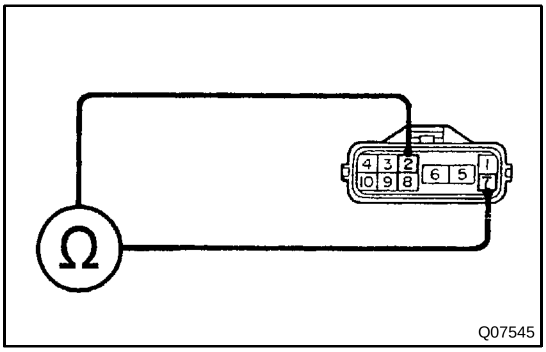
*: The voltage will drop slightly due to lighting up of the back up light.

OK	Proceed to next circuit inspection shown on problem symptoms table (See page DI-92).

NG

CONTINUED

2	Check neutral start switch.



PREPARATION:
Remove the neutral start switch

CHECK:
Check 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	5 – 6	2 – 7
R	2 – 8	–
N	5 – 6	2 – 9
D	2 – 10	–
2	2 – 3	–
L	2 – 4	–

NG → **Replace neutral start switch.**

OK

3	Check harness and connector between battery and neutral start switch, neutral start switch and engine ECU (See page IN–21).

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

OK

Check and replace engine ECU.

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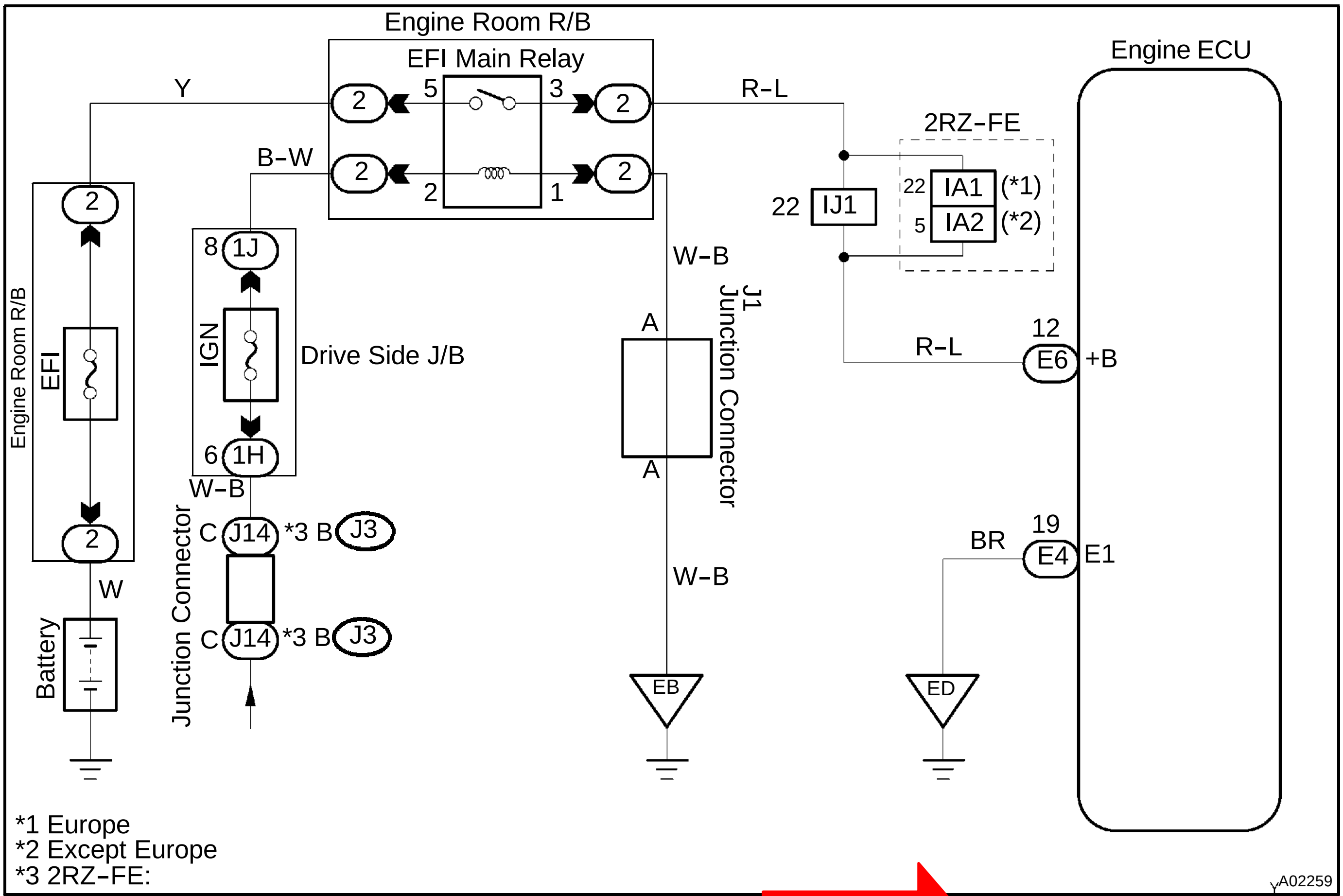
DI1IU-01

ECU Power Source Circuit

CIRCUIT DESCRIPTION

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

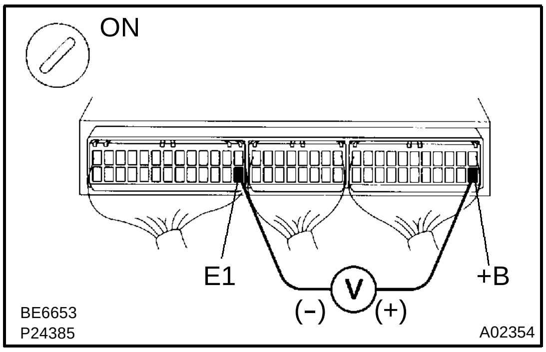
WIRING DIAGRAM



CONTINUED

INSPECTION PROCEDURE

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



PREPARATION:

(a) Remove glove compartment (See Page FI–61).

(b) Turn ignition switch ON.

CHECK:

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

OK:

Voltage: 9 – 14V

OK → **Proceed to next circuit inspection shown on problem symptoms table** **(See page DI–92).**

NG

2	Check for open in harness and connector between terminal E1 of engine ECU and body ground (See page IN–21).

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

OK

3	Check EFI main relay (See page FI–50).

NG → **Replace EFI main relay.**

OK

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

4	Check EFI fuse .

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

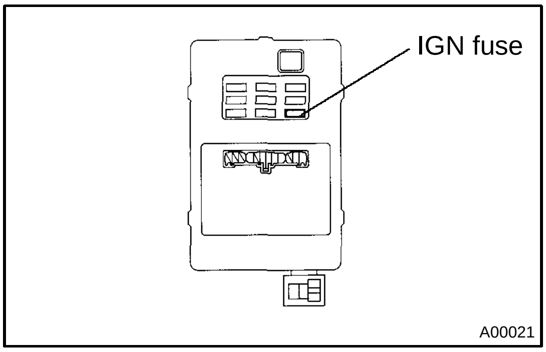
OK ↓

5	Check for open in harness and connector between main relay and battery, main relay and engine ECU (See page IN-21).

NG → Repair or replace harness or connector.

OK ↓

6	Check IGN fuse.



PREPARATION:

Remove IGN fuse J/B No.1

CHECK:

Check continuity of IGN fuse.

OK:

Continuity

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

OK ↓

CONTINUED

7	Check ignition switch .

NG → Replace ignition switch.

OK ↓

Check for open in harness and connector between IG switch and main relay, main relay and body ground (See page IN–21).

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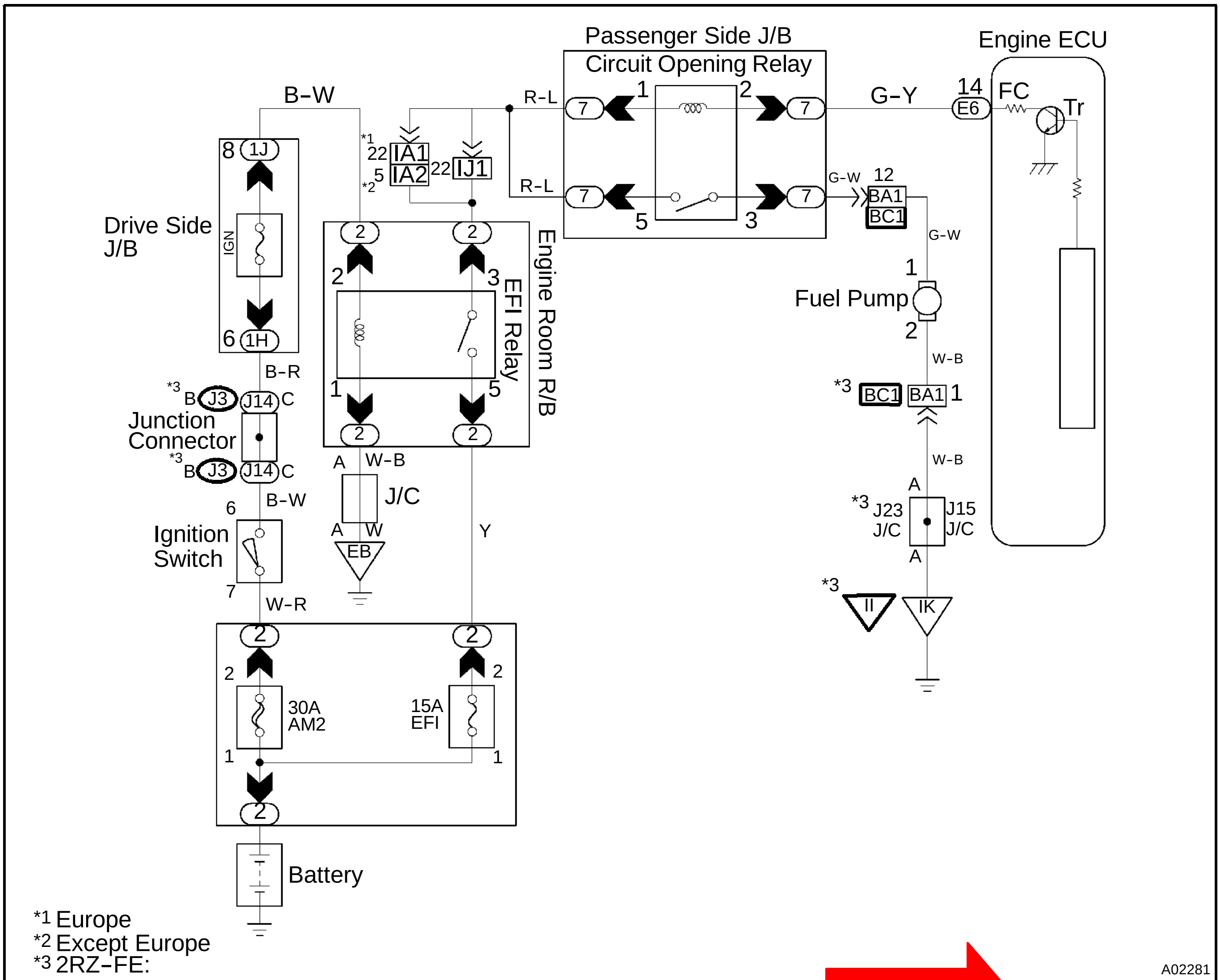
Fuel Pump Control Circuit

CIRCUIT DESCRIPTION

In the diagram below, when the engine is cranked, current flows from terminal ST of the ignition switch to the starter relay coil and also current flows to terminal STA of engine ECU (STA signal).
When the STA signal and NE signal are input to the engine ECU, Tr is turned ON, current flows to coil of the circuit opening relay, the relay switches on, power is supplied to the fuel pump and the fuel pump operates. While the NE signal is generated (engine running), the engine ECU keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.

WIRING DIAGRAM



CONTINUED

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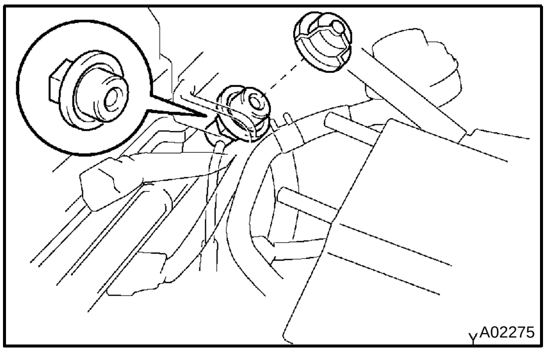
INSPECTION PROCEDURE

1	Check fuel pump operation.



PREPARATION:

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

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

(c) Select the active test mode on the hand-held tester.

(d) If you have no hand-held tester, connect the positive (+) and negative (-) leads from the battery to the fuel pump connector (See page FI-11).

CHECK:

Check that the pulsation damper screw rises up when the fuel pump opetrates.

OK:

The pulsation damper screw rises up.

OK	Proceed to next circuit inspection shown on problem symptoms table (See page DI-92).

NG

2	Check for engine ECU power source circuit (See page DI-170).

NG	Repair or replace.

OK

CONTINUED

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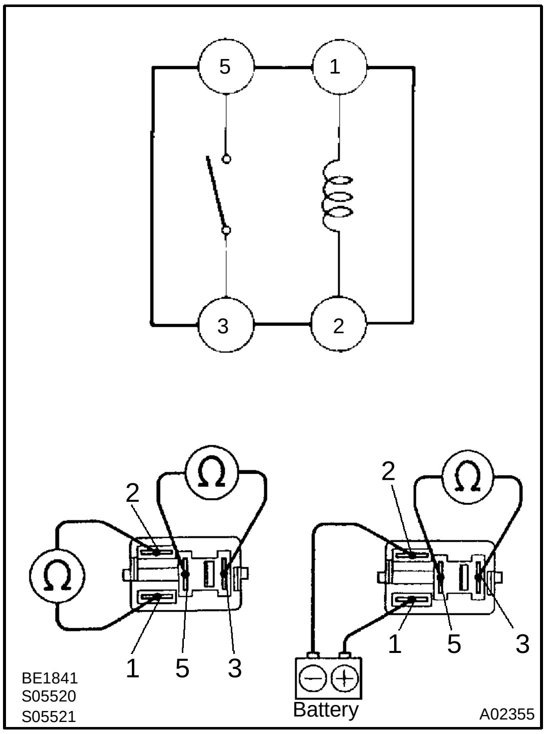
3 Check circuit opening relay.



PREPARATION:

(a) Remove the lower instrument cover.

(b) Remove circuit opening relay.

CHECK:

Check continuity between terminals of circuit opening relay shown below.

OK:

Terminals 3 and 5	Open
Terminals 1 and 2	Continuity (Reference value 74 Ω)

CHECK:

(a) Apply battery positive voltage between terminals 1 and 2.

(b) Check continuity between terminals 3 and 5.

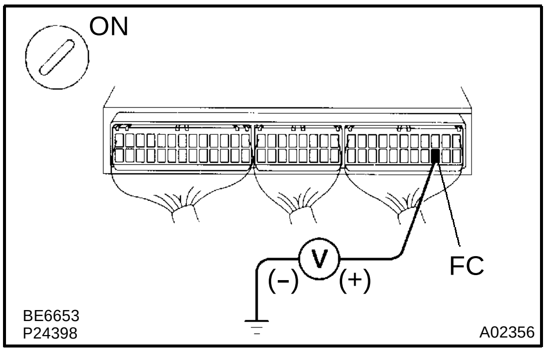
OK:

Terminals 3 and 5	Continuity

NG → **Replace circuit opening relay.**

OK

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



PREPARATION:

(a) Remove glove compartment

(See page FI–61).

(b) Turn ignition switch ON.

CHECK:

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

OK:

Voltage: 9 – 14 V

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

CONTINUED

OK

CLICK HERE TO VIEW CHAPTER INDEX

5	Check fuel pump (See page FI–11).

NG → Repair or replace fuel pump.

OK

6	Check for open in harness and connector between circuit opening relay and fuel pump, fuel pump and body ground (See page IN–21).

NG → Repair or replace harness or connector.

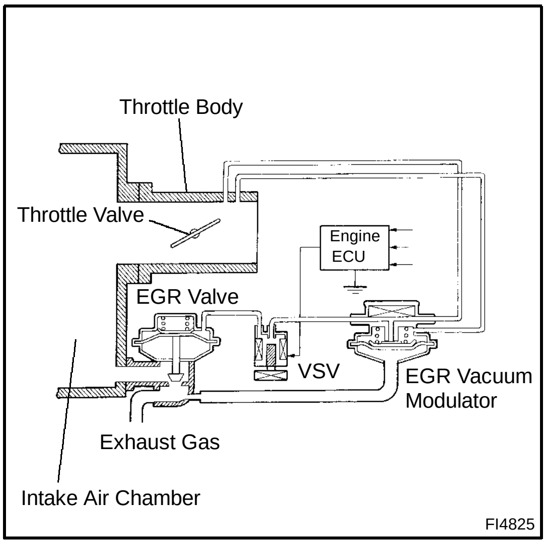
OK

Check and replace engine ECU
(See page IN–21).

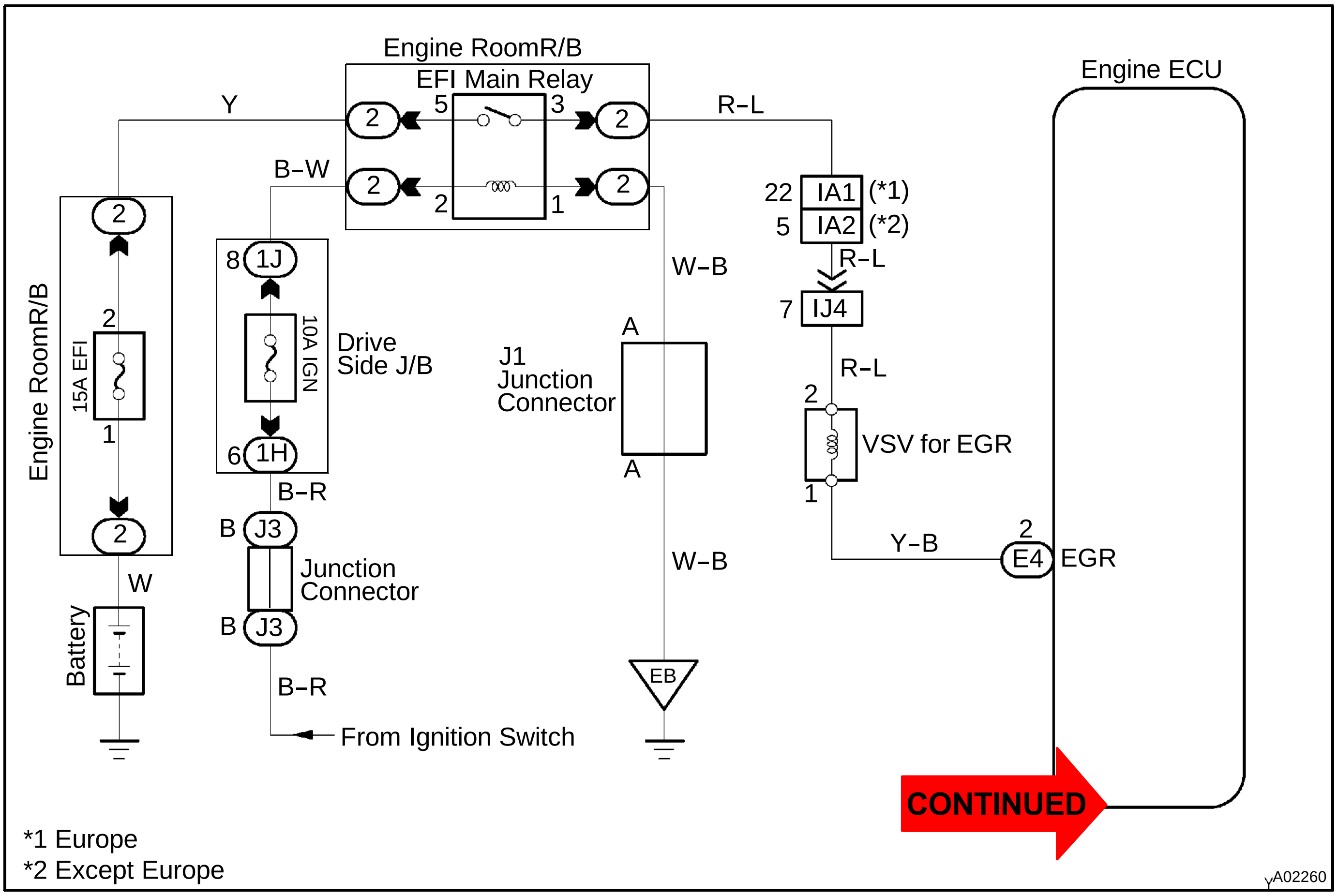
DI1IW–01

EGR System (2RZ–FE).

CIRCUIT DESCRIPTION



The EGR system recirculates exhaust gas, which is controlled to the proper quantity to suit the driving conditions, into the intake air mixture to slow down combustion, reduce the combustion temperature and reduce NOx emissions.
The amount of EGR is regulated by the EGR vacuum modulator according to the engine load.
If even one of the following conditions is fulfilled, the VSV is turned ON by a signal from the engine ECU. This results in atmospheric air acting on the EGR valve, closing the EGR valve and shutting off the exhaust (EGR cut–off).
Under the following conditions, EGR is cut to maintain driveability.
Before the engine is warmed up
During deceleration (Throttle valve closed)
Light engine load (amount of intake air very small)
Engine racing



CLICK HERE TO VIEW CHAPTER INDEX

INSPECTION PROCEDURE

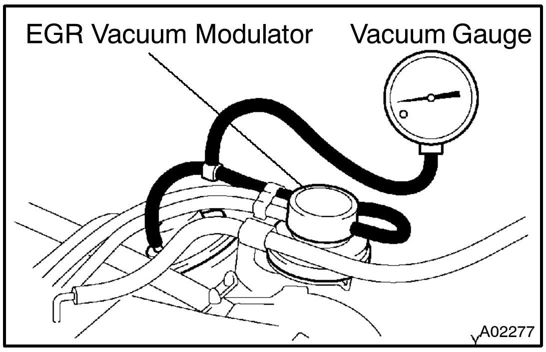
When using hand-held tester

1	Check the connection of vacuum hose.

NG → **Repair or replace.**

OK

2	Check the vacuum between EGR valve and VSV for EGR at 3,000 rpm.



PREPARATION:
(a) Using a 3-way connector, connect a vacuum gauge to the hose between VSV and EGR valve.
(b) Warm up the engine to above 80°C (176°F).

CHECK:
Check the vacuum at 3,000 rpm.

OK:
Vacuum:10 kPa (75 mmHg, 3.0 in.Hg)

OK → **Prceed to next circuit inspection shown on problem symptoms table** (See page DI-92)

NG

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

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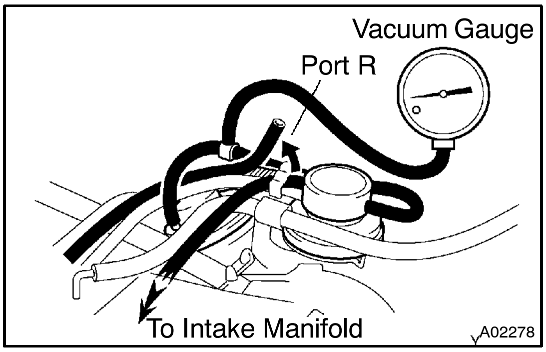
3 Check the vacuum between EGR valve and VSV for EGR at 3,500 rpm.



PREPARATION:

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

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

(c) Disconnect the vacuum hose from port R of EGR vacuum modulator and connect port R directly to the intake manifold with another hose.

CHECK:

Check the vacuum at 3,500rpm.

RESULT:

Type	Vacuum
I	0 kPa (0 mmHg, 0 in. Hg)
II	0 kPa (0 mmHg, in. Hg) ~ 40 kPa (300 mmHg, 11.8 in. Hg)
III	40 kPa (300 mmHg, 11.8 in. HG)

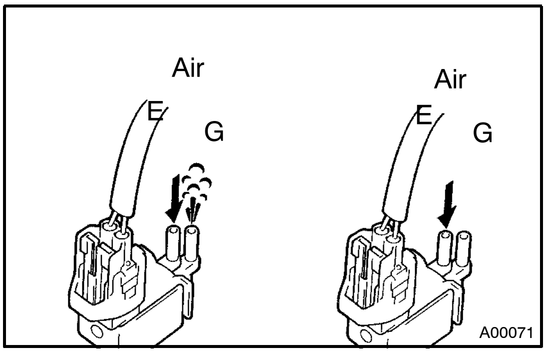
Type I → **Replace EGR vacuum modulator.**

Type II → **Go to step 4.**

Type III

Check the EGR valve, and repair or replace EGR valve.

4 Check the VSV circuit for EGR.



PREPARATION:

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

CHECK:

Check operation of VSV, when it is operated by the hand-held tester.

OK:

EGR system is OFF:
Air from pipe E is flowing out through air filter.
EGR system is ON:
Air from pipe E is flowing out through pipe G.

OK → **Check the connection, damage and blockage of vacuum hose.**

NG

CONTINUED

5 Check VSV for EGR (See page FI-53)

NG → Replace VSV for EGR.

OK

6 Check for open and short in harness and connector between VSV for EGR and engine ECU (See page IN-21)

NG → Repair or replace harness or connector.

Check and replace engine ECU.

When not using hand-held tester

1 Check the connection of vacuum hose.

NG → Repair or replace.

OK

2 Check the vacuum between EGR valve and VSV for EGR at 2,800 rpm

OK → Proceed to next circuit inspection shown on problem symptoms table (See page DI-92)

NG

CONTINUED

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3	Check the vacuum between EGR valve and VSV for EGR at 3,500 rpm

Type I → Replace EGR vacuum modulator.

Type II → Go to step 4.

Type III

Check the EGR valve, and repair or replace EGR valve.

5	Check VSV for EGR (See page FI-53).

NG → Replace VSV for EGR.

OK

6	Check for open and short in harness and connector between VSV for EGR and engine ECU. (See page IN-21)

NG → Repair or replace harness or connector.

OK

Check and replace engine ECU.

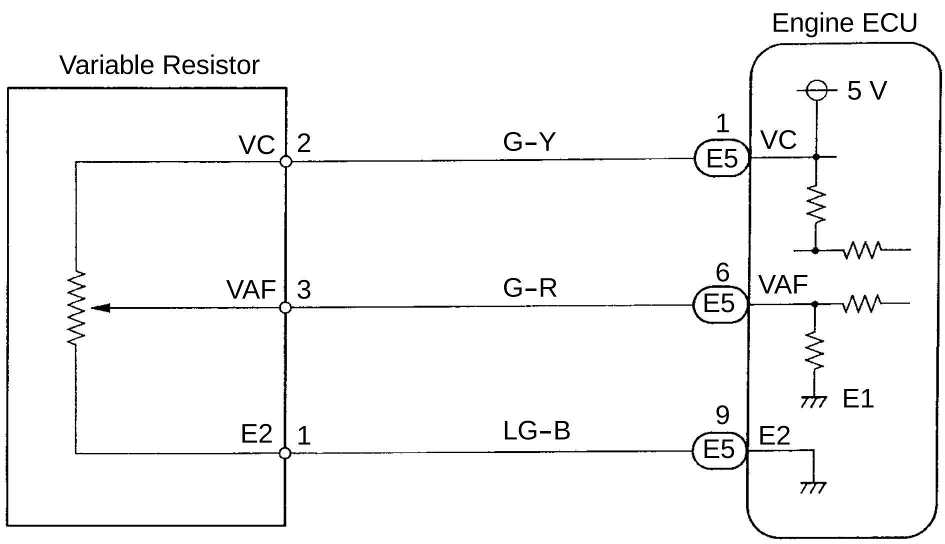
CLICK HERE TO VIEW CHAPTER INDEX

Variable Resistor Circuit (3RZ–FE)

CIRCUIT INSPECTION

This resistor is used change the air–fuel ratio of the air–fuel mixture.
The idle mixture is adjusted using this resistor.
Turning the idle mixture adjusting screw clockwise moves the contacts inside the resistor, raising the terminal VAF voltage. Conversely, turning the screw counterclockwise lowers the terminal VAF voltage.
When the terminal VAF voltage rises, the engine ECU increases the injection volume slightiy, marking the air–fuel mixture a little richer.

WIRING DIAGRAM



CONTINUED

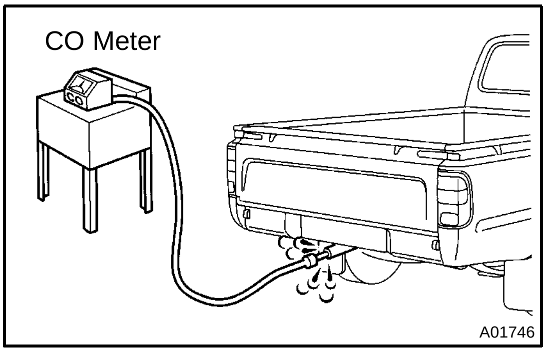
FI6851

CLICK HERE TO VIEW CHAPTER INDEX

INSPECTION PROCEDURE

NOTICE:
Always use a CO meter when adjusting the idle mixture. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.

1	Check CO concentration.



PREPARATION:
(a) Warm up engine to normal operating temp.
(b) All accessories switched OFF.
(c) All vacuum lines properly connected.
(d) Transmission in "N" position.
(e) Connect the hand–held tester or tachometer.
(f) Ignition timing check correctly.
(g) Idle speed check correctly.
(h) Check that the CO meter is properly calibrated.
(i) Race the engine at 2,500 rpm about 2 minutes.

CHECK:
Insert a tester probe at least 40 cm (1.3 ft) into the tailpipe. Measure the concentration with 1 – 3 minutes after racing the engine to allow the concentration to stabilize.

OK:
Idle CO concentration: 1.5 ± 0.5 %

OK → **CO concentration is normal. Proceed to next circuit inspection shown problem symptom tables** **(See page DI–92)**

NG

CONTINUED

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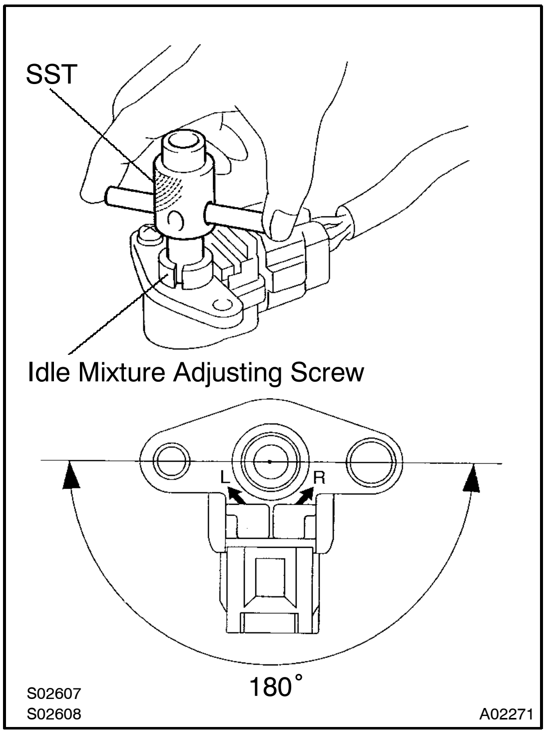
2 Adjust CO concentration.



PREPARATION:

Same condition as step 1 of this chart.

CHECK:

Using SST, adjust the idle mixture by turning the idle mixture adjusting screw in the variable resistor.

SST 09243–00020

RESULT:

OK	Concentration: 1.5 ± 0.5%
NG type I	Change in CO concentration
NG type II	No change in CO concentration

HINT:

Always check idle speed after turning the idle mixture adjusting screw. If it is incorrect, readjust idle speed.

Adjustable range of the idle mixture adjust to turn this screw is 180 degrees. Do not turn this screw more than it.

NG **Type I**
See page EM–3 and go on troubleshooting

NG **Type II**
Go to step 3.

OK

Adjustment is complete.

CONTINUED

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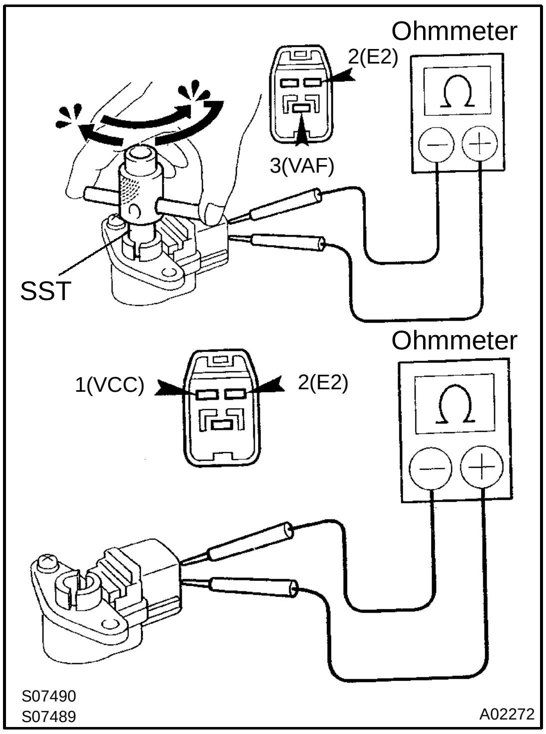
3	Check resistance of variable resistor.



Check Resistance Between 1 and 2:

PREPARATION:

Disconnect the variable resistor connector.

CHECK:

Measure resistance between terminals 1 and 2 the variable resister.

OK:

Resistance: 4 – 6 Ω

Check Resistance Between 1 and 3:

CHECK:

Measure resistance between terminals 1 and 3 when turning the idle mixture adjusting screw fully clockwise and counter-clockwise using SST.

SST 09243 – 00020

OK:

Resistance:
Change from about 5 kΩ to 0 kΩ accordingly

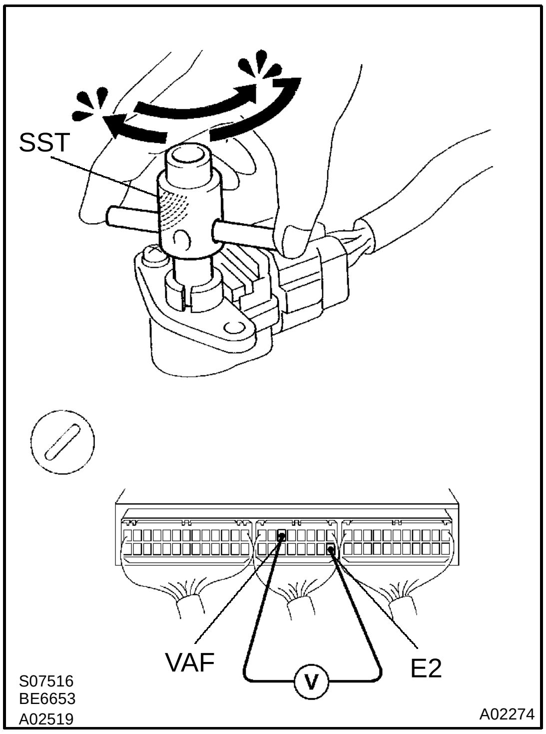
NG	Replace variable resister.

OK

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

4	Check voltage between terminals VAF and E2 of engine engine ECU connector.



PREPARATION:

(a) Reconnect the variable resistor connector.
(b) Remove the instrument panel under cover.
(c) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals VAF and E2 of engine ECU connector while slowly turning the idle mixture adjusting screw first fully counterclockwise and then fully clockwise, using SST.

SST 09243 – 00020

OK:

Voltage changes smoothly from 0 V to about 5 V, i.e. does not suddenly jump up to 5 V down to 0 V.

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

NG

5	Check for open and short in harness and connector between variable resistor and engine ECU (See page IN-21).

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

OK

Check and replace engine engine ECU.

ENGINE MECHANICAL

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
1RZ, 2RZ, 2RZ–E Engine Repair Manual	RM167E
2RZ, 2RZ–E Engine Repair Manual	RM558E
3RZ–F, 3RZ–FE Engine Repair Manual	RM521E
1RZ–E Engine Repair Manual Suplement	RM467E

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

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CO (1RZ, 3RZ-F)

EM08O-01

INSPECTION

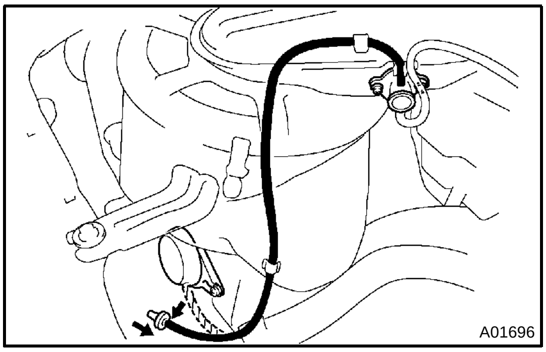
1. VISUALLY INSPECT CARBURETOR

(a) Check for loose screws or a loose mounting to the manifold.

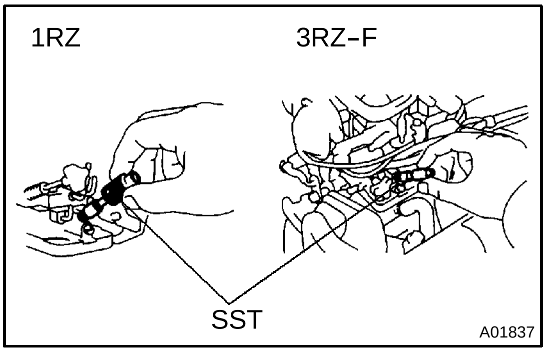
(b) Check for wear in the linkage, missing snap rings or excessive looseness in the throttle shaft. Correct any problems found.

2. INITIAL CONDITIONS

(a) Air cleaner installed
(b) Normal operating coolant temperature
(c) Choke fully open
(d) All accessories switched off
(e) All vacuum lines connected
(f) Ignition timing set correctly
(g) Transmission in the neutral range
(h) Fuel level should be about even with the correct level in the sight glass.
(i) CO meter operates normally


A01696

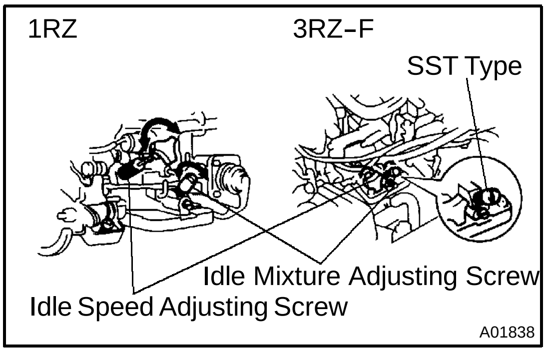
3. W/ DISCONNECT HOT AIR INTAKE (HAI) VACUUM HOSE AND PLUG HOSE END



A01837

4. ADJUST IDLE SPEED AND IDLE MIXTURE

HINT:
Use SST if necessary
SST 09243-00020



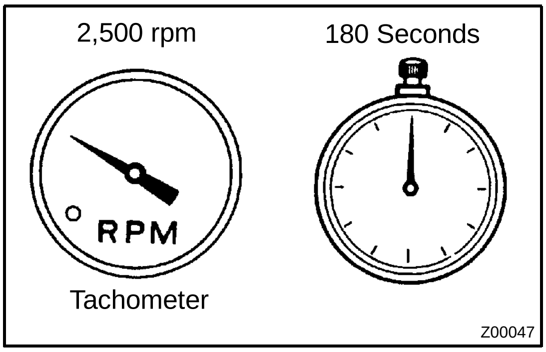
A01838

(a) Start the engine.

(b) Using a CO meter to measure the CO concentration in the exhaust, turn the idle speed and idle mixture adjusting screws to obtain the specified concentration value at idle speed.

Idle speed:
1RZ 700 - 800 rpm
3RZ-F 750 - 850rpm

CONTINUED



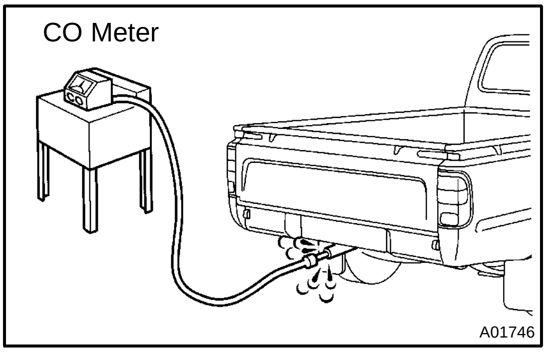
Z00047

5. INSPECT CO CONCENTRATION

(a) Check that the CO meter is properly calibrated.

(b) Race the engine 180 seconds at about 2,500 rpm before measuring concentration.

(c) Wait 1–3 minutes after racing the engine to allow the concentration to stabilize.



A01746

(d) Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe, and measure the CO concentration within a short time.

Idle CO concentration:

1.5 ± 0.5 %

- If the CO concentration is within specification this adjustment is complete.
- If the CO concentration is not within specification, turn the idle mixture adjusting screw to obtain the specified concentration value.
- If the CO concentration cannot be corrected by adjusting the idle mixture, see table below for other possible causes.

(e) Reconnect the HAI vacuum hose.

6. TROUBLESHOOTING

CO	Problems	Causes
High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty carburetion: • Faulty choke action • Incorrect float setting • Leaking needle or scat • Leaking power valve

CO (1RZ-E, 3RZ-FE)

EM08P-01

INSPECTION

HINT:
This check is used only to determine whether or not the idle CO complies with regulations.

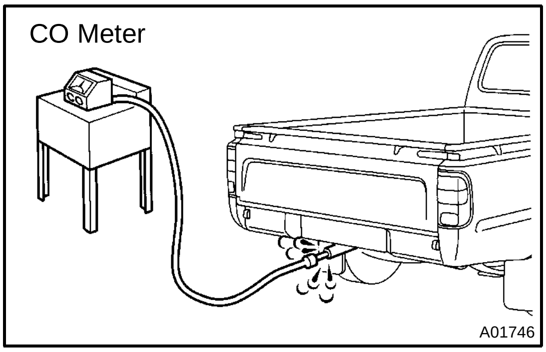
1. INITIAL CONDITIONS

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
(f) EFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission in neutral position
(i) Tachometer and CO meter calibrated by hand

2. CHECK AND ADJUST CO CONCENTRATION AT IDLE

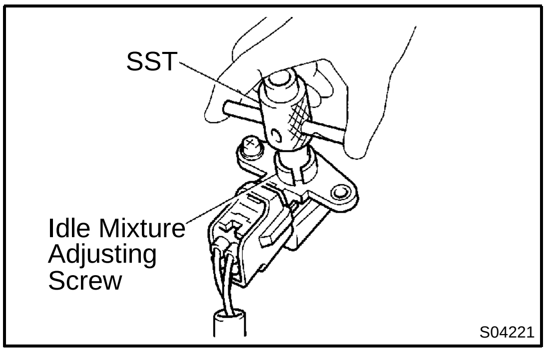
NOTICE:
Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture screw in most vehicles if they are in good condition. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.

(a) Race the engine at 2,500 rpm for approx. 180 seconds.



A01746

(b) Insert a tester probe at least 40 cm (1.3 ft) into the tailpipe.
(c) Wait at least 1 minute before measuring to allow the concentration to stabilize. Complete the measuring within 3 minutes.
Idle CO concentration:
1.5 ± 0.5 %



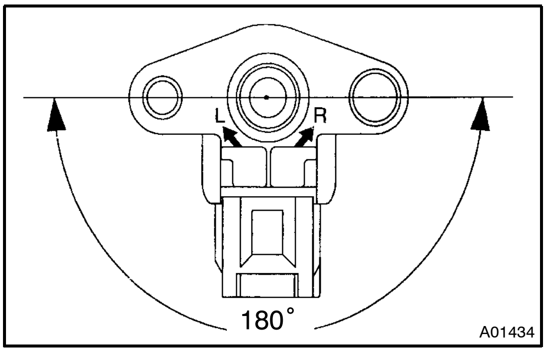
S04221

If the CO concentration does not conform to regulations, adjust by turning the idle mixture adjusting screw in the variable resistor with SST.
SST 09243-00020

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX



HINT:
The idle mixture adjusting screw can be tightened through on angle of 260°.

- If the CO concentration is within specification, this adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table below for other possible causes.

3. TROUBLESHOOTING

- 1RZ-E:

CO	Problems	Causes
High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI system: • Faulty Pressure regulator • Clogged fuel return line • Defective water temperature sensor • Defective intake air temperature sensor • Faulty engine ECU • Faulty injectors • Faulty air flow meter • Faulty throttle position sensor

- 3RZ-FE:

CO	Problems	Causes
High	Rough idle (Black smoke from exhaust)	1. Clogged air filter 2. Plugged PCV valve 3. Faulty EFI system: • Faulty Pressure regulator • Clogged fuel return line • Defective water temperature sensor • Defective intake air temperature sensor • Faulty engine ECU • Faulty injectors • Faulty air flow meter

CO/HC (2RZ-FE)

EM08Q-01

INSPECTION

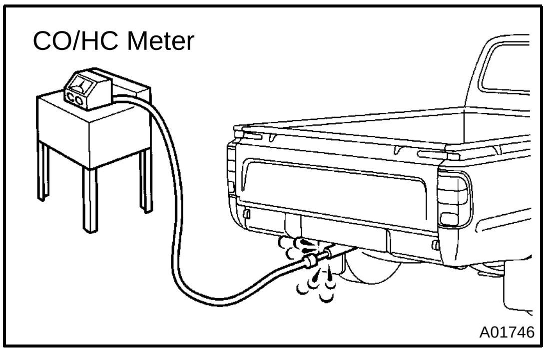
HINT:
This check is used only to determine whether or not the idle CO/HC complies with specifications.

1. INITIAL CONDITIONS

(a) Engine at reach normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
(f) EFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission in neutral position
(i) Tachometer and CO/HC meter calibrated by hand

2. START ENGINE

3. RACE ENGINE AT 2,500 RPM FOR APPROX. 180 SECONDS



4. INSERT CO/HC METER TESTING PROBE INTO TAILPIPE AT LEAST 40 cm (1.3 ft) DURING IDLING

5. CHECK CO/HC CONCENTRATION AT IDLE

Idle CO concentration:
0 – 0.5 %
Idle HC concentration:
Applicable local regulation

6. TROUBLESHOOTING

If the CO/HC concentration does not conform to specifications, perform troubleshooting in the order given below.

(a) Check oxygen sensor operation.
(See page FI–59)
(b) See the table next page for possible causes, and then inspect and correct the applicable causes if necessary.

CONTINUED

CO	HC	Problems	Causes
Normal	High	Rough idle	1. Fault ignitions: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high-tension cords 2. Incorrect valve clearance 3. Leaky intake and exhaust valves 4. Leaky EGR valve 5. Leaky cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum Leaks: • PCV hose • Intake manifold • Throttle body • Vacuum hose • Intake chamber
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI system: • Faulty fuel pressure regulator • Clogged fuel return line • Defective water temperature sensor • Defective intake air temperature sensor • Faulty engine ECU • Faulty injectors • Faulty Air flow meter

COMPRESSION (2RZ-FE)

EM08R-01

INSPECTION

HINT:

If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. WARM UP AND STOP ENGINE

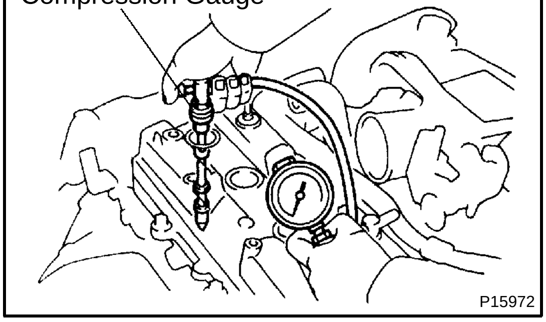
2. REMOVE IGNITION COIL CONNECTORS

3. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

NOTICE:

Pulling on or bending the cords may damage the conductor inside.

4. REMOVE SPARK PLUGS



P15972

5. CHECK CYLINDER COMPRESSION PRESSURE

(a) Insert a compression gauge into the spark plug hole.

(b) Fully open the throttle.

(c) While cranking the engine, measure the compression pressure.

HINT:

Always use a fully charged battery to obtain engine speed of 250 rpm or more.

(d) Repeat steps (a) through (c) for each cylinder.

NOTICE:

This measurement must be done in as short a time as possible.

Compression pressure:
1,230 kPa (12.5 kgf/cm^2, 178 psi) or more
Minimum pressure:
880 kPa (9.0 kgf/cm^2, 127 psi)
Difference between each cylinder:
98 kPa (1.0 kgf/cm^2, 14 psi) or less

(e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.

- If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damage.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

6. REINSTALL SPARK PLUGS

Torque: **19 N·m (200 kgf·cm, 14 ft·lbf)**

7. REINSTALL HIGH-TENSION CORDS TO SPARK PLUGS

8. RECONNECT IGNITION COIL CONNECTOR

VALVE CLEARANCE (2RZ-FE)

EM08S-01

INSPECTION

HINT:

Inspect and adjust the valve clearance when the engine is cold.

1. REMOVE PCV HOSES

2. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

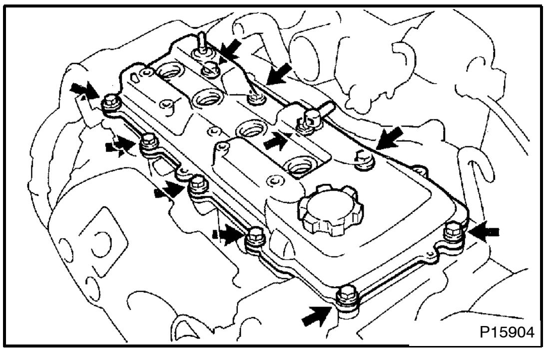
NOTICE:

Pulling on or bending the cords may damage the conductor inside.

3. DISCONNECT ENGINE WIRE

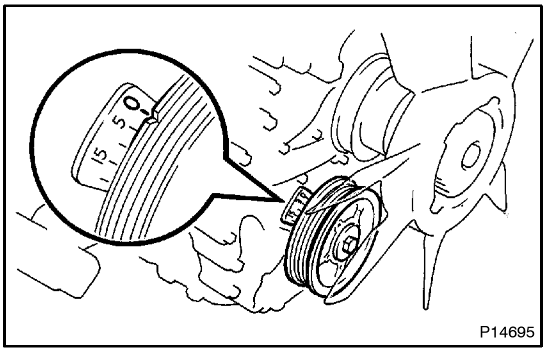
(a) Disconnect these connectors:

- w/ A/C:
  A/C compressor connector
- Oil pressure sensor connector
- Engine coolant temperature sender gauge connector
- Disconnect the 4 engine wire clamps and engine wire.


P15904

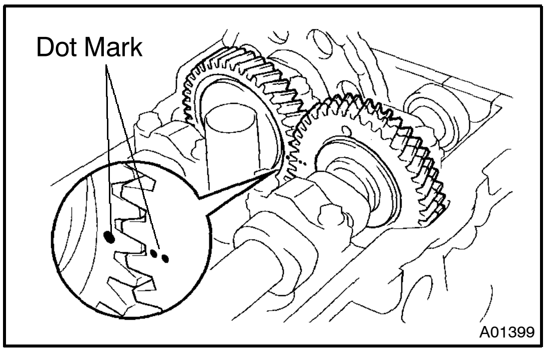
4. REMOVE CYLINDER HEAD COVER

Remove the 10 bolts, seal washers, cylinder head cover and gasket.


P14695

5. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley clockwise and align its groove with the "0" mark on the timing chain cover.



A01399

(b) Check that the timing marks (1 and 2 dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) and align the marks as above.

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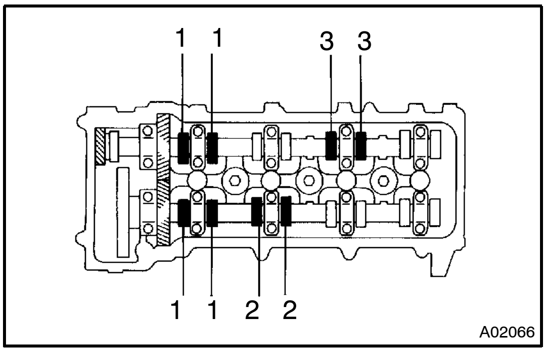
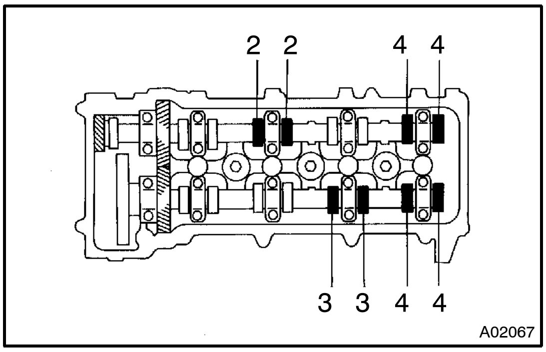


A02066



A02067

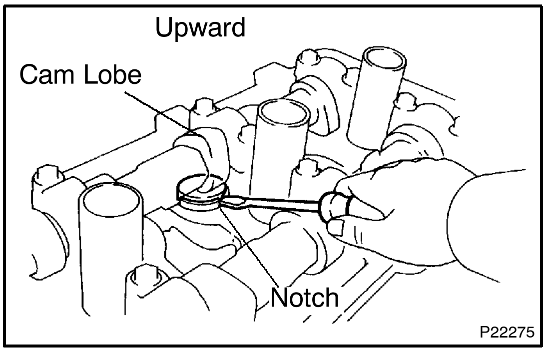
6. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.
- Using a thickness gauge, measure the clearance between the valve lifter and camshaft.
- Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold):
Intake
0.15 – 0.25 mm (0.006 – 0.01 in.)
Exhaust
0.25 – 0.35 mm (0.01 – 0.014 in.)

(b) Turn the crankshaft pulley 1 revolution (360°) and align its groove with timing mark "0" of the timing chain cover.

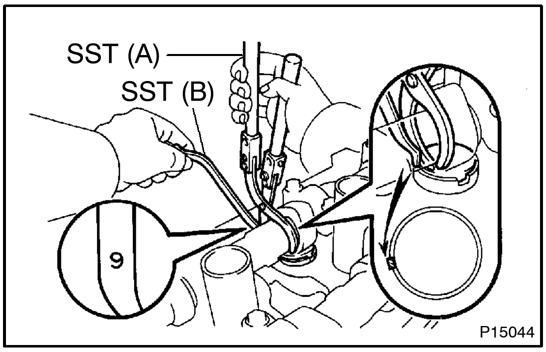
(c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))



P22275

7. ADJUST VALVE CLEARANCE

(a) Remove the adjusting shim.
- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
- Position the notch of the valve lifter toward the spark plug side.

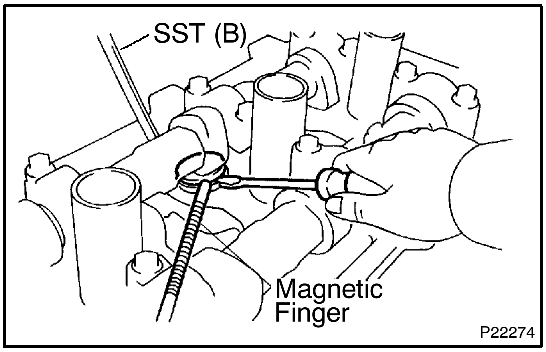


P15044

- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter flange. Remove SST (A).

SST 09248–55040 (09248–05410, 09248–05420)

HINT:
Apply SST (B) at slight angle on the side marked with "9", at the position shown in the illustration.



P22274

Remove the adjusting shim with a small screwdriver and magnetic finger.

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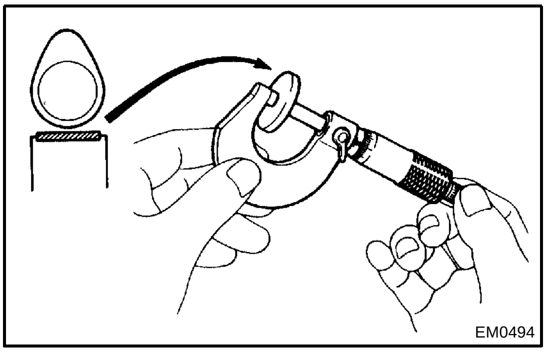

EM0494

(b) Determine the replacement adjusting shim size by these Formula or Charts:

- Using a micrometer, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so that the valve clearance comes within the specified value.
  T .... Thickness of removed shim
  A .... Measured valve clearance
  N .... Thickness of new shim

Intake:

N=T + (A – 0.20 mm (0.008 in.))

Exhaust:

N=T + (A – 0.30 mm (0.012 in.))

- Select a new shim with a thickness as close as possible to the calculated value.

HINT:
Shims are available in 17 sized in increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).

CONTINUED

Adjusting Shim Selection Chart (Intake)

Measured clearance mm (in.) / Installed shim thickness mm (in.)	2.500 (0.0984)	2.520 (0.0992)	2.540 (0.1000)	2.550 (0.1004)	2.560 (0.1008)	2.580 (0.1016)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.650 (0.1043)	2.660 (0.1047)	2.680 (0.1055)	2.700 (0.1063)	2.710 (0.1067)	2.720 (0.1071)	2.730 (0.1075)	2.740 (0.1079)	2.750 (0.1083)	2.760 (0.1087)	2.770 (0.1091)	2.780 (0.1094)	2.790 (0.1098)	2.800 (0.1102)	2.810 (0.1106)	2.820 (0.1110)	2.830 (0.1114)	2.840 (0.1118)	2.850 (0.1122)	2.860 (0.1126)	2.870 (0.1130)	2.880 (0.1134)	2.890 (0.1138)	2.900 (0.1142)	2.910 (0.1146)	2.920 (0.1150)	2.930 (0.1154)	2.940 (0.1157)	2.950 (0.1161)	2.960 (0.1166)	2.970 (0.1169)	2.980 (0.1173)	2.990 (0.1177)	3.000 (0.1181)	3.010 (0.1185)	3.020 (0.1189)	3.030 (0.1193)	3.040 (0.1197)	3.050 (0.1201)	3.060 (0.1205)	3.070 (0.1209)	3.080 (0.1213)	3.090 (0.1217)	3.100 (0.1220)	3.120 (0.1228)	3.140 (0.1236)	3.150 (0.1240)	3.160 (0.1244)	3.180 (0.1252)	3.200 (0.1260)	3.220 (0.1268)	3.240 (0.1276)	3.250 (0.1280)	3.260 (0.1283)	3.280 (0.1291)	3.300 (0.1299)
0.000 – 0.030 (0.0000 – 0.0012)										1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13
0.031 – 0.050 (0.0012 – 0.0020)								1	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	11	11	11	11	12	12	13	13	13	13	14
0.051 – 0.070 (0.0020 – 0.0028)							1	1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	11	11	11	11	12	12	13	13	13	13	14	14
0.071 – 0.090 (0.0028 – 0.0035)						1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15
0.091 – 0.110 (0.0036 – 0.0043)					1	1	1	1	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	12	12	12	13	13	13	14	14	14	15	15
0.111 – 0.130 (0.0044 – 0.0051)			1	1	1	1	1	2	2	2	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15
0.131 – 0.149 (0.0052 – 0.0059)		1	1	1	1	1	2	2	3	3	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	13	13	13	13	14	14	15	15	15	15	16
0.150 – 0.250 (0.0059 – 0.0098)
0.251 – 0.270 (0.0099 – 0.0106)	2	3	3	3	3	4	4	5	5	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	15	15	15	15	16	16	17	17	17	17	17	
0.271 – 0.290 (0.0107 – 0.0114)	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	16	16	16	17	17	17	17	17		
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0.311 – 0.330 (0.0122 – 0.0130)	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	8	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17					
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0.411 – 0.430 (0.0162 – 0.0169)	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17											
0.431 – 0.450 (0.0170 – 0.0177)	6	6	7	7	7	7	8	8	9	9	9	9	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17												
0.451 – 0.470 (0.0178 – 0.0185)	6	7	7	7	7	8	8	9	9	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17														
0.471 – 0.490 (0.0185 – 0.0193)	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																
0.491 – 0.510 (0.0193 – 0.0201)	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																		
0.511 – 0.530 (0.0201 – 0.0209)	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																				
0.531 – 0.550 (0.0209 – 0.0217)	8	8	9	9	9	9	10	10	11	11	11	11	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																						
0.551 – 0.570 (0.0217 – 0.0224)	8	9	9	9	9	10	10	11	11	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																								
0.571 – 0.590 (0.0225 – 0.0232)	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																										
0.591 – 0.610 (0.0233 – 0.0240)	9	9	10	10	10	11	11	11	12	12	12	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																												
0.611 – 0.630 (0.0241 – 0.0248)	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																														
0.631 – 0.650 (0.0248 – 0.0256)	10	10	11	11	11	11	12	12	13	13	13	13	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																
0.651 – 0.670 (0.0256 – 0.0264)	10	11	11	11	11	12	12	13	13	13	13	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																		
0.671 – 0.690 (0.0264 – 0.0272)	11	11	11	11	12	12	13	13	13	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																				
0.691 – 0.710 (0.0272 – 0.0280)	11	11	12	12	12	13	13	13	14	14	14	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																						
0.711 – 0.730 (0.0280 – 0.0287)	12	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																																								
0.731 – 0.750 (0.0288 – 0.0295)	12	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	17	17	17	17	17	17	17																																										
0.751 – 0.770 (0.0296 – 0.0303)	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	17	17	17	17	17	17																																												
0.771 – 0.790 (0.0304 – 0.0311)	13	13	13	13	14	14	15	15	15	16	16	16	17	17	17	17	17	17	17																																														
0.791 – 0.810 (0.0311 – 0.0319)	13	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17	17																																																
0.811 – 0.830 (0.0319 – 0.0327)	14	14	14	14	15	15	15	16	16	16	17	17	17	17	17																																																		
0.831 – 0.850 (0.0327 – 0.0335)	14	14	15	15	15	15	16	16	17	17	17	17	17																																																				
0.851 – 0.870 (0.0335 – 0.0343)	14	15	15	15	15	16	16	17	17	17	17	17																																																					
0.871 – 0.890 (0.0343 – 0.0350)	15	15	15	15	16	16	17	17	17	17	17																																																						
0.891 – 0.910 (0.0351 – 0.0358)	15	15	16	16	16	17	17	17	17																																																								
0.911 – 0.930 (0.0359 – 0.0366)	16	16	16	16	17	17	17	17																																																									
0.931 – 0.950 (0.0367 – 0.0374)	16	16	17	17	17	17	17																																																										
0.951 – 0.970 (0.0374 – 0.0382)	16	17	17	17	17	17																																																											
0.971 – 0.990 (0.0382 – 0.0390)	17	17	17	17																																																													
0.991 – 1.010 (0.0390 – 0.0398)	17	17	17																																																														
1.011 – 1.030 (0.0398 – 0.0406)	17	17																																																															
1.031 – 1.050 (0.0406 – 0.0413)	17																																																																

V00831

Intake valve clearance (Cold):
0.15 – 0.25 mm (0.006 – 0.01 in.)
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed and measured clearance is 0.440 mm (0.0173 in.). Replace the 2.800 mm (0.1102 in.) shim with a No. 12 shim.

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

HINT: New shims have the thickness in millimeters imprinted on the face.

CONTINUED

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Adjusting Shim Selection Chart (Exhaust)

Installed shim thickness mm (in.) 2.500 – 2.750:

Measured clearance mm (in.)	2.500 (0.0984)	2.520 (0.0992)	2.540 (0.1000)	2.550 (0.1004)	2.560 (0.1008)	2.580 (0.1016)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.650 (0.1043)	2.660 (0.1047)	2.680 (0.1055)	2.700 (0.1063)	2.710 (0.1067)	2.720 (0.1071)	2.730 (0.1075)	2.740 (0.1079)	2.750 (0.1083)	2.760 (0.1087)	2.770 (0.1091)	2.780 (0.1094)	2.790 (0.1098)
0.000 – 0.030 (0.0000 – 0.0012)																		1	1	1	1	1
0.031 – 0.050 (0.0012 – 0.0020)															1	1	1	1	1	1	1	2
0.051 – 0.070 (0.0020 – 0.0028)													1	1	1	1	1	1	1	2	2	2
0.071 – 0.090 (0.0028 – 0.0035)												1	1	1	1	1	1	2	2	2	2	2
0.091 – 0.110 (0.0036 – 0.0043)											1	1	1	1	1	2	2	2	2	2	3	3
0.111 – 0.130 (0.0044 – 0.0051)									1	1	1	1	1	2	2	2	2	2	3	3	3	3
0.131 – 0.150 (0.0052 – 0.0059)								1	1	1	1	1	2	2	2	2	3	3	3	3	3	4
0.151 – 0.170 (0.0059 – 0.0067)							1	1	1	1	1	2	2	2	3	3	3	3	3	4	4	4
0.171 – 0.190 (0.0067 – 0.0075)						1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	4
0.191 – 0.210 (0.0075 – 0.0083)					1	1	1	1	2	2	2	3	3	3	3	4	4	4	4	4	5	5
0.211 – 0.230 (0.0083 – 0.0091)			1	1	1	1	1	2	2	2	3	3	4	4	4	4	4	4	5	5	5	5
0.231 – 0.249 (0.0091 – 0.0098)		1	1	1	1	1	2	2	3	3	3	3	4	4	4	4	5	5	5	5	5	6
0.250 – 0.350 (0.0098 – 0.0138)																						
0.351 – 0.370 (0.0138 – 0.0146)	2	3	3	3	3	4	4	5	5	5	5	6	6	6	7	7	7	7	7	8	8	8
0.371 – 0.390 (0.0146 – 0.0154)	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8
0.391 – 0.410 (0.0154 – 0.0161)	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	8	8	8	8	8	9	9
0.411 – 0.430 (0.0162 – 0.0169)	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	8	8	9	9	9	9
0.431 – 0.450 (0.0170 – 0.0177)	4	4	5	5	5	5	6	6	7	7	7	7	8	8	8	8	9	9	9	9	9	10
0.451 – 0.470 (0.0178 – 0.0185)	4	5	5	5	5	6	6	7	7	7	7	8	8	8	9	9	9	9	9	10	10	10
0.471 – 0.490 (0.0185 – 0.0193)	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	9	9	10	10	10	10	10
0.491 – 0.510 (0.0193 – 0.0201)	5	5	6	6	6	7	7	7	8	8	8	9	9	9	9	10	10	10	10	10	11	11
0.511 – 0.530 (0.0201 – 0.0209)	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	10	10	11	11	11	11
0.531 – 0.550 (0.0209 – 0.0217)	6	6	7	7	7	7	8	8	9	9	9	9	10	10	10	10	11	11	11	11	11	12
0.551 – 0.570 (0.0217 – 0.0224)	6	7	7	7	7	8	8	9	9	9	9	10	10	10	11	11	11	11	11	12	12	12
0.571 – 0.590 (0.0225 – 0.0232)	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12
0.591 – 0.610 (0.0233 – 0.0240)	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	12	12	12	12	12	13	13
0.611 – 0.630 (0.0241 – 0.0248)	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	12	13	13	13	13
0.631 – 0.650 (0.0248 – 0.0256)	8	8	9	9	9	9	10	10	11	11	11	11	12	12	12	12	13	13	13	13	13	14
0.651 – 0.670 (0.0256 – 0.0264)	8	9	9	9	9	10	10	11	11	11	11	12	12	12	13	13	13	13	13	14	14	14
0.671 – 0.690 (0.0264 – 0.0272)	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14
0.691 – 0.710 (0.0272 – 0.0280)	9	9	10	10	10	11	11	11	12	12	12	13	13	13	13	14	14	14	14	14	15	15
0.711 – 0.730 (0.0280 – 0.0287)	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	14	14	15	15	15	15
0.731 – 0.750 (0.0288 – 0.0295)	10	10	11	11	11	11	12	12	13	13	13	13	14	14	14	14	15	15	15	15	15	16
0.751 – 0.770 (0.0296 – 0.0303)	10	11	11	11	11	12	12	13	13	13	13	14	14	14	15	15	15	15	15	16	16	16
0.771 – 0.790 (0.0304 – 0.0311)	11	11	11	12	12	12	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	16
0.791 – 0.810 (0.0311 – 0.0319)	11	11	12	12	12	13	13	13	14	14	14	15	15	15	15	16	16	16	16	16	17	17
0.811 – 0.830 (0.0319 – 0.0327)	11	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	16	16	17	17	17	17
0.831 – 0.850 (0.0327 – 0.0335)	12	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	17	17	17	17	17	17
0.851 – 0.870 (0.0335 – 0.0343)	12	13	13	13	13	14	14	15	15	15	15	16	16	16	17	17	17	17	17	17	17	
0.871 – 0.890 (0.0343 – 0.0350)	13	13	13	14	14	14	15	15	15	16	16	16	16	17	17	17	17	17	17			
0.891 – 0.910 (0.0351 – 0.0358)	13	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17	17					
0.911 – 0.930 (0.0359 – 0.0366)	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17							
0.931 – 0.950 (0.0367 – 0.0374)	14	14	15	15	15	15	16	16	17	17	17	17	17									
0.951 – 0.970 (0.0374 – 0.0382)	14	15	15	15	15	16	16	17	17	17	17	17										
0.971 – 0.990 (0.0382 – 0.0390)	15	15	15	16	16	16	17	17	17	17	17											
0.991 – 1.010 (0.0390 – 0.0398)	15	15	16	16	16	17	17	17	17													
1.011 – 1.030 (0.0398 – 0.0406)	15	16	16	16	17	17	17	17														
1.031 – 1.050 (0.0406 – 0.0413)	16	16	17	17	17	17	17															
1.051 – 1.070 (0.0414 – 0.0421)	16	17	17	17	17	17																
1.071 – 1.090 (0.0422 – 0.0429)	17	17	17	17	17																	
1.091 – 1.110 (0.0430 – 0.0437)	17	17	17																			
1.111 – 1.130 (0.0437 – 0.0445)	17	17																				
1.131 – 1.150 (0.0445 – 0.0413)	17																					

Installed shim thickness mm (in.) 2.800 – 3.010:

Measured clearance mm (in.)	2.800 (0.1102)	2.810 (0.1106)	2.820 (0.1110)	2.830 (0.1114)	2.840 (0.1118)	2.850 (0.1122)	2.860 (0.1126)	2.870 (0.1130)	2.880 (0.1134)	2.890 (0.1138)	2.900 (0.1142)	2.910 (0.1146)	2.920 (0.1150)	2.930 (0.1154)	2.940 (0.1157)	2.950 (0.1161)	2.960 (0.1166)	2.970 (0.1169)	2.980 (0.1173)	2.990 (0.1177)	3.000 (0.1181)	3.010 (0.1185)
0.000 – 0.030 (0.0000 – 0.0012)	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5
0.031 – 0.050 (0.0012 – 0.0020)	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6
0.051 – 0.070 (0.0020 – 0.0028)	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6
0.071 – 0.090 (0.0028 – 0.0035)	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7
0.091 – 0.110 (0.0036 – 0.0043)	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7
0.111 – 0.130 (0.0044 – 0.0051)	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8
0.131 – 0.150 (0.0052 – 0.0059)	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8
0.151 – 0.170 (0.0059 – 0.0067)	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8
0.171 – 0.190 (0.0067 – 0.0075)	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9
0.191 – 0.210 (0.0075 – 0.0083)	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9
0.211 – 0.230 (0.0083 – 0.0091)	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10
0.231 – 0.249 (0.0091 – 0.0098)	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10
0.250 – 0.350 (0.0098 – 0.0138)																						
0.351 – 0.370 (0.0138 – 0.0146)	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12
0.371 – 0.390 (0.0146 – 0.0154)	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13
0.391 – 0.410 (0.0154 – 0.0161)	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13
0.411 – 0.430 (0.0162 – 0.0169)	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14
0.431 – 0.450 (0.0170 – 0.0177)	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14
0.451 – 0.470 (0.0178 – 0.0185)	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14
0.471 – 0.490 (0.0185 – 0.0193)	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15
0.491 – 0.510 (0.0193 – 0.0201)	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15
0.511 – 0.530 (0.0201 – 0.0209)	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16
0.531 – 0.550 (0.0209 – 0.0217)	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16
0.551 – 0.570 (0.0217 – 0.0224)	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16
0.571 – 0.590 (0.0225 – 0.0232)	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17
0.591 – 0.610 (0.0233 – 0.0240)	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17
0.611 – 0.630 (0.0241 – 0.0248)	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17
0.631 – 0.650 (0.0248 – 0.0256)	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	
0.651 – 0.670 (0.0256 – 0.0264)	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17			
0.671 – 0.690 (0.0264 – 0.0272)	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17					
0.691 – 0.710 (0.0272 – 0.0280)	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17							
0.711 – 0.730 (0.0280 – 0.0287)	15	16	16	16	16	16	17	17	17	17	17	17	17									
0.731 – 0.750 (0.0288 – 0.0295)	16	16	16	16	17	17	17	17	17	17	17											
0.751 – 0.770 (0.0296 – 0.0303)	16	16	17	17	17	17	17	17	17													
0.771 – 0.790 (0.0304 – 0.0311)	17	17	17	17	17	17	17															
0.791 – 0.810 (0.0311 – 0.0319)	17	17	17	17	17																	
0.811 – 0.830 (0.0319 – 0.0327)	17	17	17																			
0.831 – 0.850 (0.0327 – 0.0335)	17																					

Installed shim thickness mm (in.) 3.020 – 3.300:

Measured clearance mm (in.)	3.020 (0.1189)	3.030 (0.1193)	3.040 (0.1197)	3.050 (0.1201)	3.060 (0.1206)	3.070 (0.1209)	3.080 (0.1213)	3.090 (0.1217)	3.100 (0.1220)	3.120 (0.1228)	3.140 (0.1236)	3.150 (0.1240)	3.160 (0.1244)	3.180 (0.1252)	3.200 (0.1260)	3.220 (0.1268)	3.240 (0.1276)	3.250 (0.1280)	3.260 (0.1283)	3.280 (0.1291)	3.300 (0.1299)
0.000 – 0.030 (0.0000 – 0.0012)	6	6	6	6	6	7	7	7	7	8	8	8	8	9	9	10	10	10	10	11	11
0.031 – 0.050 (0.0012 – 0.0020)	6	6	7	7	7	7	7	8	8	8	9	9	9	9	10	10	11	11	11	11	12
0.051 – 0.070 (0.0020 – 0.0028)	7	7	7	7	7	8	8	8	8	9	9	9	9	10	10	11	11	11	11	12	12
0.071 – 0.090 (0.0028 – 0.0035)	7	7	7	8	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13
0.091 – 0.110 (0.0036 – 0.0043)	7	8	8	8	8	8	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13
0.111 – 0.130 (0.0044 – 0.0051)	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13
0.131 – 0.150 (0.0052 – 0.0059)	8	8	9	9	9	9	9	10	10	10	11	11	11	11	12	12	13	13	13	13	14
0.151 – 0.170 (0.0059 – 0.0067)	9	9	9	9	9	10	10	10	10	11	11	11	11	12	12	13	13	13	13	14	14
0.171 – 0.190 (0.0067 – 0.0075)	9	9	9	10	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15
0.191 – 0.210 (0.0075 – 0.0083)	9	10	10	10	10	11	11	11	11	11	12	12	12	13	13	13	14	14	14	15	15
0.211 – 0.230 (0.0083 – 0.0091)	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	14	14	14	15	15	15
0.231 – 0.249 (0.0091 – 0.0098)	10	10	11	11	11	11	11	12	12	12	13	13	13	13	14	14	15	15	15	15	16
0.250 – 0.350 (0.0098 – 0.0138)																					
0.351 – 0.370 (0.0138 – 0.0146)	13	13	13	13	13	14	14	14	14	14	15	15	15	16	16	17	17	17	17	17	
0.371 – 0.390 (0.0146 – 0.0154)	13	13	13	14	14	14	14	14	15	15	15	16	16	16	17	17	17	17	17		
0.391 – 0.410 (0.0154 – 0.0161)	13	14	14	14	14	14	15	15	15	15	16	16	16	17	17	17	17				
0.411 – 0.430 (0.0162 – 0.0169)	14	14	14	14	15	15	15	15	15	16	16	16	17	17	17	17					
0.431 – 0.450 (0.0170 – 0.0177)	14	14	15	15	15	15	15	16	16	16	17	17	17	17	17						
0.451 – 0.470 (0.0178 – 0.0185)	15	15	15	15	15	16	16	16	16	17	17	17	17	17							
0.471 – 0.490 (0.0185 – 0.0193)	15	15	15	16	16	16	16	16	17	17	17	17	17								
0.491 – 0.510 (0.0193 – 0.0201)	15	16	16	16	16	16	17	17	17	17	17										
0.511 – 0.530 (0.0201 – 0.0209)	16	16	16	16	17	17	17	17	17	17											
0.531 – 0.550 (0.0209 – 0.0217)	16	16	17	17	17	17	17	17	17												
0.551 – 0.570 (0.0217 – 0.0224)	17	17	17	17	17	17	17														
0.571 – 0.590 (0.0225 – 0.0232)	17	17	17	17	17																
0.591 – 0.610 (0.0233 – 0.0240)	17	17	17																		
0.611 – 0.630 (0.0241 – 0.0248)	17																				

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

HINT: New shims have the thickness in millimeters imprinted on the face.

Exhaust valve clearance (Cold):
0.25 – 0.35 mm (0.01 – 0.014 in.)
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed and measured clearance is 0.440 mm (0.0173 in.). Replace the 2.800 mm (0.1102 in.) shim with a No. 10 shim.

V00832

CONTINUED

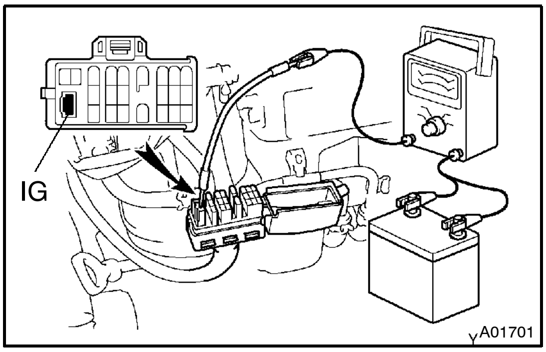
8. INSTALL CYLINDER HEAD COVER

9. RECONNECT ENGINE WIRE

10. REINSTALL HIGH–TENSION CORDS TO SPARK PLUGS

11. REINSTALL PCV HOSES

CLICK HERE TO VIEW CHAPTER INDEX
3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX



IGNITION TIMING (1RZ-E)

EM08T-01

INSPECTION

1. WARM UP ENGINE

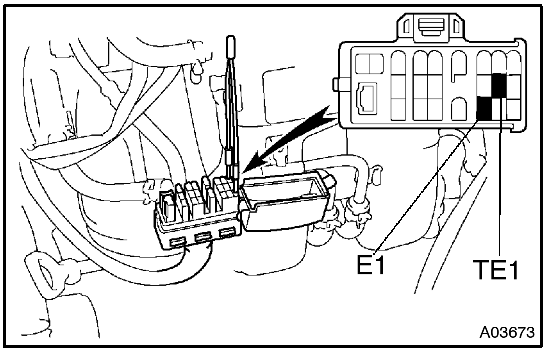
Allow the engine to warm up to normal operating temperature.

2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

(a) Connect the tester probe of a tachometer to terminal IG⊖ of the check connecter.

NOTICE:

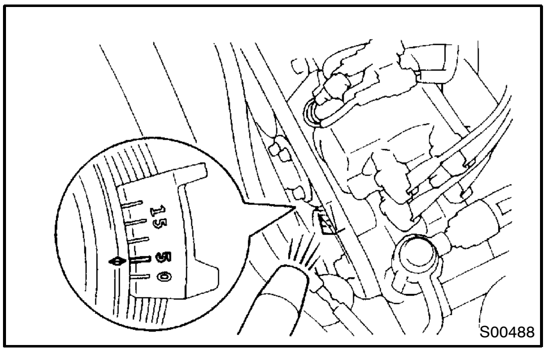
Never allow the tachometer terminal to touch ground as it could result in damage to the igniter and/ or ignition coil. As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.



3. INSPECT AND ADJUST IGNITION TIMING

(a) Using SST, connect terminals TE1 and E1 of the check connecter.

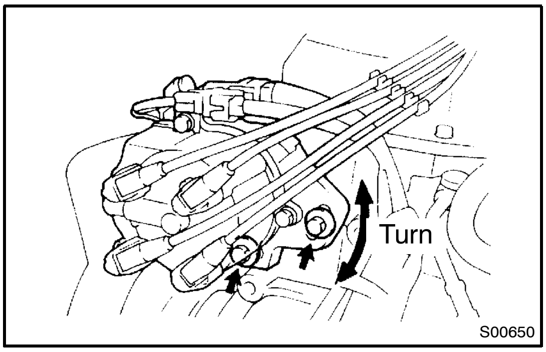
SST 09843-18020



(b) Using a timing light, check the ignition timing.

Ignition timing:

5° BTDC @ idle



(c) Loosen the 2 bolt, and adjust by turning the IIA

(d) Tighten the 2 bolts, and recheck the ignition timing.

Torque:20 N·m (200 kgf·cm, 14 ft·lbf)

Remove the SST from the check connector.

SST 09843-18020

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

4. FURTHER CHECK IGNITION TIMING

Ignition timing:

7° – 17° BTDC @ idle

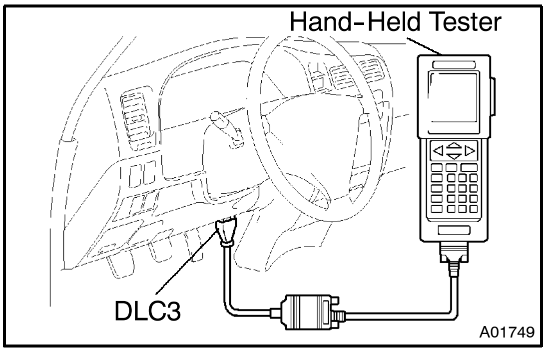
HINT:

The timing mark moves in range between 7° and 17°

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX



IGNITION TIMING (2RZ–FE, 3RZ–FE)

EM08U–01

INSPECTION

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

2. CONNECT HAND–HELD TESTER

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

(b) Please refer to the hand–held tester operator's manual for further details.

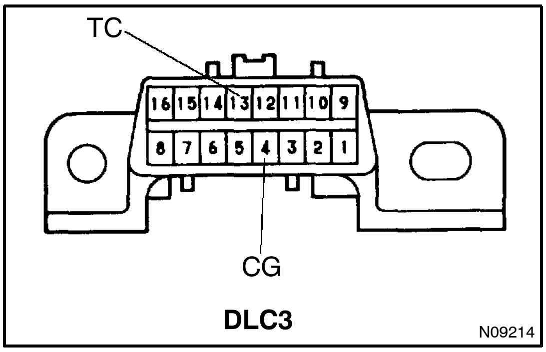
3. CONNECT TIMING LIGHT TO ENGINE

Connect the tester probe of a timing light to the No.1 high–tension cord for No.4 cylinder.

4. CHECK IDLE SPEED

(See page EM–18)

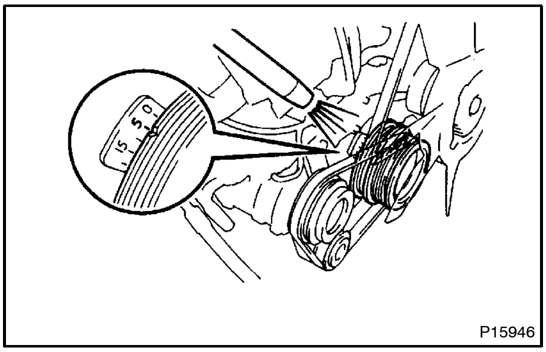
5. DISCONNECT HAND–HELD TESTER



6. INSPECT IGNITION TIMING

(a) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.

SST 09843–18020



(b) Using a timing light, check the ignition timing.

Ignition timing:

5° BTDC @ idle

(Transmission in neutral position)

(c) Remove the SST from the check connector.

SST 09843–18020

7. FURTHER CHECK IGNITION TIMING

Ignition timing:

6 – 17° BTDC @ idle

(Transmission in neutral position)

HINT:

The timing mark moves in a range between 10° and 25°.

8. DISCONNECT TIMING LIGHT FROM ENGINE

IDLE SPEED (1RZ–E)

EM08V–01

INSPECTION

1. INITIAL CONDITIONS

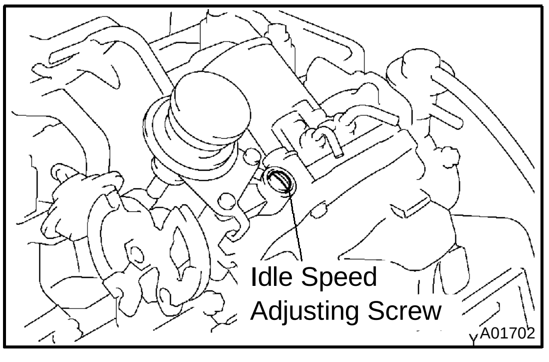
(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All vacuum lines properly connected
(e) EFI system wiring connectors fully pugged
(f) All operating accessories switched OFF
(g) Ignition timing set correctly

2. CONNECT TACHOMETER

(See page EM–14)

3. INSPECT AIR VALVE OPERATION

(See page FI–31)



4. INSPECTION AND ADJUST IDLE SPEED

(a) Race the engine at 2,500 rpm for approx. 90 seconds.
(b) Check the idle speed.

Idle speed:
700 – 800 rpm

(c) Adjust the idle speed by turning the speed adjusting screw.

5. DISCONNECT TACHOMETER

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

IDLE SPEED (2RZ–FE, 3RZ–FE)

EM08W–01

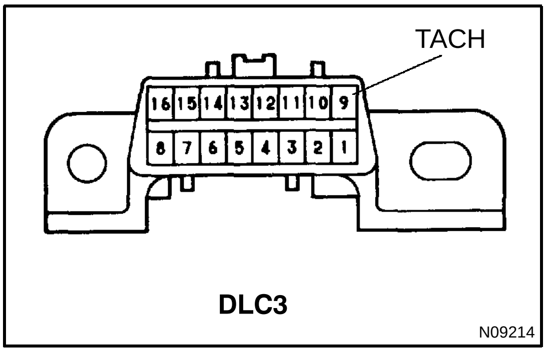
INSPECTION

1. INITIAL CONDITIONS

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
(f) EFI system wiring connectors fully plugged
(g) Ignition timing checks correctly
(h) Transmission in neutral position

2. CONNECT HAND–HELD TESTER

(See page EM–16)



If you have no hand–held tester, connect tachometer test prove to terminal 9 (TACH) of DLC3.

SST 09843–18020

3. INSPECTION IDLE SPEED

(a) Race the engine speed at 2,500 rpm for approx. 90 seconds.
(b) Check the idle speed
Idle speed:
650 – 750 rpm

If the idle speed is not as specified, check the ISC valve and air intake system.

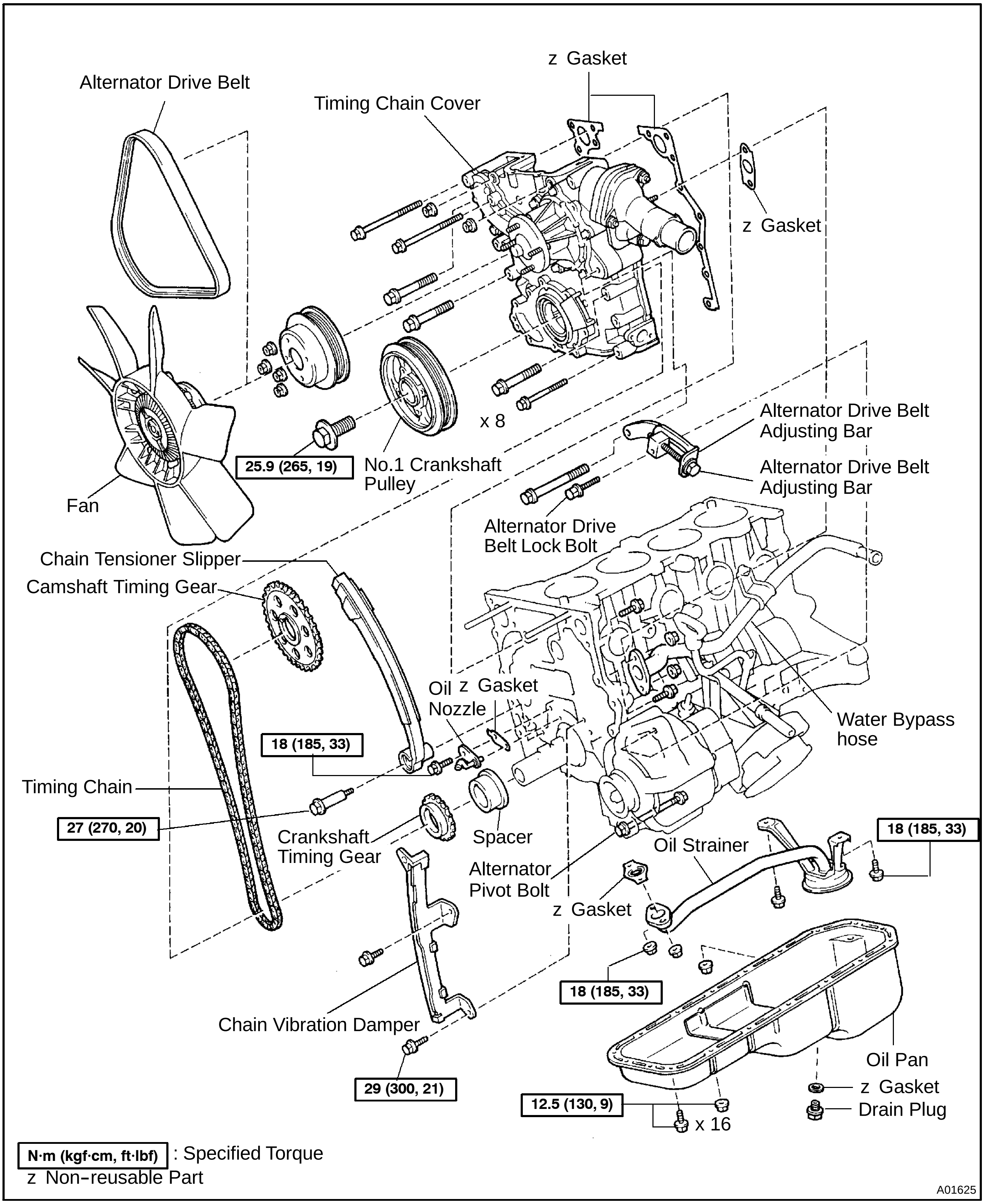
4. DISCONNECT HAND–HELD TESTER

CLICK HERE TO VIEW CHAPTER INDEX

TIMING CHAIN (1RZ, 1RZ–E)

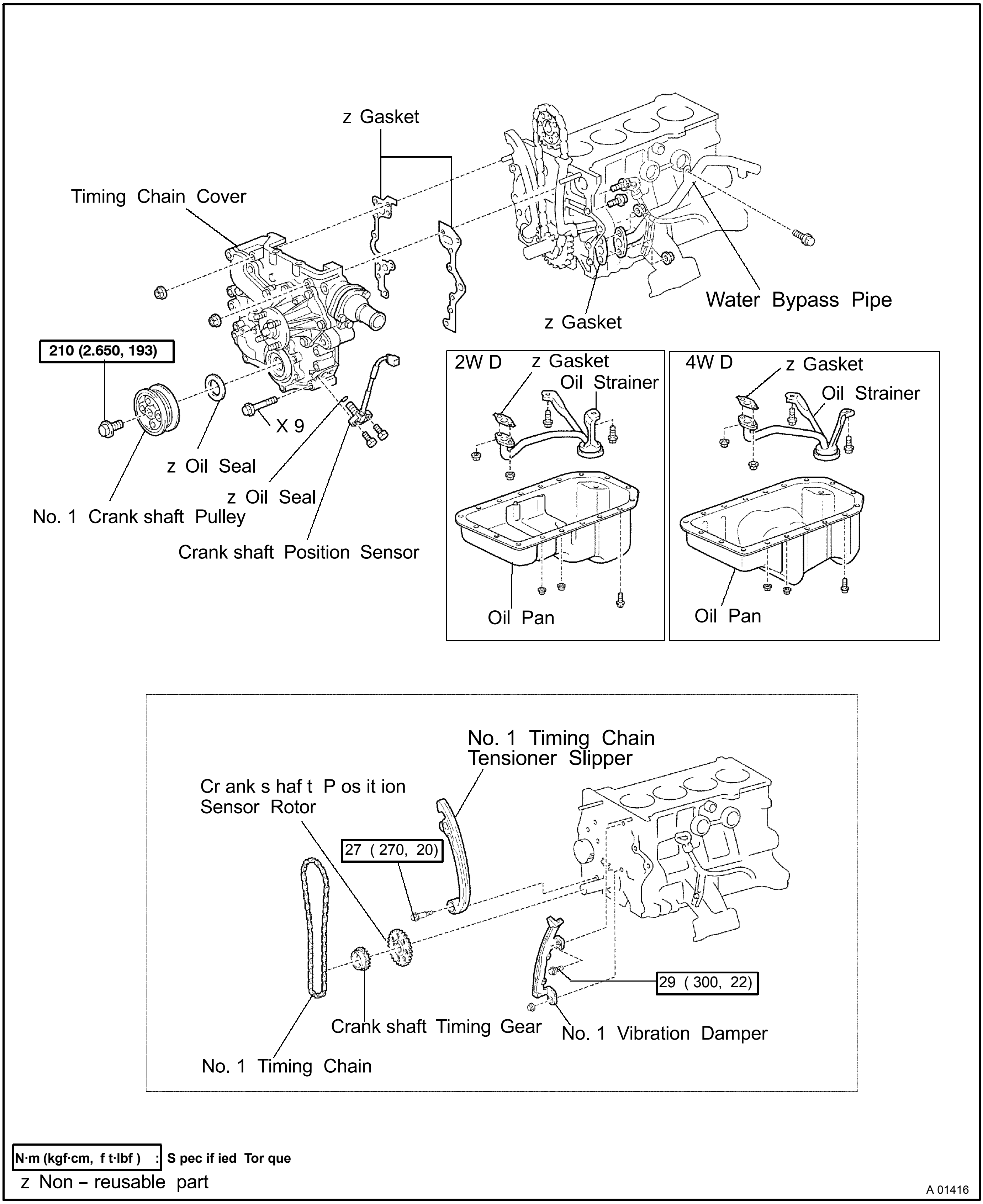
COMPONENTS

EM08X–01



TIMING CHAIN (2RZ - FE)
COMPONENTS

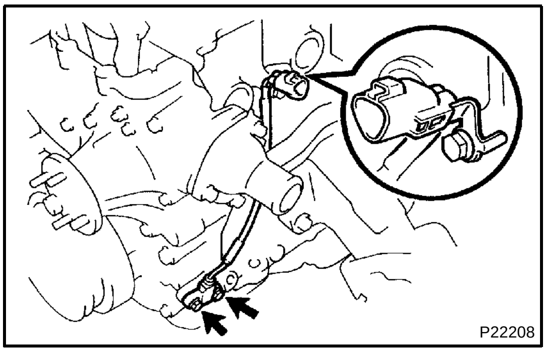
E M 08Y – 01



CLICK HERE TO VIEW CHAPTER INDEX

EM08Z–01

REMOVAL



1. DRAIN ENGINE OIL

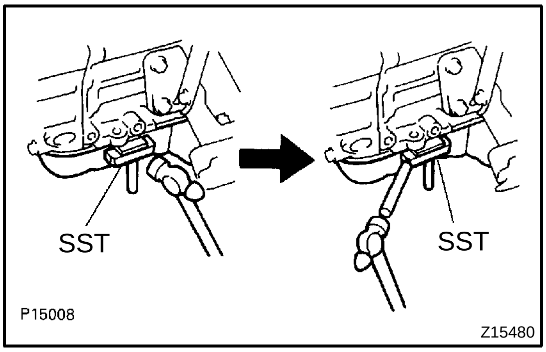
2. REMOVE CYLINDER HEAD ASSEMBLY

(See page EM–33)

3. REMOVE CRANKSHAFT POSITION SENSOR

(a) Remove the 2 bolts crankshaft position sensor.

(b) Remove the O – ring from crankshaft position sensor.



4. REMOVE OIL PAN

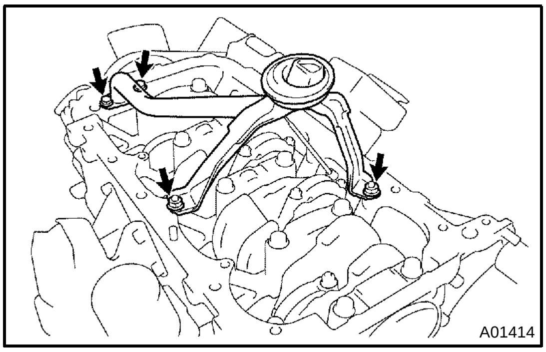
(a) Remove the 16 bolts and 2 nuts.

(b) Insert the blade of SST between the cylinder block and oil pan, cut off applied sealer and remove the oil pan.

SST 09032–00100

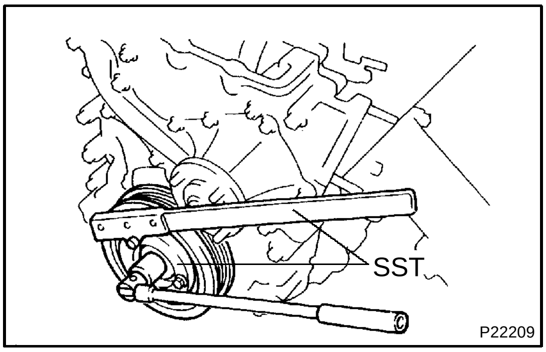
NOTICE:

Be careful not to damage the oil pan flanges of the oil pan and cylinder block.



5. REMOVE OIL STRAINER

Remove the 2 bolts, 2 nuts, oil strainer and gasket.

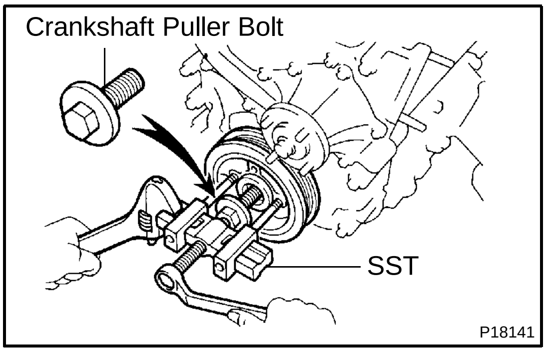


6. REMOVE CRANKSHAFT PULLEY

(a) Using SST, remove the pulley bolt.

SST 09213–54015, 09330–00021

(b) Remove the crankshaft pulley.

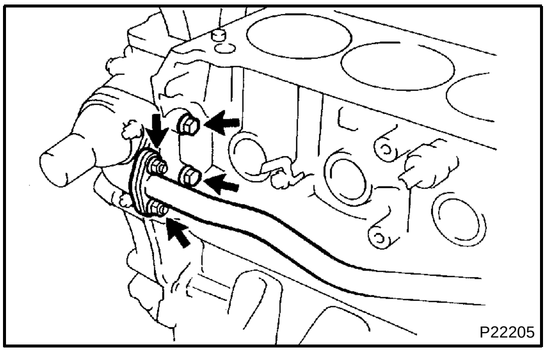


HINT:

If necessary, remove the pulley with SST and crankshaft pulley bolt.

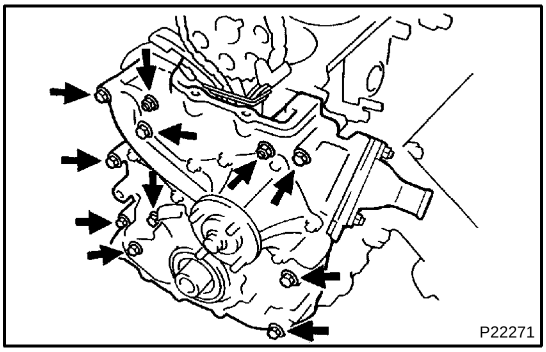
SST 09950–50010 (09951–05010, 09952–05010, 09953–05010, 09954–05020)

CONTINUED

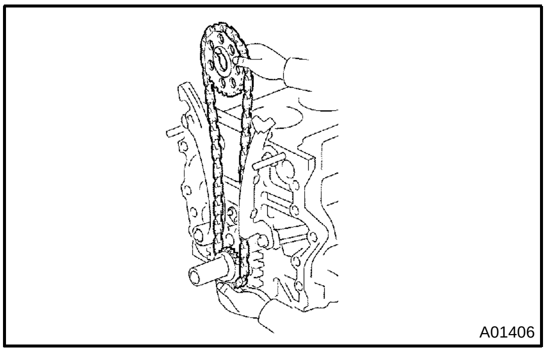

P22205

7. REMOVE TIMING CHAIN COVER

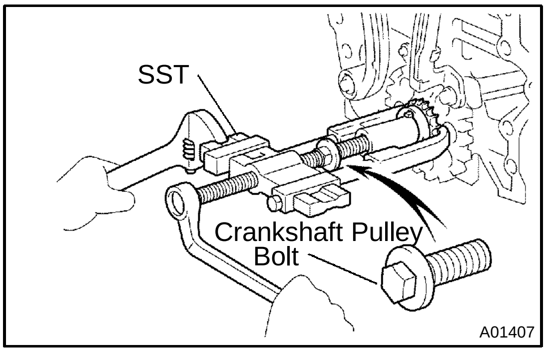
(a) Remove the 2 water bypass pipe nuts.
(b) Remove the 2 timing chain cover bolts.


P22271

(c) Remove the 9 bolts and 2 nuts.
(d) Using a plastic faced hammer, loosen the chain cover and remove the timing chain cover and 3 gasket.


A01406

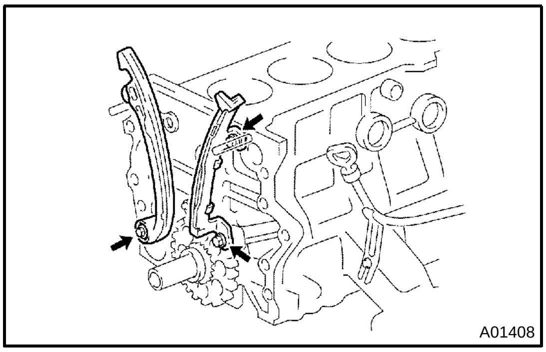
8. REMOVE NO.1 TIMING CHAIN AND CAMSHAFT TIMING GEAR



A01407

9. REMOVE CRANKSHAFT TIMING GEAR

HINT:
If necessary, remove the gear with SST and crankshaft pulley bolt.
SST 09950–40010 (09951–04010, 09952–04010, 09953–04010, 09954–04010, 09955–04060)

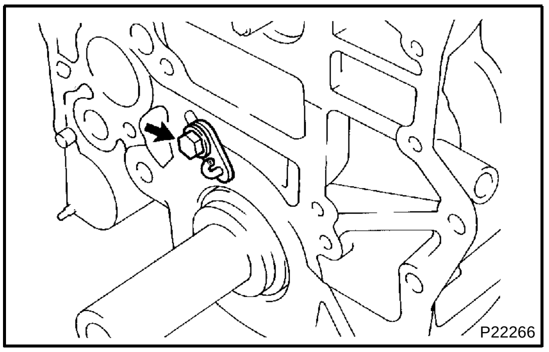

A01408

10. REMOVE NO.1 TIMING CHAIN TENSIONER SLIPPER AND NO.1 VIBRATION DAMPER

(a) Remove the bolt and slipper.
(b) Remove the 2 bolts and No.1 damper.

11. REMOVE CRANKSHAFT POSITION SENSOR ROTOR

CONTINUED

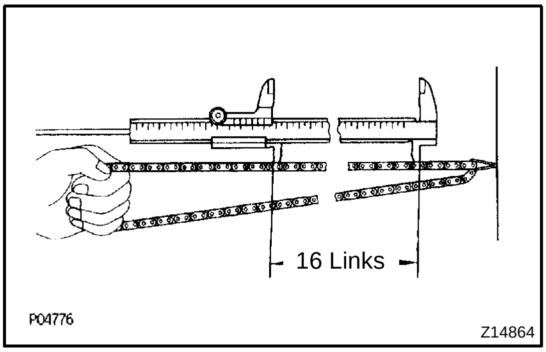


12. REMOVE TIMING CHAIN OIL JET

Remove the bolt, oil jet and gasket.

EM090-01

INSPECTION



Z14864

1. INSPECT TIMING CHAINS, TIMING GEARS AND TIMING SPROCKETS

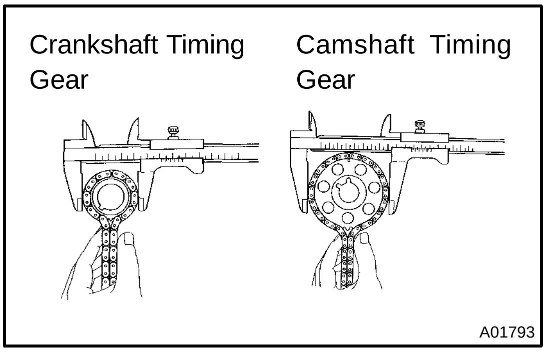
(a) Measure the length of 16 links with the chain fully stretched.

Maximum chain elongation:
No.1 Timing chain
147.5 mm (5.807 in.)

If the elongation is greater than maximum, replace the chain.

HINT:

Make the same measurements pulling at 3 or more places selected at random.



A01793

(b) Wrap the chain around the timing gear and timing sprocket.

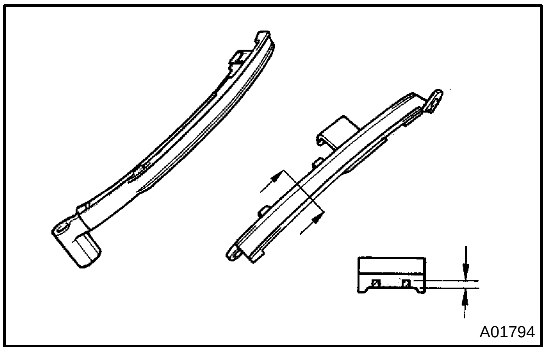
(c) Using vernier calipers, measure the timing gear and timing sprocket diameter with the chain.

NOTICE:

Vernier calipers must contact the chain rollers for measuring.

Minimum gear diameter:
Camshaft
113.8 mm (4.480 in.)
Crankshaft
59.4 mm (2.339 in.)

If the diameter is less than minimum, replace the chain, gears and sprocket.

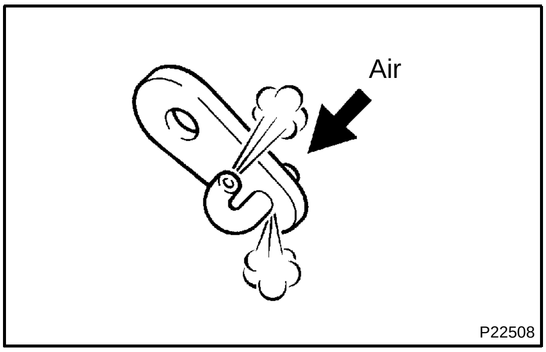

A01794

2. INSPECT CHAIN TENSIONER SLIPPER AND VIBRATION DAMPERS

Measure the chain tensioner slipper and vibration damper wears.

Maximum wear:
1.0 mm (0.039 in.)

If the wear is greater than maximum, replace the slipper and/or dampers.



P22508

3. INSPECT OIL JET

Check the oil for damage or clogging.

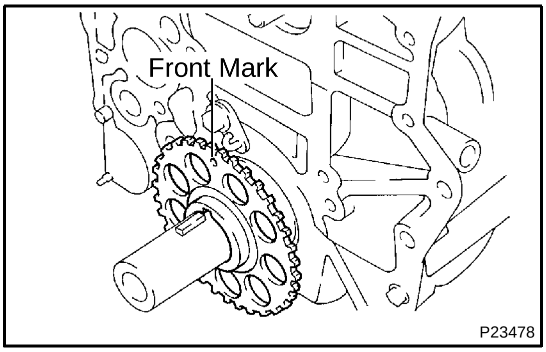
If necessary, replace the oil jet.

4. INSPECT NO.1 CHAIN TENSIONER

(See page EM–50)

If necessary, replace the oil jet (No.2 chain tensioner).

EM091-01



INSTALLATION

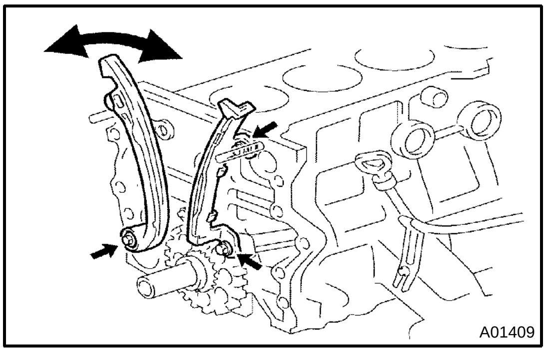
1. INSTALL OIL JET

Install a new gasket and the oil jet with the bolt.

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

2. INSTALL CRANKSHAFT POSITION SENSOR ROTOR

Install the rotor to the crankshaft with the front mark (cavity) of the rotor facing forward.



3. INSTALL NO.1 TIMING CHAIN TENSIONER SLIPPER AND NO.1 VIBRATION DAMPER

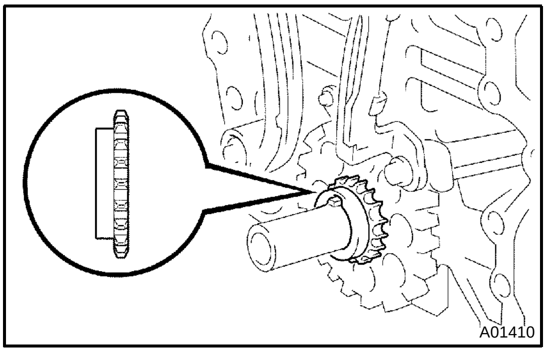
(a) Install the No.1 damper with the bolt and nut.

Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

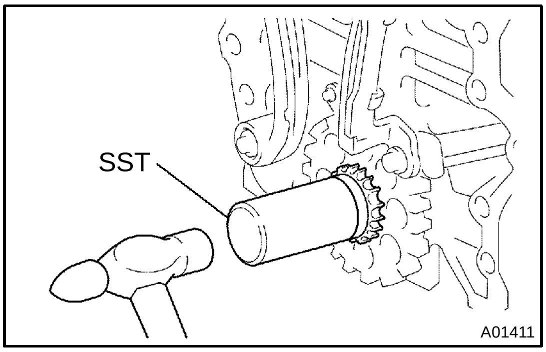
(b) Install the slipper with the bolt.

Torque: 27 N·m (270 kgf·cm, 20 ft·lbf)

(c) Check that the slipper moves smoothly.

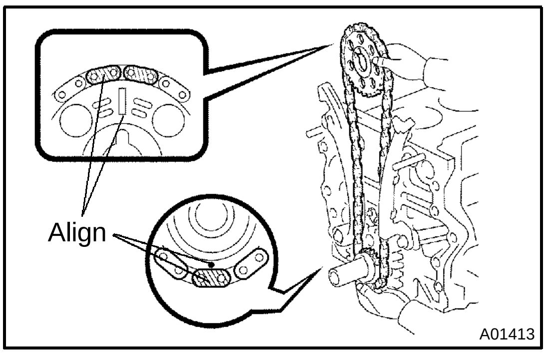


4. INSTALL CRANKSHAFT TIMING GEAR



HINT:
If necessary, install the gear with SST.

SST 09636–20010



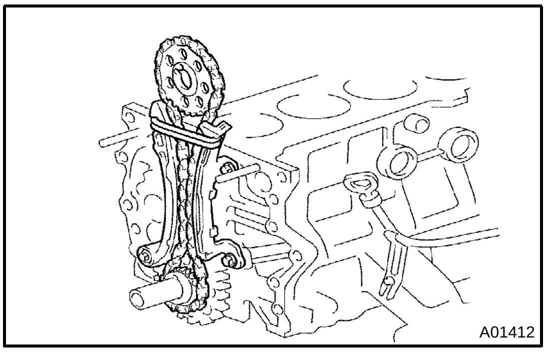
5. INSTALL NO.1 TIMING CHAIN AND CAMSHAFT TIMING GEAR

(a) Align the timing mark between the mark link of the No.1 timing chain, and install the No.1 timing chain to the timing gear.

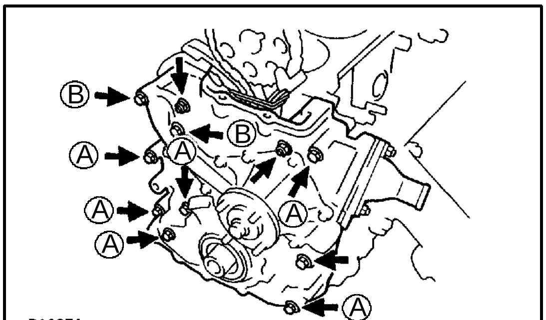
(b) Align the timing mark of the crankshaft timing gear with the mark link of the No.1 timing chain and install the No.1 timing chain.

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX


A01412

(c) Tie the No.1 timing chain with a cord as shown in the illustration, and make sure it doesn't come loose.

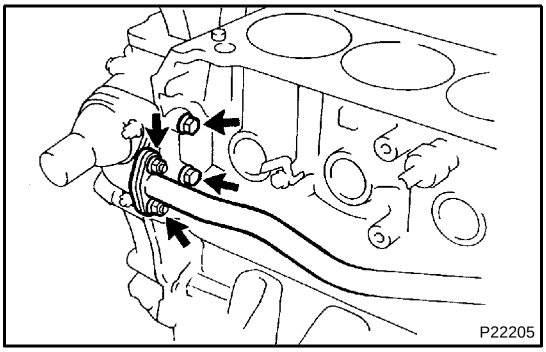


P22271 Z15300

6. INSTALL TIMING CHAIN COVER

(a) Install 3 new gaskets to the cylinder block and water bypass pipe.

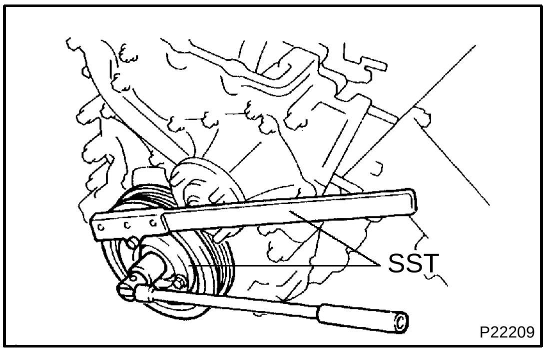
(b) Install the timing chain cover with the 9 bolts and 2 nuts.
Torque:
Bolt:
12 mm head A: 20 N·m (200 kgf·cm, 14 ft·lbf)
12 mm head B: 24.5 N·m (250 kgf·cm, 18 ft·lbf)
14 mm head: 44 N·m (440 kgf·cm, 32 ft·lbf)
Nut : 20 N·m (200 kgf·cm, 14 ft·lbf)


P22205

(c) Install the 2 timing chain cover bolts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

(d) Install the 2 water bypass pipe nuts.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

(e) Remove the cord from the chain.



P22209

7. INSTALL CRANKSHAFT PULLEY

(a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.

(b) Using SST, install and torque the pulley bolt.
SST 09213–54015, 09330–00021
Torque: 260 N·m (2,650 kgf·cm, 193 ft·lbf)

(c) w/ A/C:
Install the No.3 and No.2 crankshaft pulleys with the 4 bolts.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

8. INSTALL OIL STRAINER

Install a new gasket and the oil strainer with the bolt and 2 nuts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

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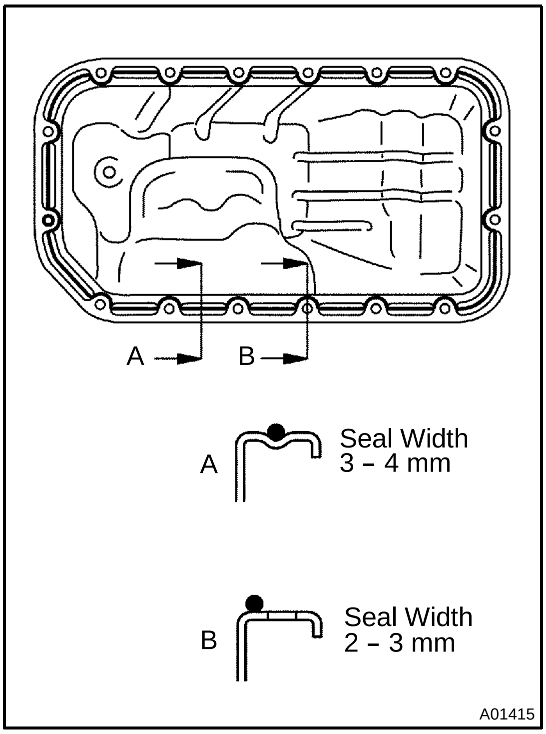


9. INSTALL OIL PAN

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surface of the oil pan.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

NOTICE:

Do not use a solvent which will affect the painted surfaces.

(b) Apply seal packing to the oil pan as shown in the illustration.

Seal packing:

Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.) opening or 3 – 4 mm (0.012 – 0.016 in.) opening.

HINT:

Avoid applying an excessive amount to the surface.

- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the oil pan with the 16 bolts and 2 nuts.

Torque: 12.5 N·m (130 kgf·cm, 9 ft·lbf)

10. INSTALL CRANKSHAFT POSITION SENSOR

Install a new O–ring.

Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)

11. INSTALL CYLINDER HEAD ASSEMBLY

(See page EM–52)

12. FILL WITH ENGINE OIL

13. START ENGINE AND CHECK FOR LEAKS

14. VEHICLE ROAD TEST

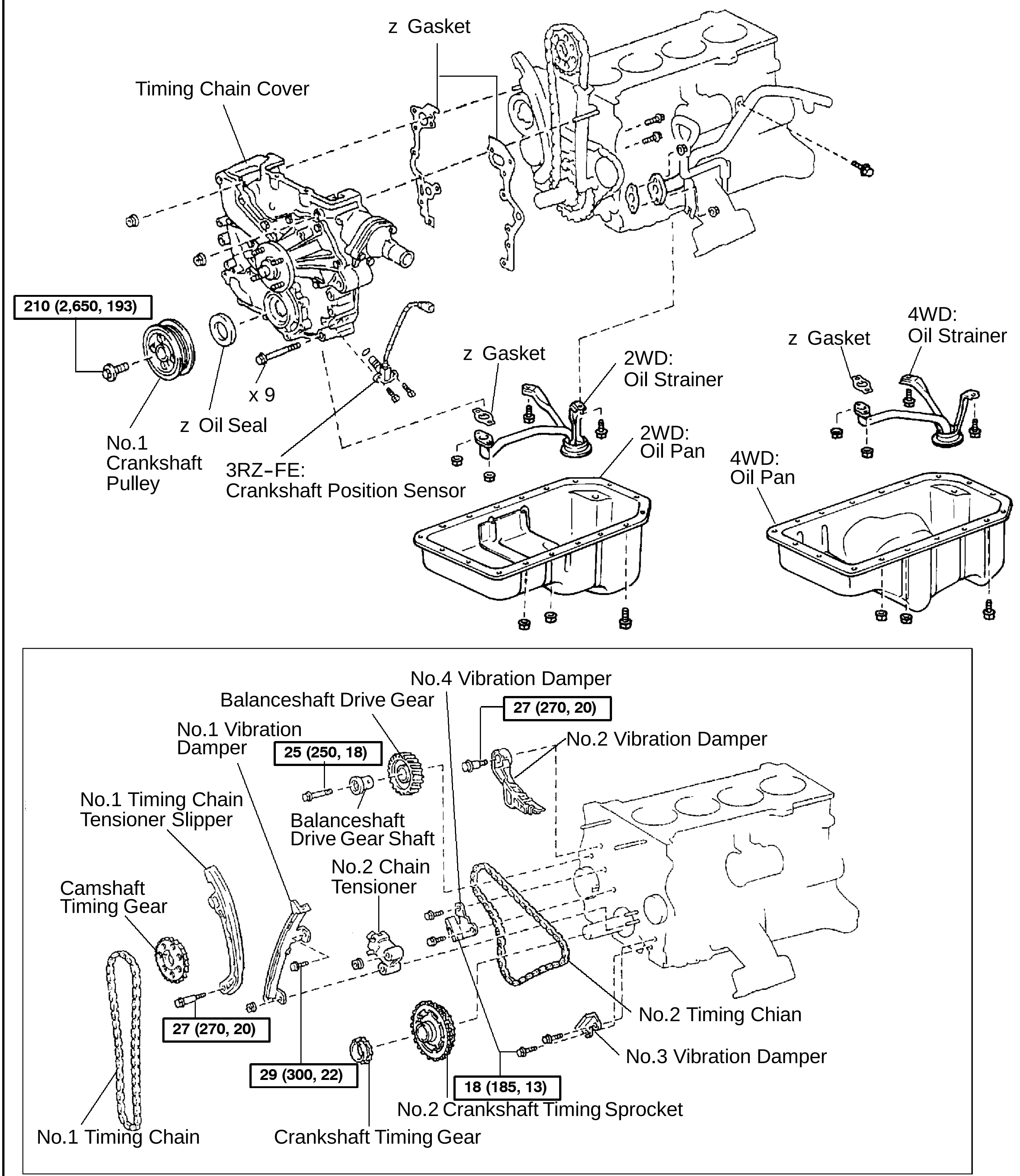
Check for abnormal noise, shock slippage, correct shift points and smooth operation.

15. RECHECK ENGINE COOLANT AND ENGINE OIL LEVEL

TIMING CHAIN (3RZ-F, 3RZ-FE)

COMPONENTS

EM092-01



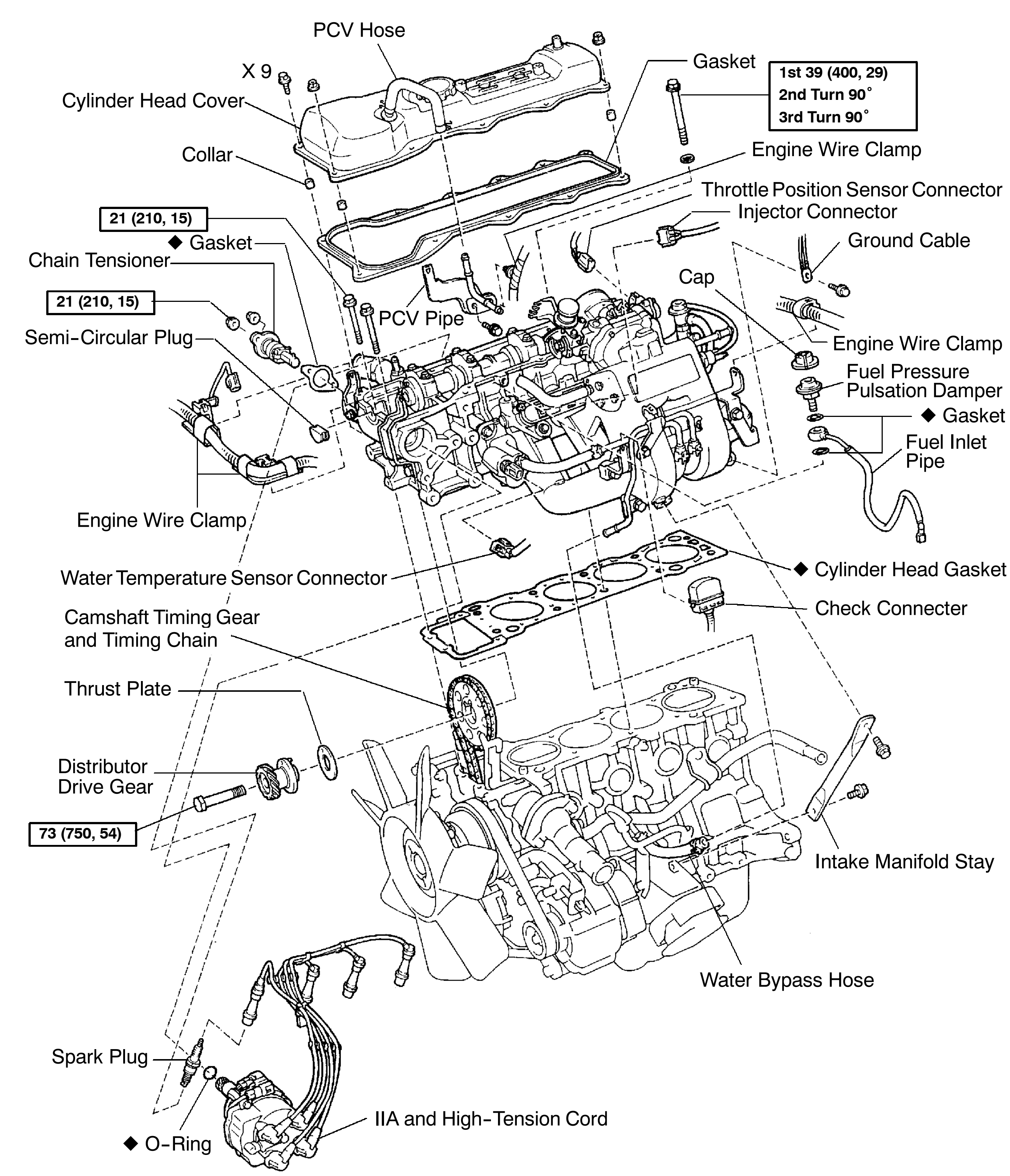
N·m (kgf·cm, ft·lbf) : Specified torque z Non-reusable part

A01624

CYLINDER HEAD (1RZ-E)

COMPONENTS

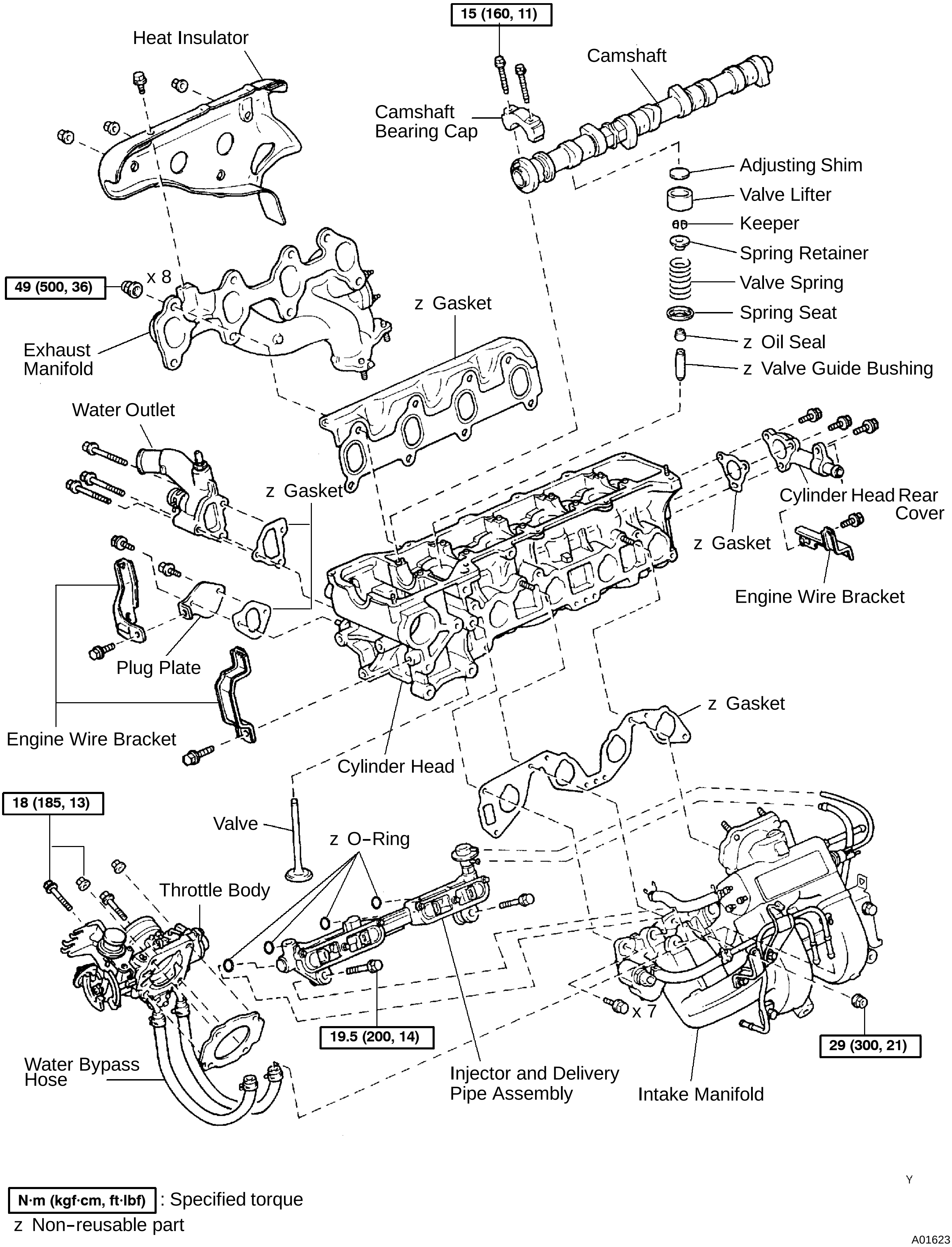
EM093-01



◆ Non-reusable part

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

CONTINUED



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

z Non-reusable part

ENGINE MECHANICAL – CYLINDER HEAD (2RZ-FE)

CONTINUED

ENGINE MECHANICAL – CYLINDER HEAD (2RZ-FE)

CONTINUED

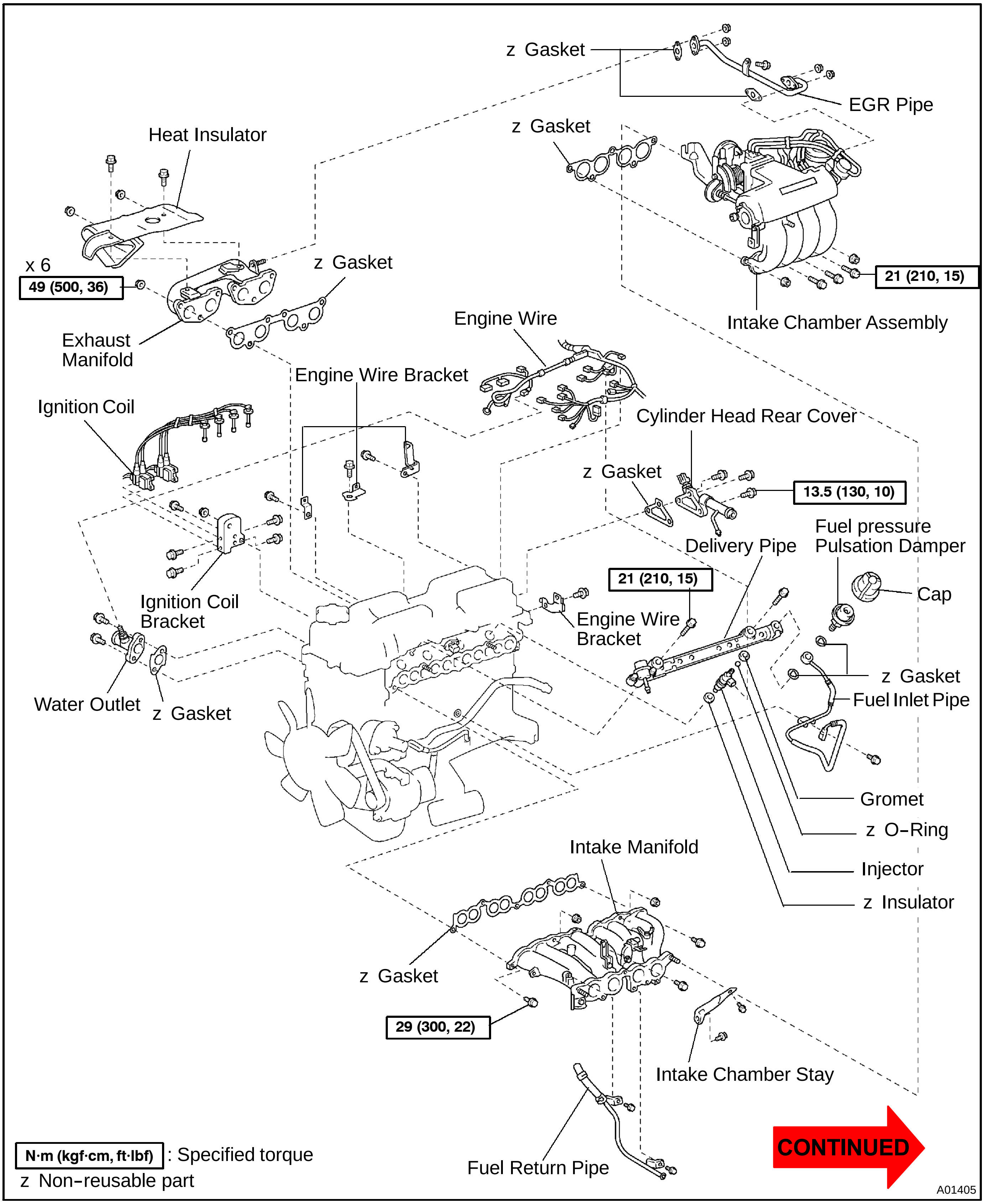
ENGINE MECHANICAL – CYLINDER HEAD (2RZ-FE)

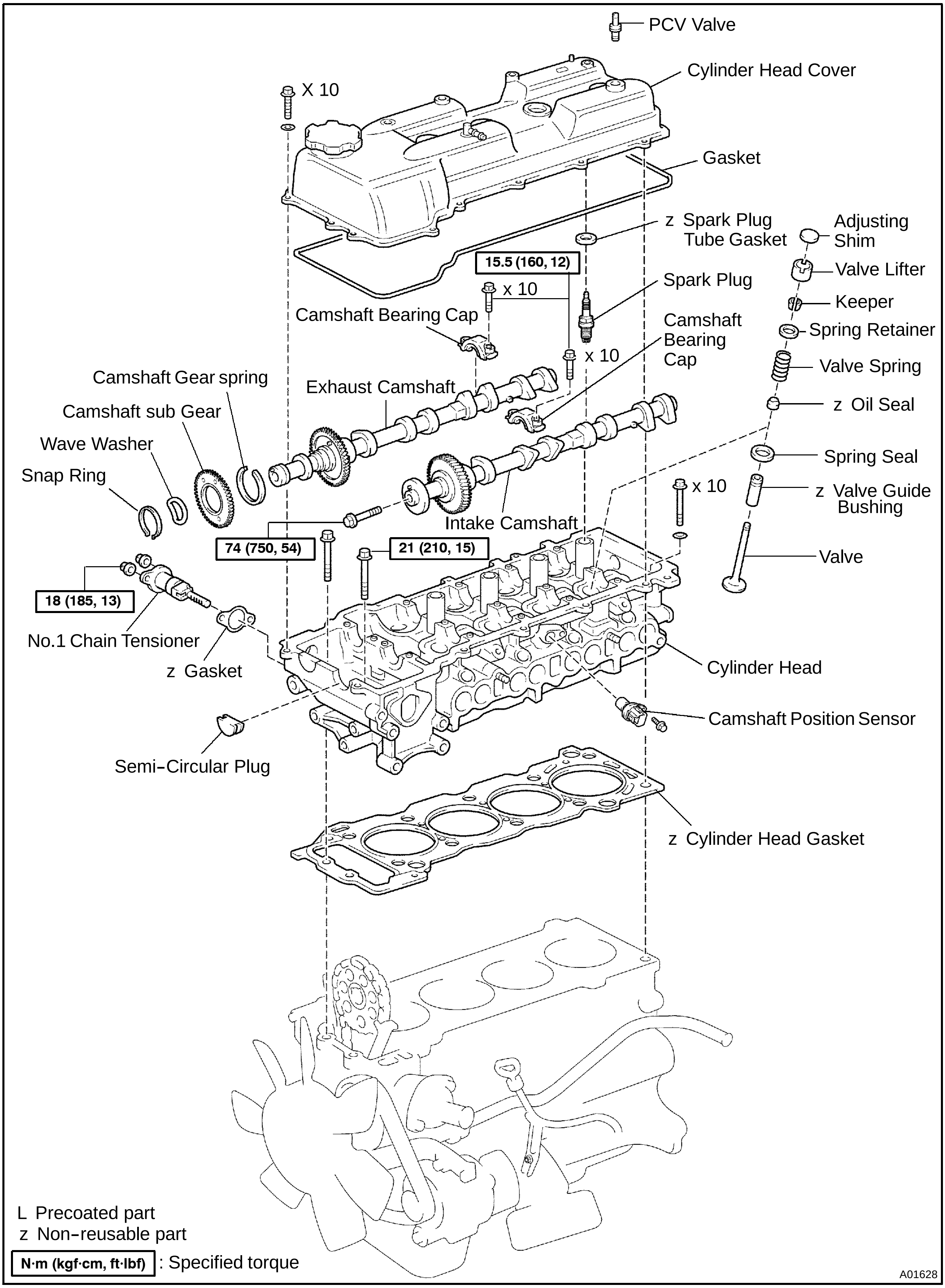
PAGE 3 OF 3

CYLINDER HEAD (2RZ-FE)

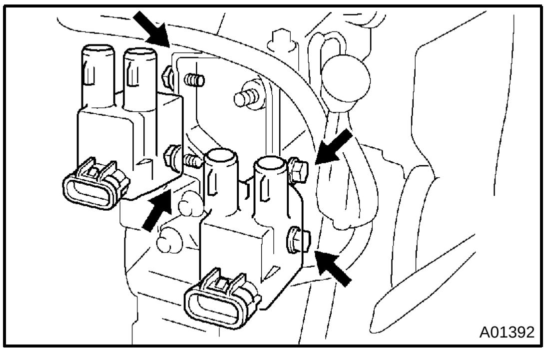
COMPONENTS

EM094-01




PCV Valve
Cylinder Head Cover
X 10
Gasket
z Spark Plug Tube Gasket
Adjusting Shim
Valve Lifter
15.5 (160, 12)
x 10
Spark Plug
Keeper
Camshaft Bearing Cap
Spring Retainer
Camshaft Bearing Cap
x 10
Valve Spring
Camshaft Gear spring
Exhaust Camshaft
z Oil Seal
Camshaft sub Gear
Wave Washer
Spring Seal
Snap Ring
x 10
z Valve Guide Bushing
Intake Camshaft
74 (750, 54)
21 (210, 15)
Valve
18 (185, 13)
No.1 Chain Tensioner
z Gasket
Cylinder Head
Camshaft Position Sensor
Semi–Circular Plug
z Cylinder Head Gasket
L Precoated part
z Non–reusable part
N·m (kgf·cm, ft·lbf) : Specified torque
A01628

EM095-01



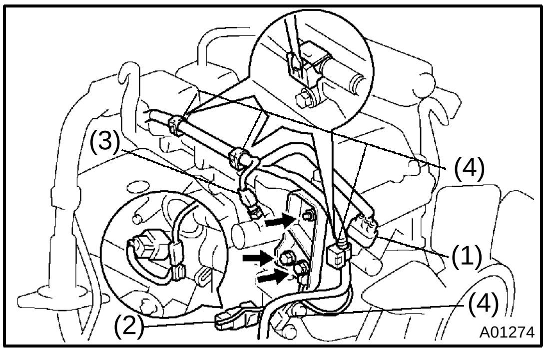
REMOVAL

1. REMOVE PCV HOSES

2. REMOVE IGNITION COILS

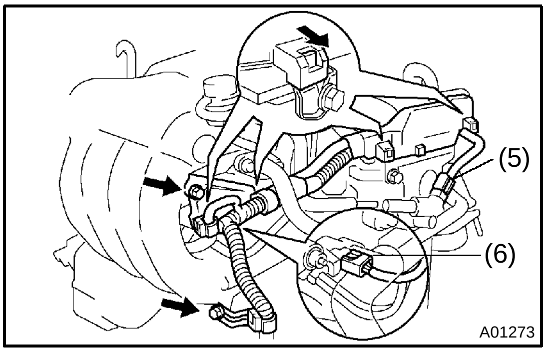
(a) Disconnect the 2 connectors from the ignition coils.
(b) Disconnect high-tension cords at rubber boot from the cylinder head.
(c) Disconnect the 4 high-tension cords from ignition coil.
(d) Remove the 4 bolts and 2 ignition coils from the bracket.
Torque: 10 N·m (100 kgf·cm, 7 ft·lbf)

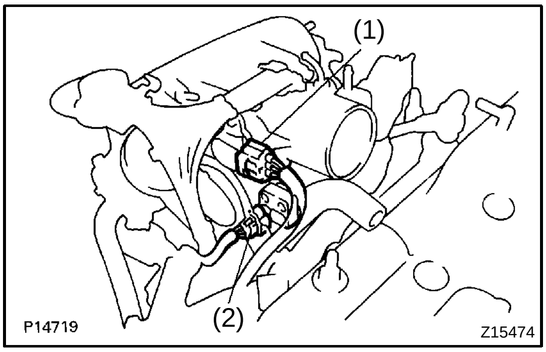
HINT:
Arrange the ignition coils in correct order.



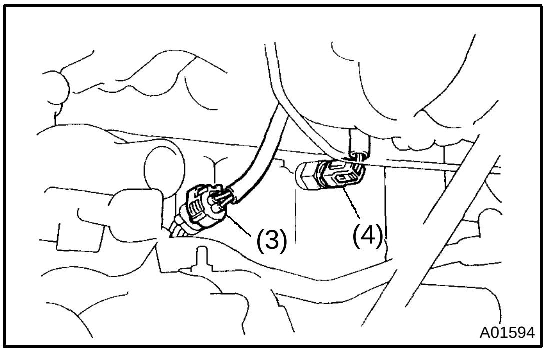
3. DISCONNECT ENGINE WIRE

(a) Remove the ignition coil bracket and ground.
(b) Disconnect these connectors and clamps:
 (1) w/ A/C:
  A/C compressor connector
 (2) Oil pressure sensor connector and clamp
 (3) Engine coolant sender gauge connector
 (4) 3 engine wire clamps and engine wire
 (5) ECT sensor connector
 (6) VSV connector for EGR
(c) Disconnect the 4 engine wire clamps and engine wire.
(d) Remove the engine wire braked from air intake chamber.





(e) Disconnect these connectors:
 (1) Throttle position sensor connector
 (2) ISC valve connector



 (3) Crankshaft position sensor connector
 (4) Knock sensor connector

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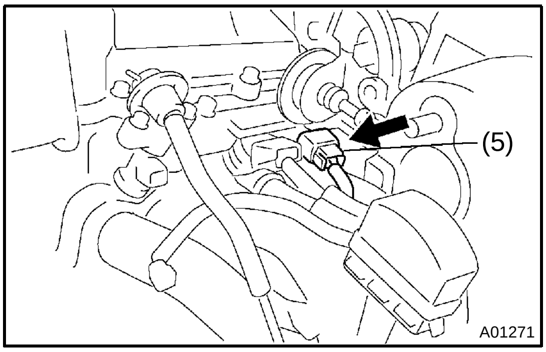
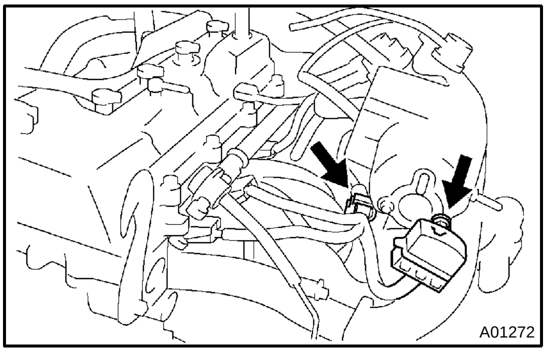


A01271

(5) Camshaft position sensor connector

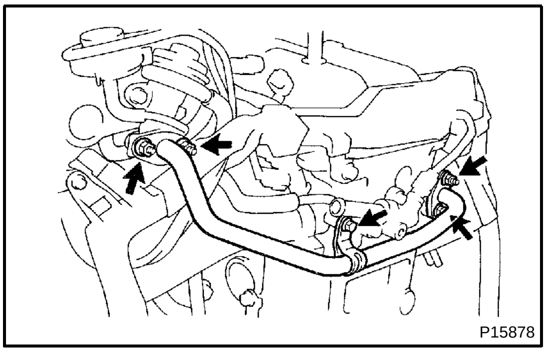


A01272

(f) Disconnect the check connector from the bracket.

(g) Disconnect the engine wire clamp.

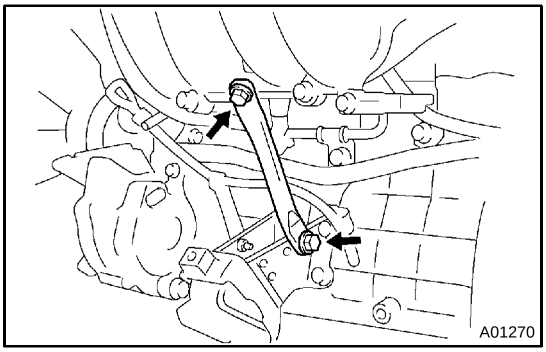
4. DISCONNECT INJECTOR CONNECTORS



P15878

5. REMOVE EGR PIPE

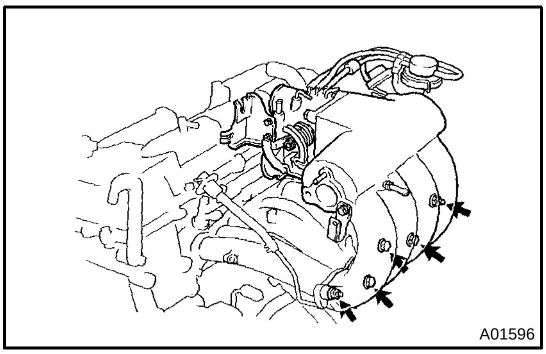
Remove the 4 nuts, bolt, EGR pipe and 2 gasket.



A01270

6. REMOVE INTAKE CHAMBER STAY

Remove the 2 bolts and intake chamber stay.



A01596

7. REMOVE AIR INTAKE CHAMBER ASSEMBLY

(a) Disconnect these hoses:

- EVAP hose from throttle body
- Brake booster vacuum hose from union
- Water bypass hose from water bypass pipe
- Water bypass hose from cylinder head rear cover

(b) Remove the 3 bolts, 2 nuts, air intake chamber assembly and gasket.

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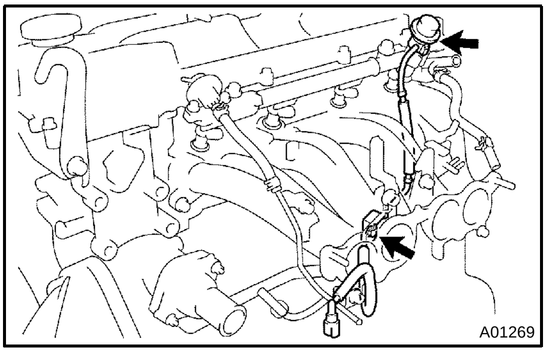
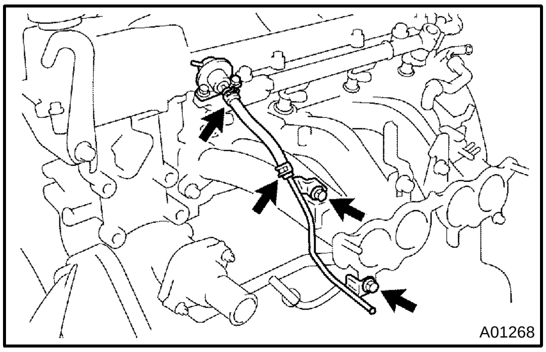


8. REMOVE FUEL INLET PIPE

Remove the pulsation damper, 2 gaskets and fuel inlet pipe.

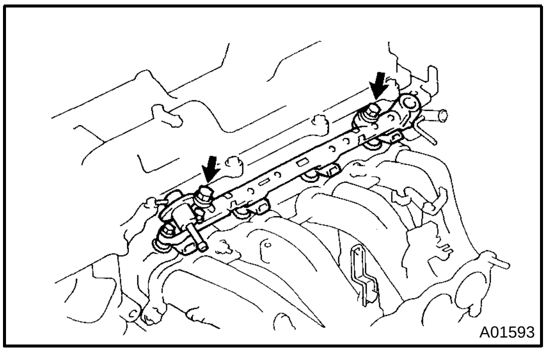


9. REMOVE FUEL RETURN PIPE

(a) Disconnect these hoses:

- Fuel return hose from fuel pressure regulator
- Fuel return hose from fuel return pipe

(b) Remove the 2 bolts and fuel return pipe.

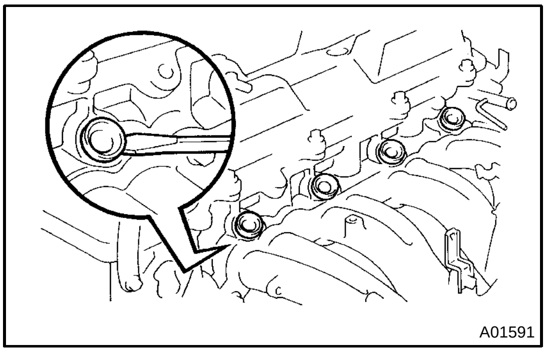


10. REMOVE DELIVERY PIPE AND INJECTORS

(a) Remove the 2 bolts and delivery pipe together with the 4 injectors.

NOTICE:

Be careful not to drop the injectors when removing the delivery pipe.

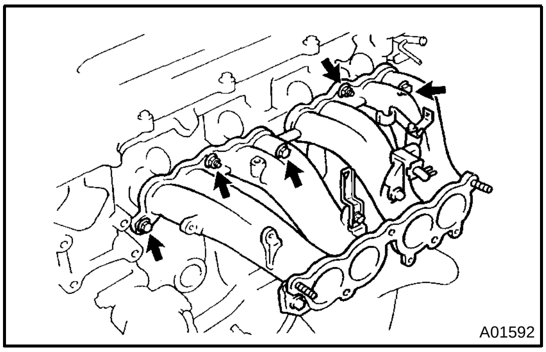


(b) Remove the 4 insulators from the 4 spacers.

(c) Pull out the 4 injectors from the delivery pipe.

(d) Remove the O-ring and grommet from each injector.

(e) Using a screwdriver, pry out the 4 spacers.



11. REMOVE INTAKE MANIFOLD

Remove the 3 bolts, 2 nuts, intake manifold and gasket.

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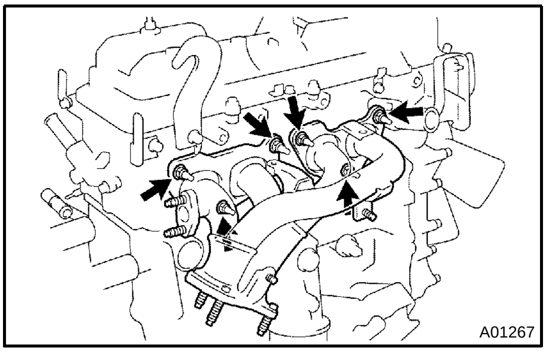
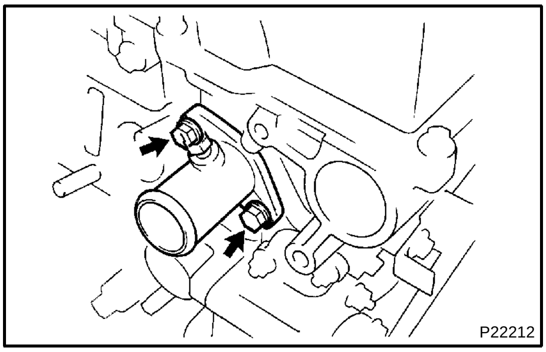


12. REMOVE EXHAUST MANIFOLD

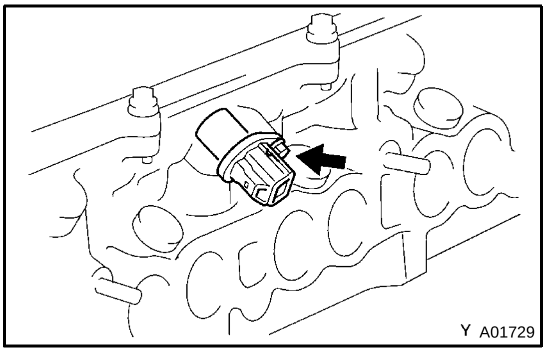
(a) Remove the 2 bolts, 2 nuts and heat insulator.

(b) Remove the 6 nuts, exhaust manifold and gasket.

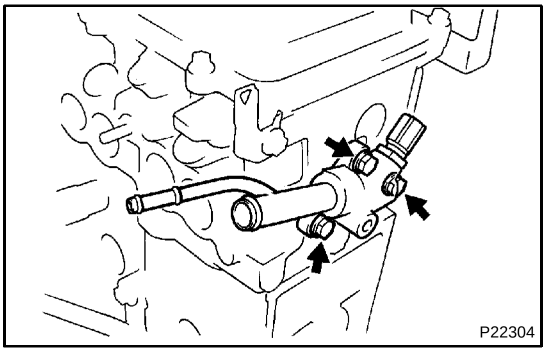


13. REMOVE WATER OUTLET

(a) Remove the 2 bolts, water outlet and gasket.



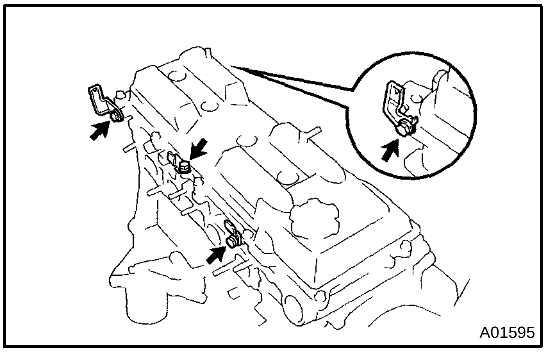
(b) Remove the camshaft position sensor.



14. REMOVE CYLINDER HEAD REAR COVER

Remove the 3 bolts, cylinder head rear cover and gasket.

15. REMOVE SPARK PLUGS



16. REMOVE ENGINE WIRE BRACKETS

Remove the 4 bolts, 4 wire brackets and ground strap.

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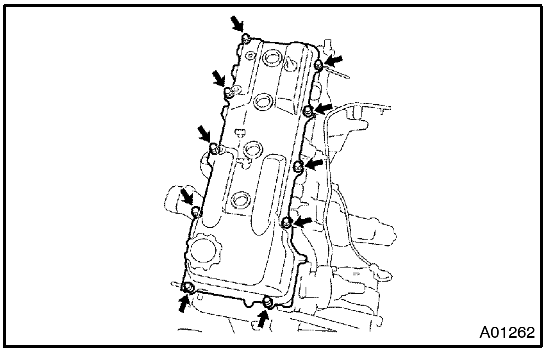
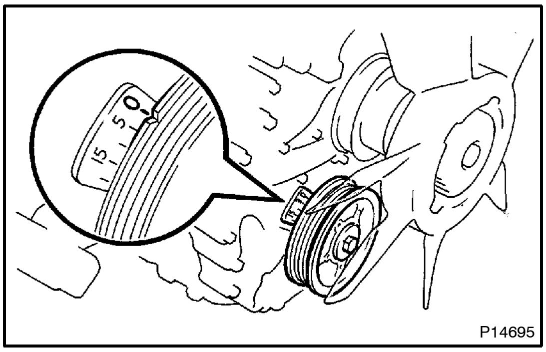


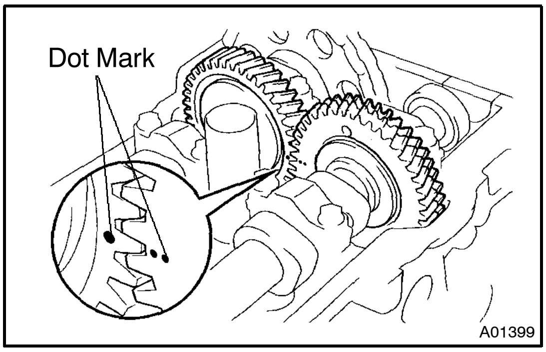
17. REMOVE CYLINDER HEAD COVER

Remove the 10 bolts, seal washers, cylinder head cover and gasket.

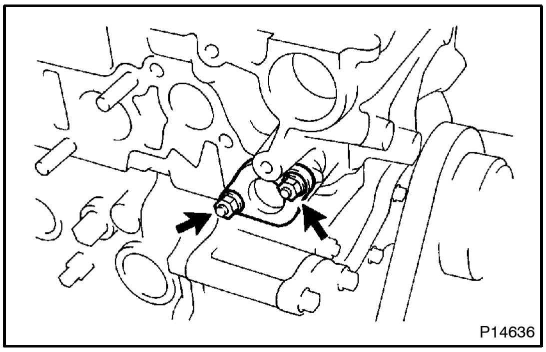


18. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley clockwise and align its groove with the ”0” mark on the timing chain cover.

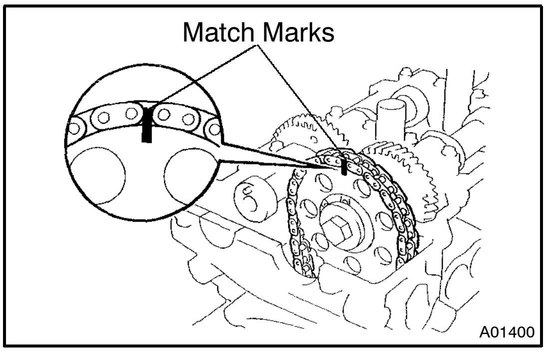


(b) Check that the timing marks (1 and 2 dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) and align the marks as above.



19. REMOVE CHAIN TENSIONER

Remove the 2 nuts, chain tensioner and gasket.



20. REMOVE SEMI–CIRCULAR PLUGS

21. REMOVE CAMSHAFT TIMING GEAR

(a) Place the matchmarks on the camshaft timing gear and No.1 timing chain.

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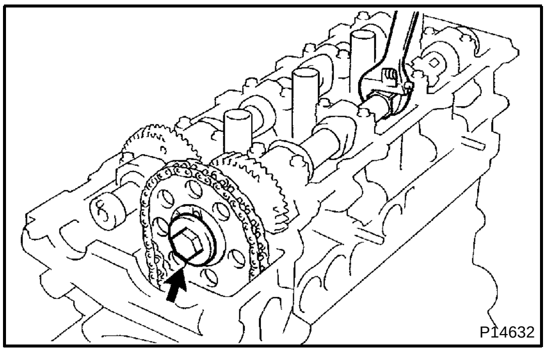


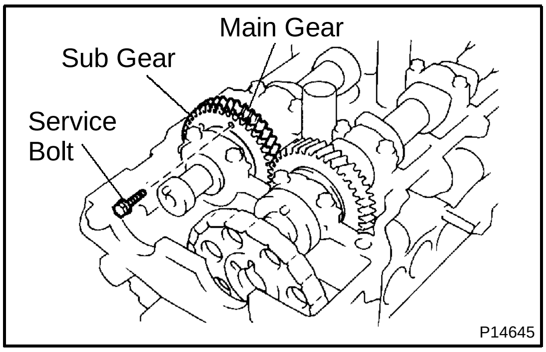
(b) Hold the intake camshaft with a wrench and remove the bolt.

(c) Remove the camshaft timing gear and chain from the intake camshaft and leave on the slipper and damper.

22. REMOVE CAMSHAFTS

NOTICE:

Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these steps should be carried out.



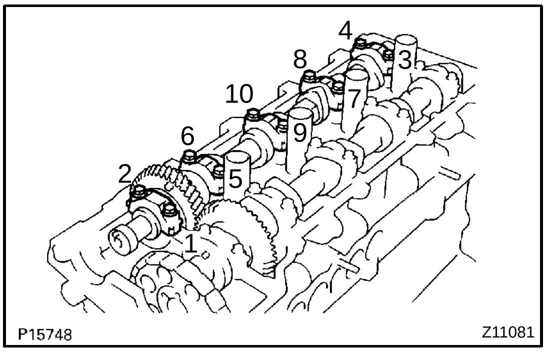
(a) Remove exhaust camshaft

(1) Bring the service bolt hole of the driven sub–gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

(2) Secure the exhaust camshaft sub–gear to the main gear with a service bolt.

Recommended service bolt:

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

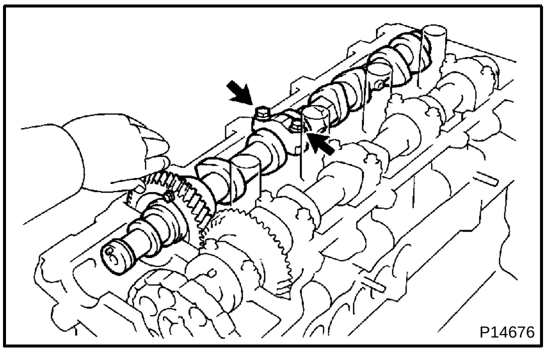


HINT:

When removing the camshaft, make sure that the torsional spring force of the sub–gear has been eliminated by the above operation.

(3) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.

(4) Remove the 5 bearing caps and camshaft.



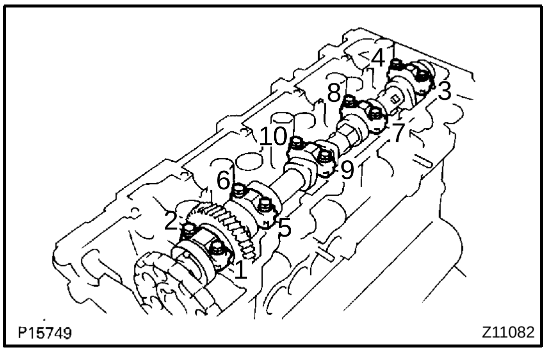
HINT:

If the camshaft is not being lifted out straight and level, reinstall the No.3 bearing cap with the 2 bolts. Then alternately loosen and remove the bearing cap bolts with the camshaft gear pulled up.

NOTICE:

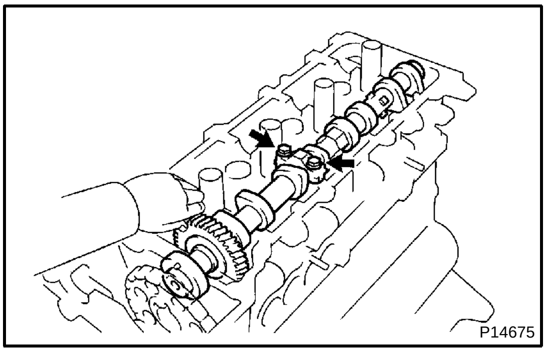
Do not pry on or attempt to force the camshaft with a tool or other object.

CONTINUED



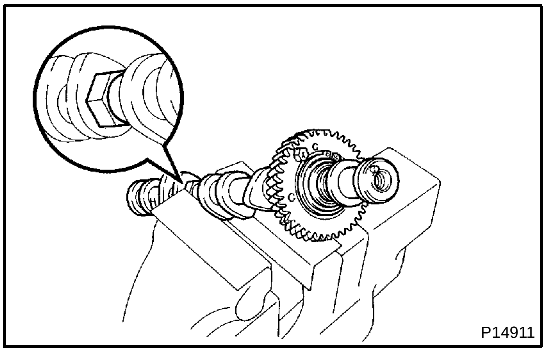
P15749 Z11082

(b) Remove intake camshaft.
  (1) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
  (2) Remove the 5 bearing caps and camshaft.


P14675

HINT:
If the camshaft is not being lifted out straight and level, reinstall the No.3 bearing cap with the 2 bolts. Then alternately loosen and remove the 2 bearing cap bolts with the camshaft gear pulled up.

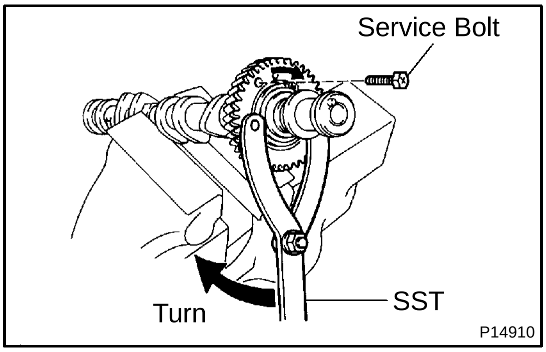
NOTICE:
Do not pry on or attempt to force the camshaft with a tool or other object.


P14911

23. DISASSEMBLE EXHAUST CAMSHAFT

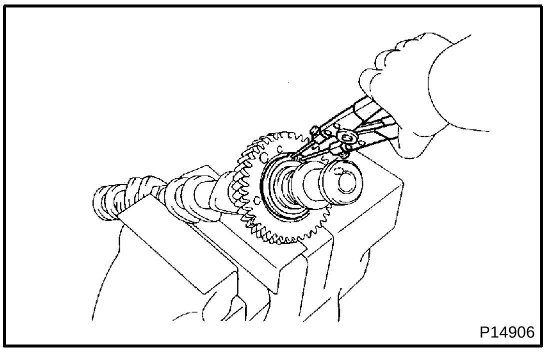
(a) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE:
Be careful not to damage the camshaft.



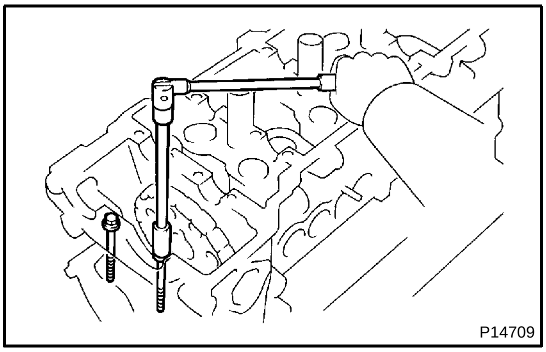
P14910

(b) Using SST, turn the sub–gear clockwise, and remove the service bolt.
  SST 09960–10010 (09962–01000, 09963–00500)


P14906

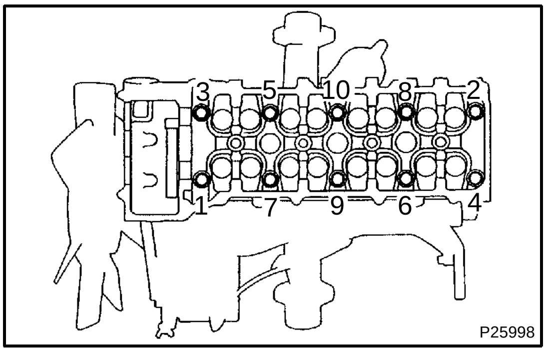
(c) Using snap ring pliers, remove the snap ring.
(d) Remove these parts:
- Wave washer
- Camshaft sub–gear
- Camshaft gear spring

CONTINUED


P14709

24. REMOVE CYLINDER HEAD

(a) Remove the 2 bolts in front of the head before the other head bolts are removed.

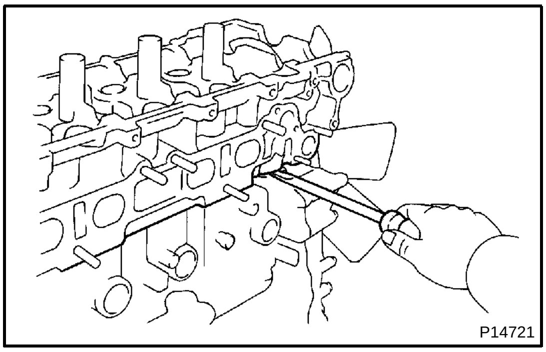


P25998

(b) Uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.

NOTICE:

Cylinder head warpage or cracking could result from removing bolts in incorrect order.


P14721

(c) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

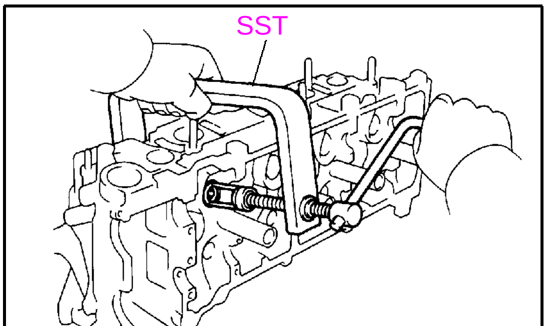
HINT:

If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.

NOTICE:

Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

EM096-01



P14702

DISASSEMBLY

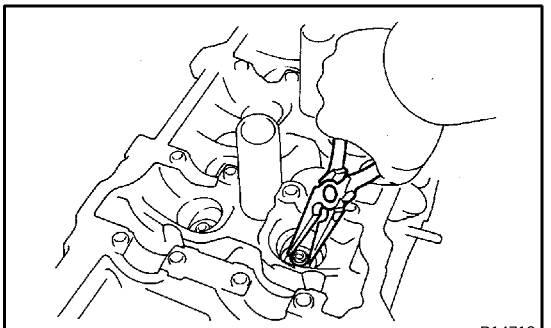
1. REMOVE VALVE LIFTERS AND SHIMS

HINT:
Arrange the valve lifters and shims in correct order.

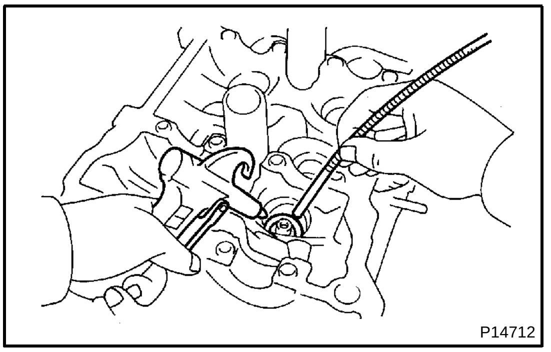
2. REMOVE VALVES

(a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202-70020 (09202-00010)

(b) Remove the spring retainer, valve spring and valve.


P14713

(c) Using needle-nose pliers, remove the oil seal.

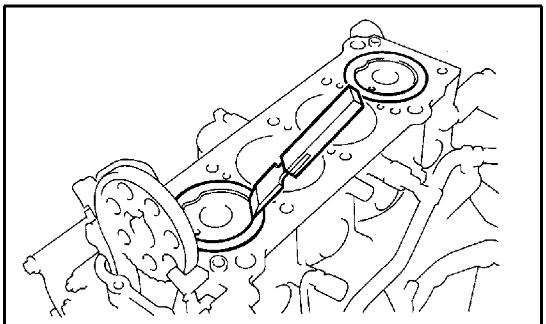

P14712

(d) Using compressed air and a magnetic finger, remove the spring seat by blowing air.

HINT:
Arrange the valves, valve springs, spring seats and spring retainers in correct order.

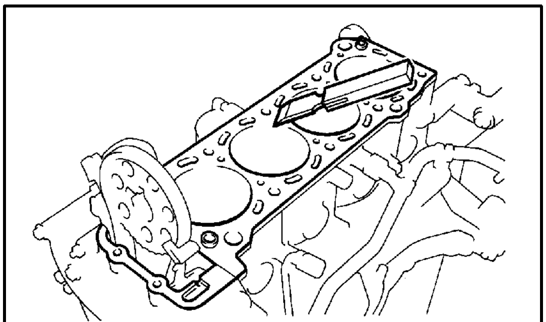
EM097–01

INSPECTION


P14674

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.

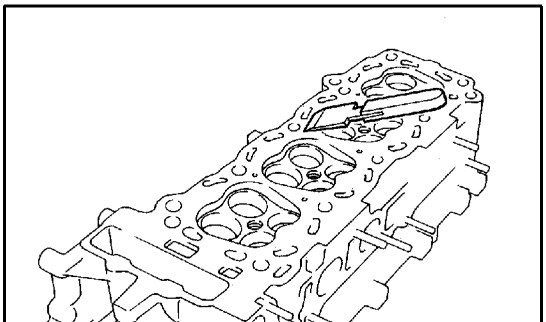

P14673

(b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.

(c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION:

Protect your eyes when using high–compressed air.

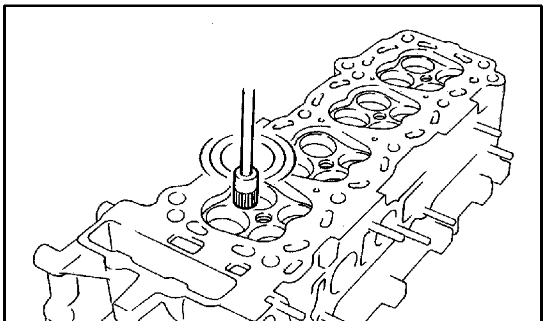

P14693

2. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

NOTICE:

Be careful not to scratch the cylinder block contact surface.

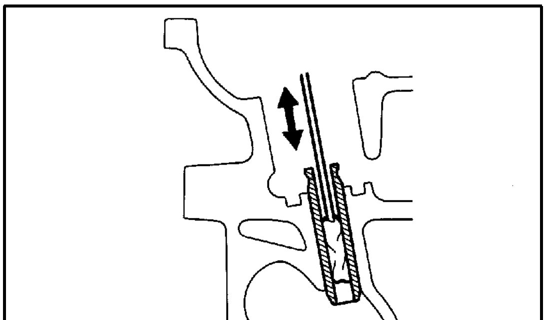

P14692

3. CLEAN COMBUSTION CHAMBERS

Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE:

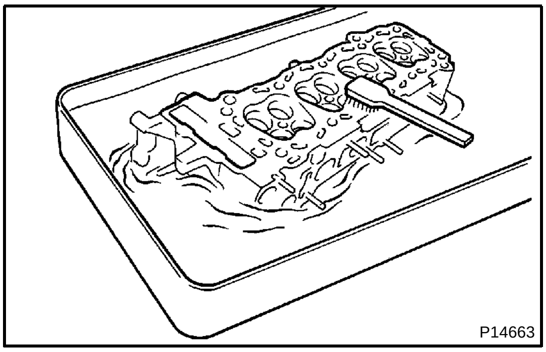
Be careful not to scratch the cylinder block contact surface.


P14660

4. CLEAN VALVE GUIDE BUSHINGS

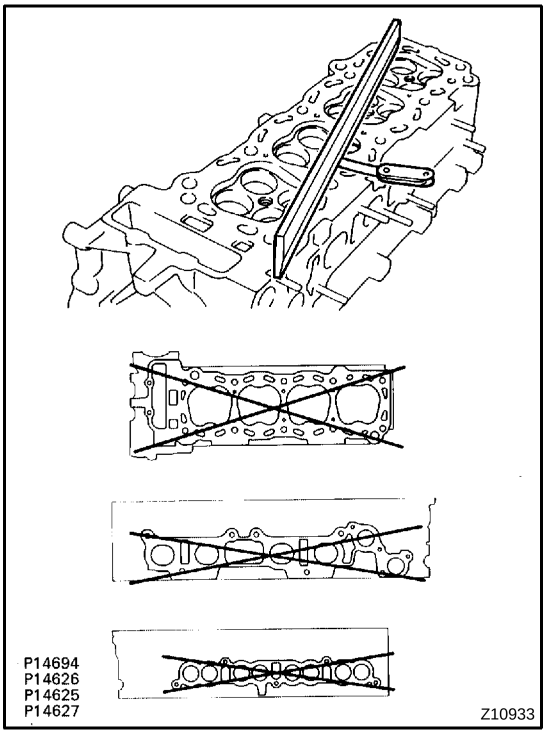
Using a valve guide bushing brush and solvent, clean all the guide bushings.

CONTINUED



5. CLEAN CYLINDER HEAD

Using a soft brush and solvent, thoroughly clean the cylinder head.

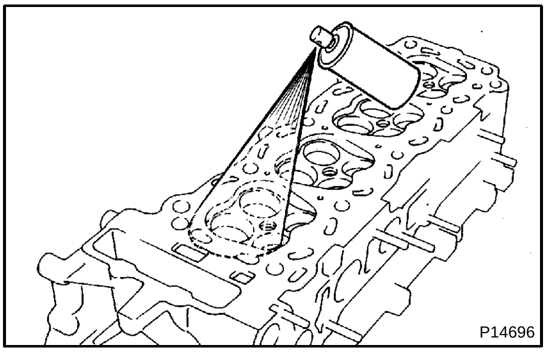


6. INSPECT FOR FLATNESS

Using a precision straight edge and thickness gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

Maximum warpage:
Cylinder block side
0.05 mm (0.0020 in.)
Manifold side
0.10 mm (0.0039 in.)

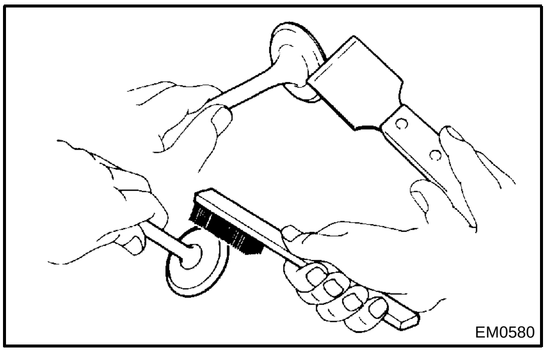
If warpage is greater than maximum, replace the cylinder head.



7. INSPECT FOR CRACKS

Using a dye penetrant, check the combustion chambers, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.

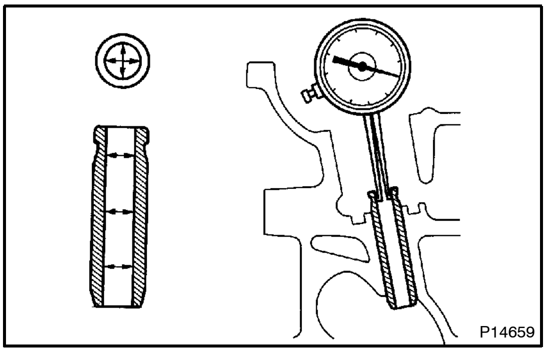


8. CLEAN VALVES

(a) Using a gasket scraper, chip off any carbon from the valve head.

(b) Using a wire brush, thoroughly clean the valve.

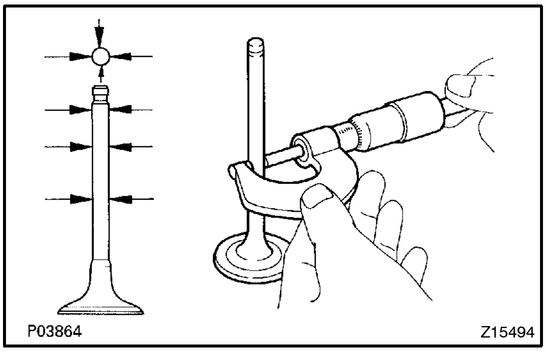
CONTINUED



9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

(a) Using a caliper gauge, measure the inside diameter of the guide bushing.

Bushing inside diameter:
6.010 – 6.030 mm (0.2366 – 0.2374 in.)



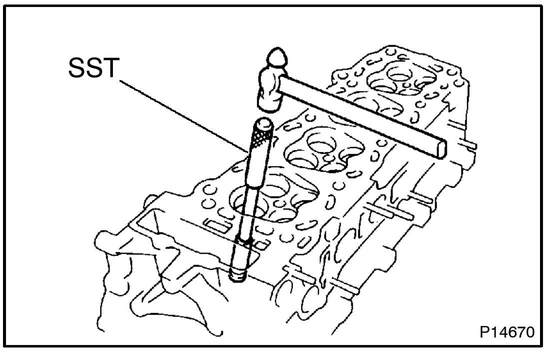
(b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:
Intake
5.970 – 5.985 mm (0.2350 – 0.2356 in.)
Exhaust
5.965 – 5.980 mm (0.2348 – 0.2354 in.)

(c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

Standard oil clearance:
Intake
0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust
0.030 – 0.065 mm (0.0012 – 0.0026 in.)
Maximum oil clearance:
Intake
0.08 mm (0.0031 in.)
Exhaust
0.10 mm (0.0039 in.)

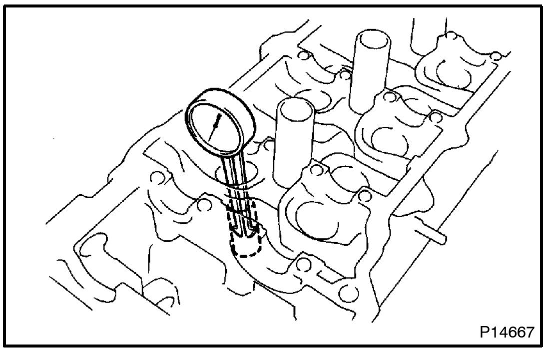
If the clearance is greater than maximum, replace the valve and guide bushing.



10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

(a) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).

(b) Using SST and a hammer, tap out the guide bushing.
SST 09201–10000 (09201–01060),
09950–70010 (09951–07150)



(c) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

CONTINUED

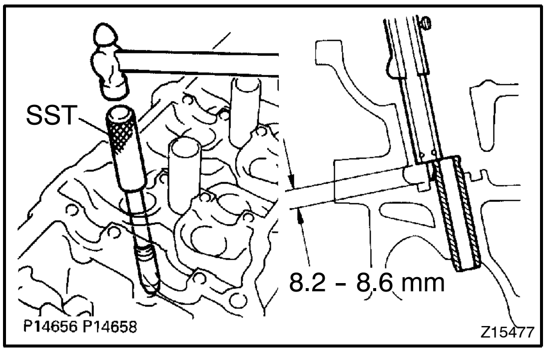
Both intake and exhaust

Bushing bor diameter mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4341)	Use STD
11.050 – 11.077 (0.4350 – 0.4361)	Use O/S 0.05

(d) Select a new guide bushing (STD size or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to these dimension:

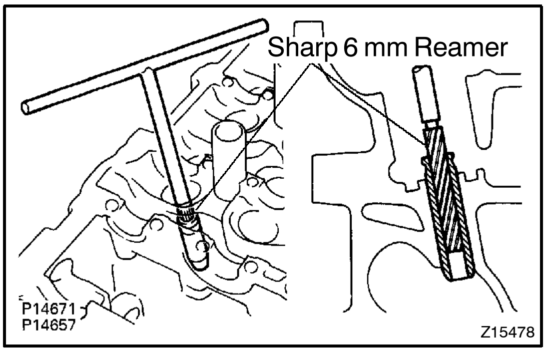
11.050 – 11.077 mm (0.4350 – 0.4361 in.)

If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.

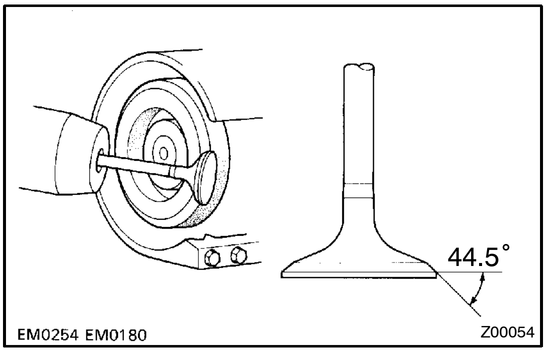


(e) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).

(f) Using SST and a hammer, tap in a new guide bushing to where there 8.2 – 8.6 mm (0.323 – 0.339 in.) protruding from the cylinder head.
SST 09201–10000 (09201–01060),
09950–70010 (09951–07150)



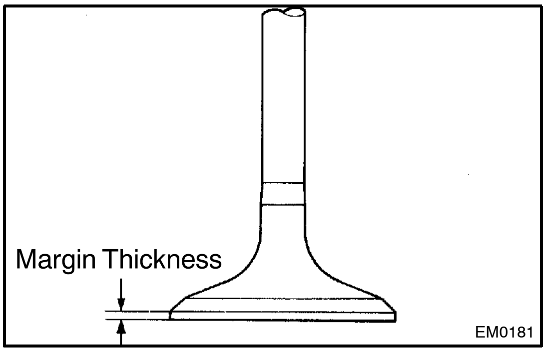
(g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step 9 on the previous page) between the guide bushing and valve stem.



11. INSPECT AND GRIND VALVES

(a) Grind the valve enough to remove pits and carbon.

(b) Check that the valve is ground to the correct valve face angle.
Valve face angle:
44.5°



(c) Check the valve head margin thickness.
Standard margin thickness:
1.0 mm (0.039 in.)
Minimum margin thickness:
0.5 mm (0.020 in.)

If the margin thickness is less than minimum, replace the valve.

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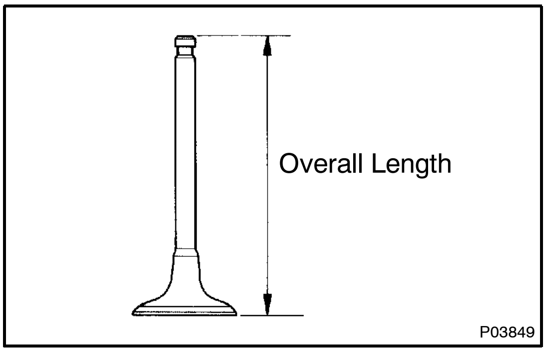
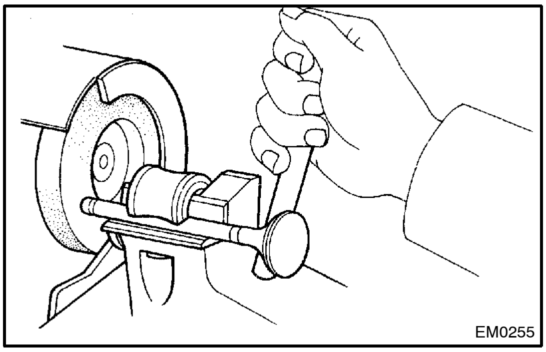
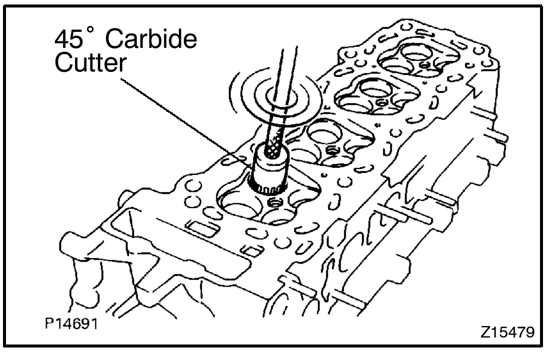


(d) Check the valve overall length.
Standard overall length:
Intake: 103.45 mm (4.0728 in.)
Exhaust: 103.60 mm (4.0787 in.)
Minimum overall length:
Intake: 102.95 mm (4.0531 in.)
Exhaust: 103.10 mm (4.0590 in.)
If the overall length is less than minimum, replace the valve.



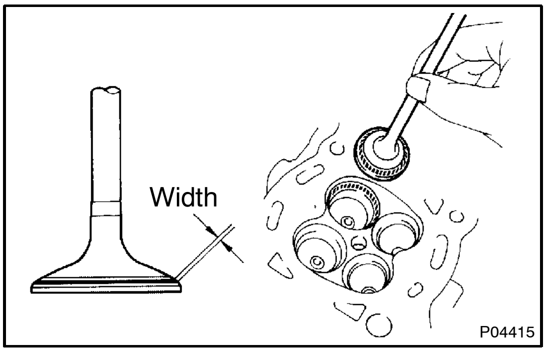
(e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
NOTICE:
Do not grind off more than minimum.

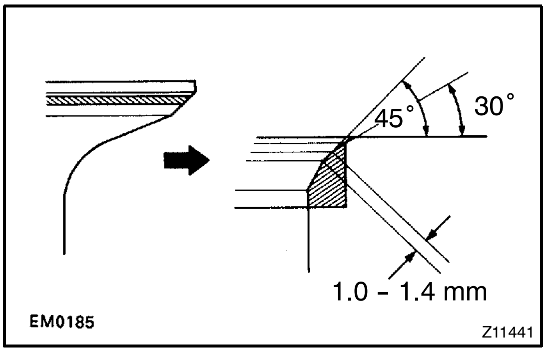


12. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.
(b) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.
(c) Check the valve face and seat for these:
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with these width:

0.9 – 1.9 mm (0.035 – 0.075 in.)





(d) If not, correct the valve seats as follows:
(1) Intake:
If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

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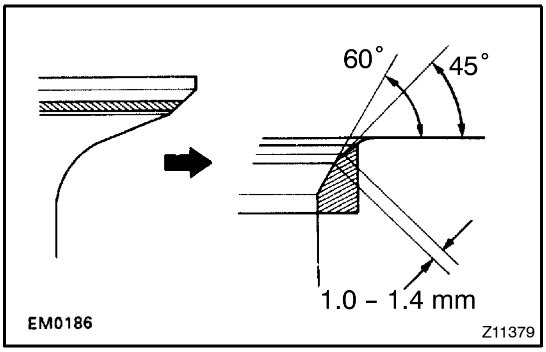
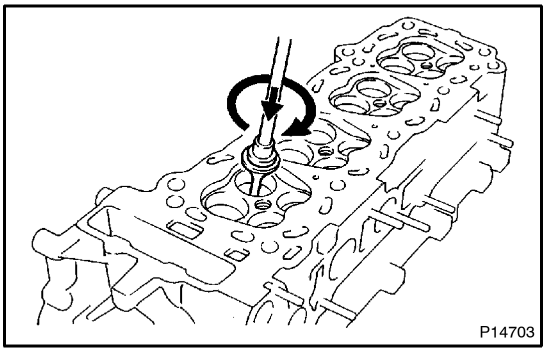
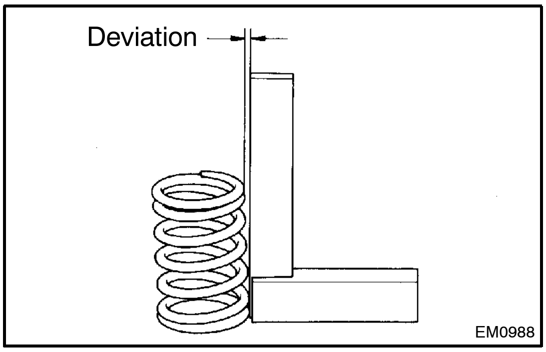


(2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



(e) Hand–lap the valve and valve seat with an abrasive compound.

(f) After hand–lapping, clean the valve and valve seat.

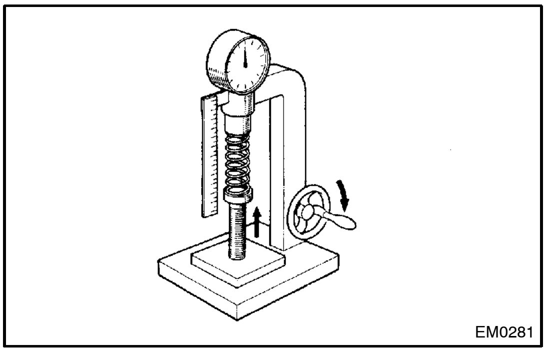


13. INSPECT VALVE SPRINGS

(a) Using a steel square, measure the deviation of the valve spring.

Maximum deviation:
2.0 mm (0.079 in.)

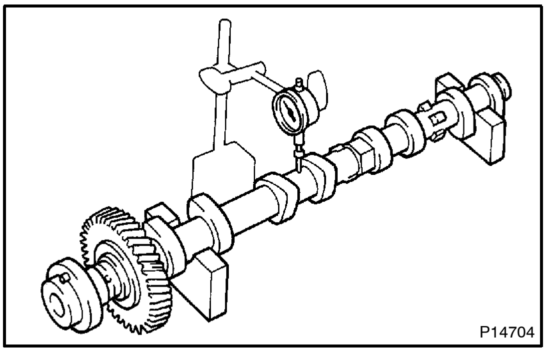
If the deviation is greater than maximum, replace the valve spring.



(b) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:
162 – 190 N (16.5 – 19.4 kgf, 36.4 – 42.8 lbf)
at 40.3 mm (1.580 in.)

If the installed tension is not as specified, replace the valve spring.



14. INSPECT CAMSHAFT FOR RUNOUT

(a) Place the camshaft on V–blocks.

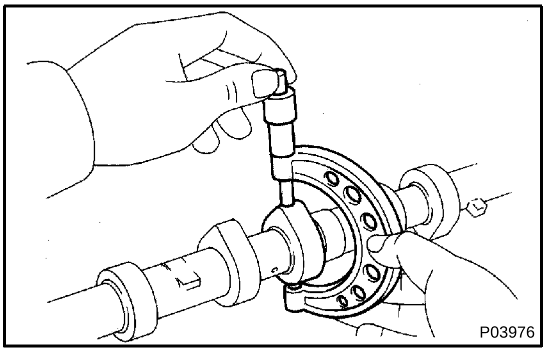
(b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:
0.06 mm (0.0024 in.)

If the circle runout is greater than maximum, replace the camshaft.

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

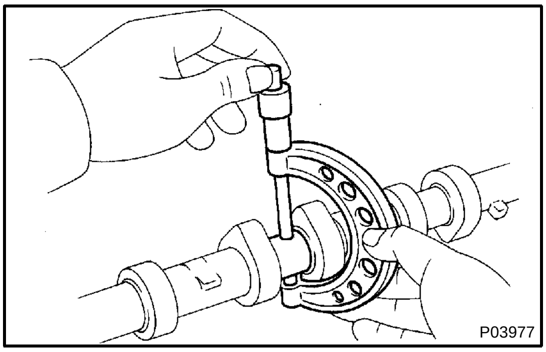


15. INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:
Intake
45.31 – 45.41 mm (1.7839 – 1.7878 in.)
Exhaust
45.06 – 45.16 mm (1.7740 – 1.7779 in.)

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



16. INSPECT CAMSHAFT JOURNALS

Using a micrometer, measure the journal diameter.

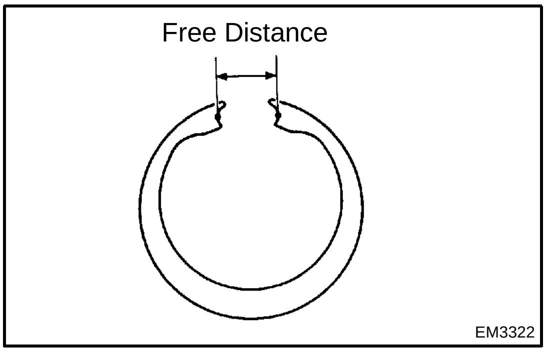
Journal diameter:
26.959 – 26.975 mm (1.0614 – 1.0620 in.)

If the journal diameter is not as specified, check the oil clearance.

17. INSPECT CAMSHAFT BEARINGS

Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

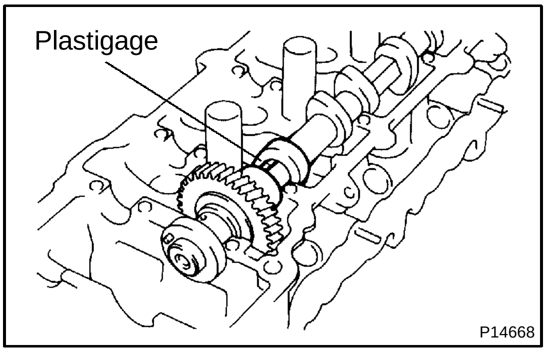


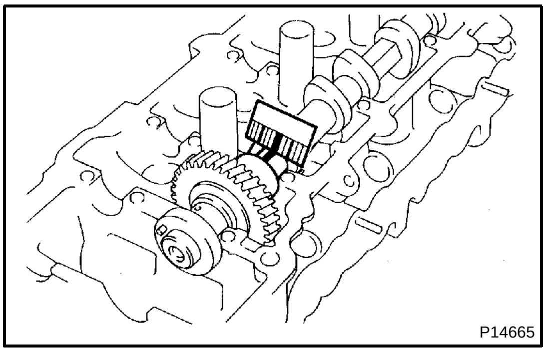
18. INSPECT CAMSHAFT GEAR SPRING

Using a vernier caliper, measure the free distance between the spring ends.

Free distance:
22.5 – 22.9 mm (0.886 – 0.902 in.)

If the free distance is not as specified, replace the gear spring.





19. INSPECT CAMSHAFT JOURNAL OIL CLEARANCE

(a) Clean the bearing caps and camshaft journals.
(b) Place the camshafts on the cylinder head.
(c) Lay a strip of Plastigage across each of the camshaft journals.
(d) Install the bearing caps.
(See page EM–54)
Torque:15.5 N·m (160 kgf·cm, 12 ft·lbf)

NOTICE:
Do not turn the camshaft.

(e) Remove the bearing caps.
(f) Measure the Plastigage at its widest point.
Standard oil clearance:
0.025 – 0.062 mm (0.0010 – 0.0024 in.)
Maximum oil clearance:
0.08 mm (0.0031 in.)

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(g) Completely remove the Plastigage.

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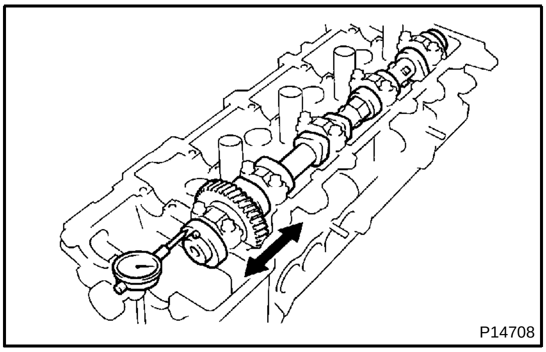

P14708

20. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshaft.

(See page EM–55)

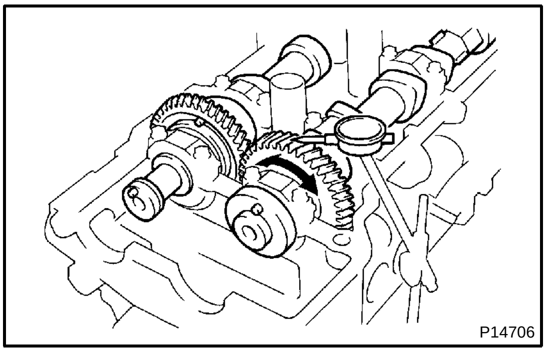
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:

0.040 – 0.095 mm (0.0016 – 0.0037 in.)

Maximum thrust clearance:

0.12 mm (0.0047 in.)


P14706

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

21. INSPECT CAMSHAFT GEAR BACKLASH

(a) Install the camshafts without installing the exhaust cam sub–gear.

(See page EM–55)

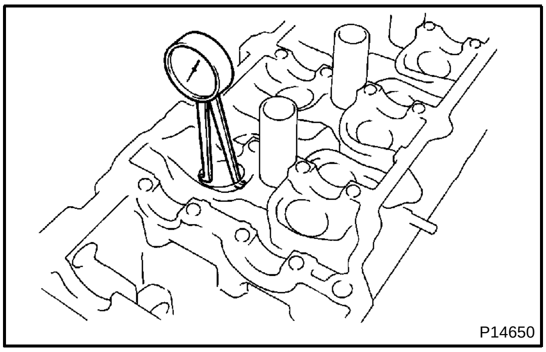
(b) Using a dial indicator, measure the backlash.

Standard backlash:

0.020 – 0.200 mm (0.0008 – 0.0079 in.)

Maximum backlash:

0.30 mm (0.0188 in.)


P14650

If the backlash is greater than maximum, replace the camshafts.

22. INSPECT VALVE LIFTERS AND LIFTER BORES

(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

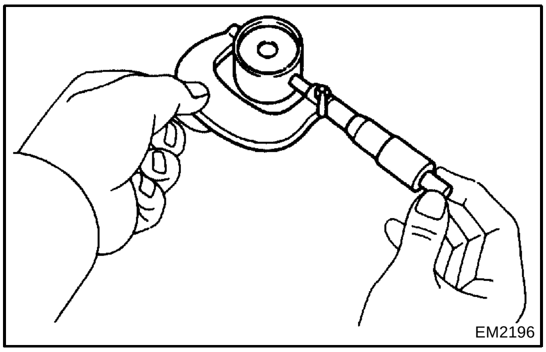
Lifter bore diameter:

31.000 – 31.016 mm (1.2205 – 1.2211 in.)

(b) Using a micrometer, measure the lifter diameter.

Lifter diameter:

30.966 – 30.976 mm (1.1578 – 1.2195 in.)


EM2196

(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

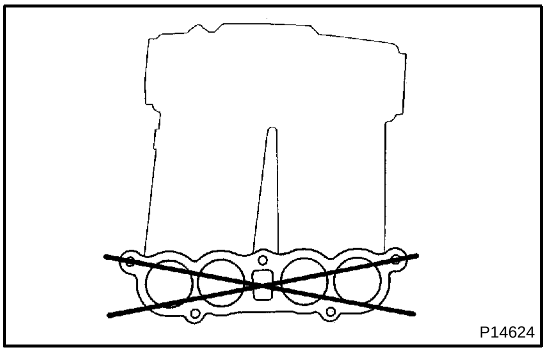
Standard oil clearance:

0.024 – 0.050 mm (0.0009 – 0.0020 in.)

Maximum oil clearance:

0.07 mm (0.0028 in.)

If the oil clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.


P14624

23. INSPECT AIR INTAKE CHAMBER

Using a precision straight edge and thickness gauge, measure the surface contacting the intake manifold for warpage.

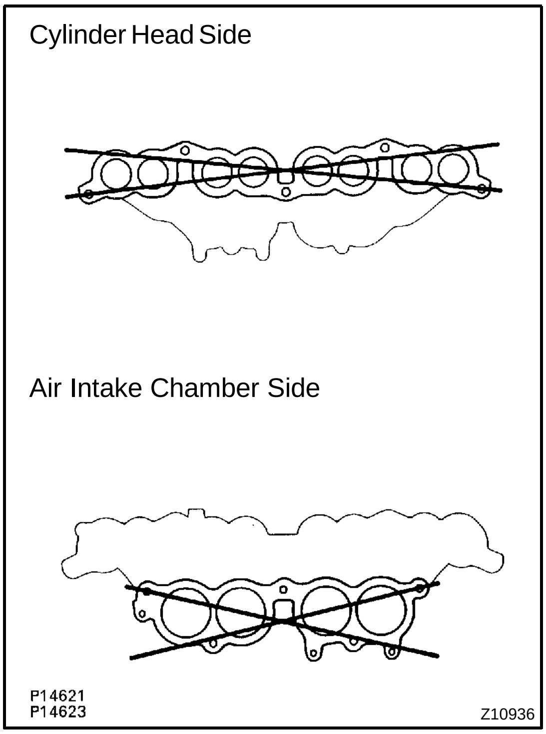
Maximum warpage:

0.20 mm (0.0078 in.)

If warpage is greater than maximum, replace the air intake chamber.

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

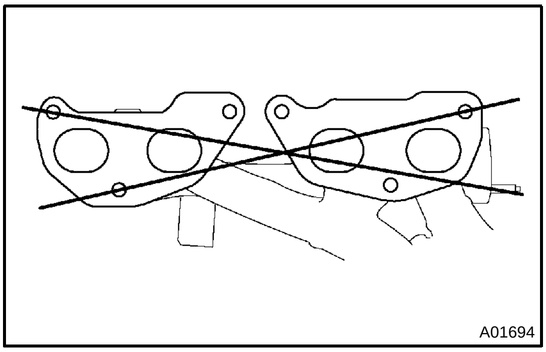


24. INSPECT INTAKE MANIFOLD

Using a precision straight edge and thickness gauge, measure the surface contacting the cylinder head and air intake chamber for warpage.

Maximum warpage:
0.20 mm (0.0078 in.)

If warpage is greater than maximum, replace the manifold.

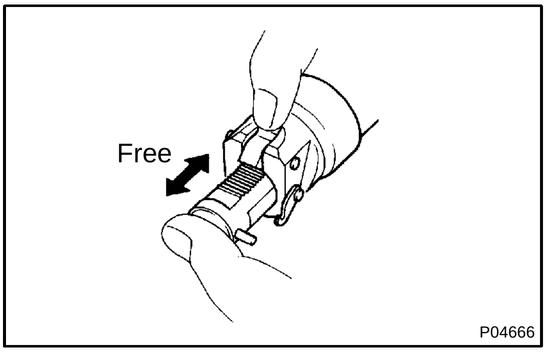


25. INSPECT EXHAUST MANIFOLD

Using a precision straight edge and thickness gauge, measure the surface contacting the cylinder head for warpage.

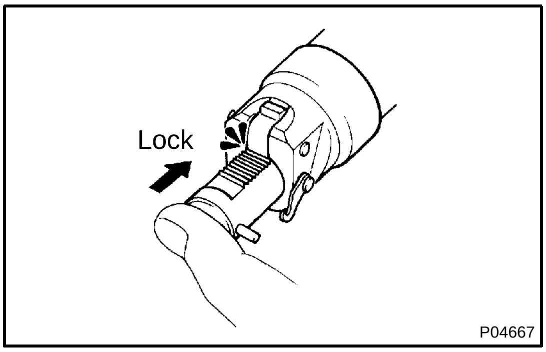
Maximum warpage:
0.50 mm (0.0197 in.)

If warpage is greater than maximum, replace the manifold.



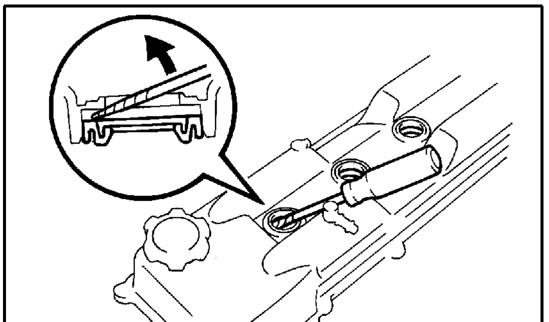
26. INSPECT CHAIN TENSIONER

(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.



(b) Released the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.

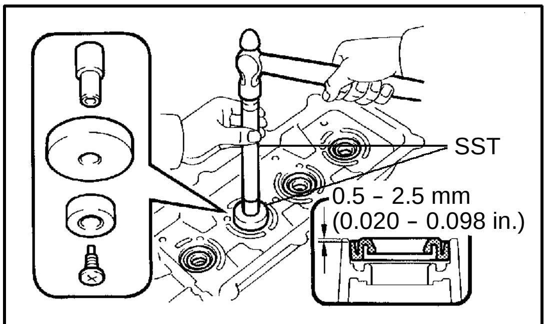
CONTINUED



P14681

27. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS

(a) Using a screwdriver, pry out the tube gasket.

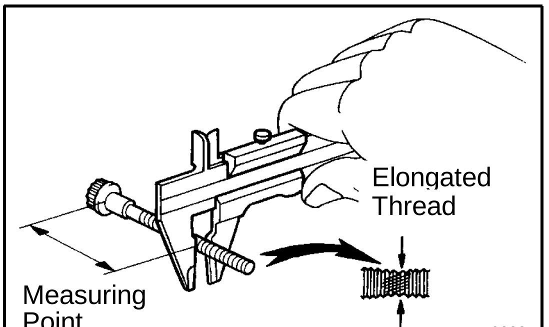


P22287

(b) Using SST and a hammer, tap in a new tube gasket as shown in the illustration.

SST 09950–60010 (09951–00260, 09951–00490, 09952–06010), 09950–70010 (09951–07150)

(c) Apply a light coat of MP grease to the gasket lip.



A02827

28. INSPECT CYLINDER HEAD BOLTS

Using vernier calipers, measure the minimum diameter of the elongated thread at the measuring point.

Standard outside diameter:
10.76 – 10.97 mm (0.4236 – 0.4319 in.)
Minimum outside diameter:
10.40 mm (0.4094 in.)

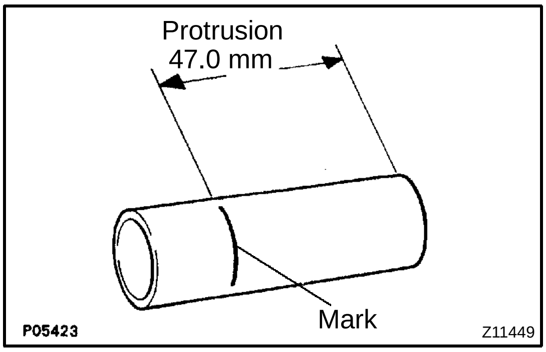
If the diameter is less than minimum, replace the bolt.

EM098-01

REASSEMBLY

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



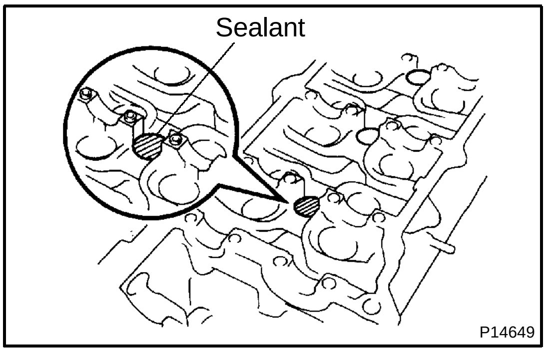
1. INSTALL SPARK PLUG TUBES

HINT:

When using a new cylinder head, spark plug tubes must be installed.

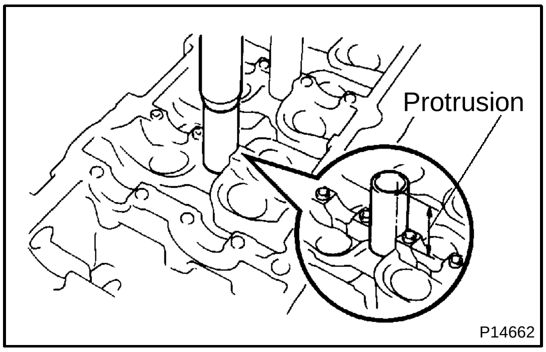
(a) Mark the standard position away from the edge, onto the spark plug tube.

Standard protrusion:
47.0 mm (1.850 in.)



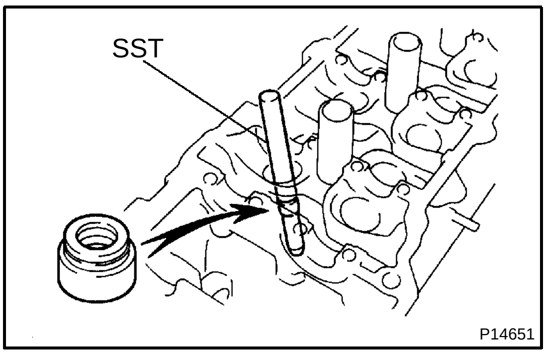
(b) Apply adhesive to the spark plug tube hole of the cylinder head.

Sealant:
Part No.08833-00070, Adhesive 1324, THREE BOND1324 or equivalent



(c) Using a press, press in a new spark plug tube until there is 47.0 mm (1.850 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

NOTICE:
Avoid pressing a new spark plug tube in too far by measuring the amount of protrusion while pressing.



2. INSTALL VALVES

(a) Using SST, push in a new oil seal.

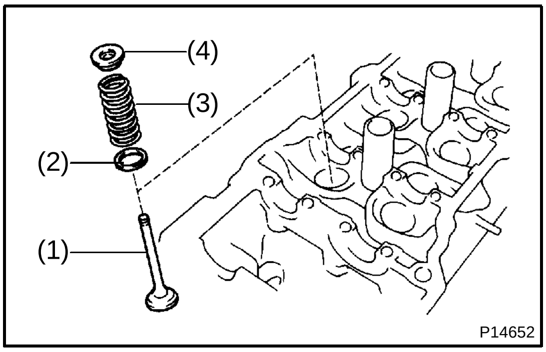
SST 09236-00101 (09236-15010)

HINT:

Different oil seals are used for the intake and exhaust.

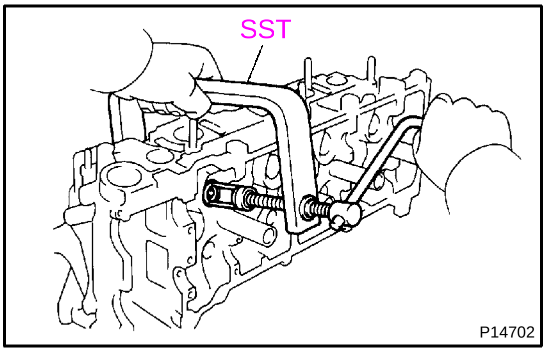
Code mark (Intake side only):
"H"

CONTINUED



P14652

(b) Install these parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer



P14702

(c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202–70020 (09202–00010)

(d) Using a plastic–faced hammer, lightly tap the valve stem tip to ensure a proper fit.

3. INSTALL VALVE LIFTERS AND SHIMS

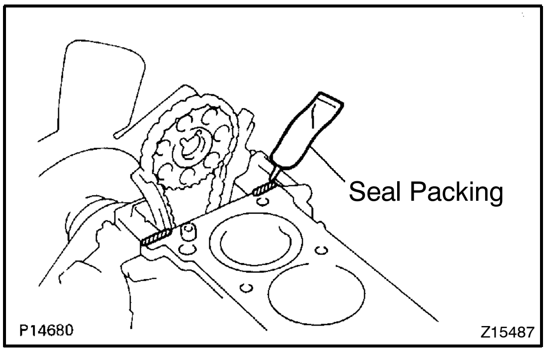
(a) Install the valve lifter and shim.

(b) Check that the valve lifter rotates smoothly by hand.

EM099-01

INSTALLATION

1. PLACE CYLINDER HEAD ON CYLINDER BLOCK



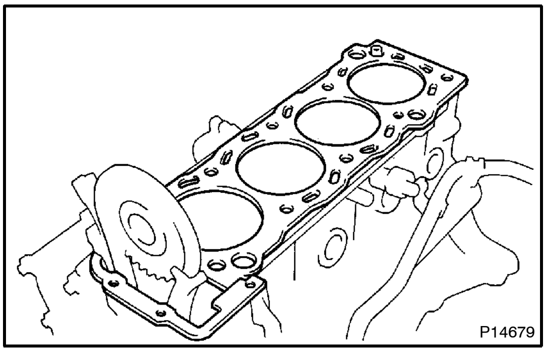
(a) Apply seal packing to the 2 locations as shown.

Seal packing:

Part No. 08826-00080 or equivalent

NOTICE:

Do not apply too much seal packing.



(b) Place a new cylinder head gasket in position on the cylinder block.

NOTICE:

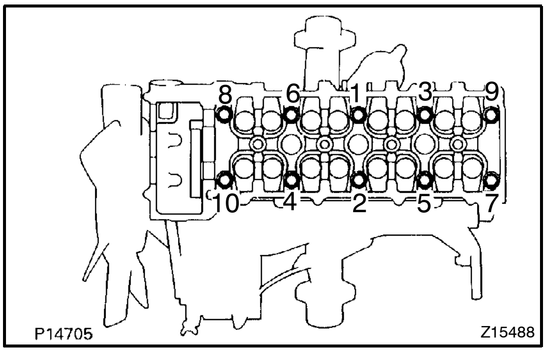
Be careful of the installation direction.

(c) Place the cylinder head in position on the cylinder head gasket.

2. INSTALL CYLINDER HEAD BOLTS

HINT:

- The cylinder head bolts are tightened in 3 progressive steps (steps (b) and (d)).
- If any cylinder head bolt is broken or deformed, replace it.

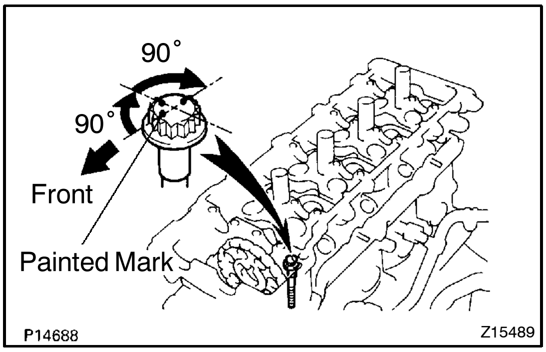


(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Install and uniformly tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

If any of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

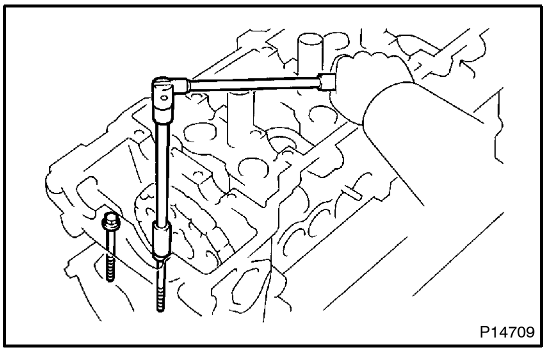


(c) Mark the front of the cylinder head bolt head with paint.

(d) Retighten the cylinder head bolts by 90° in the numerical order shown.

(e) Retighten the cylinder head bolts by an additional 90°.

(f) Check that the painted mark is now facing rearward.



(g) Install and torque the 2 bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

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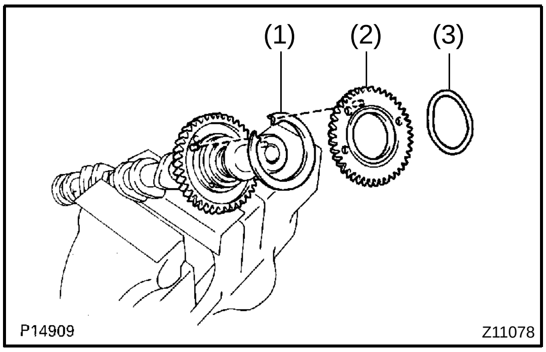


3. ASSEMBLE EXHAUST CAMSHAFT

(a) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE:

Be careful not to damage the camshaft.

(b) Install these parts:

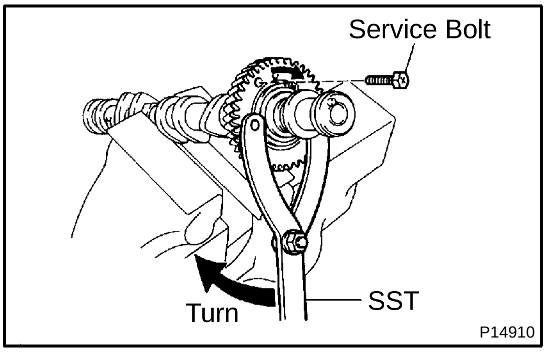
(1) Camshaft gear spring

(2) Camshaft sub–gear

(3) Wave washer

HINT:

Align the pins on the gears with the spring ends.



(c) Using snap ring pliers, install the snap ring.

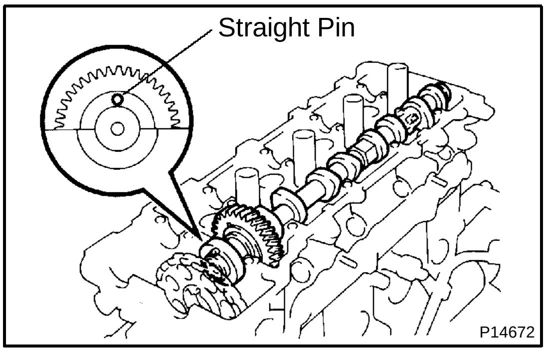
(d) Using SST, align the holes of the camshaft main gear and sub–gear by turning sub–gear clockwise, and install a service bolt.

SST 09960–10010 (09962–01000, 09963–00500)

4. INSTALL CAMSHAFTS

NOTICE:

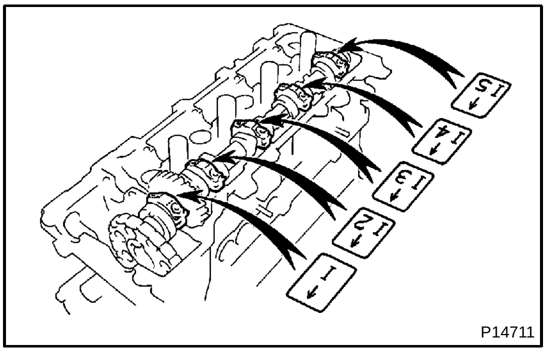
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these steps should be carried out.



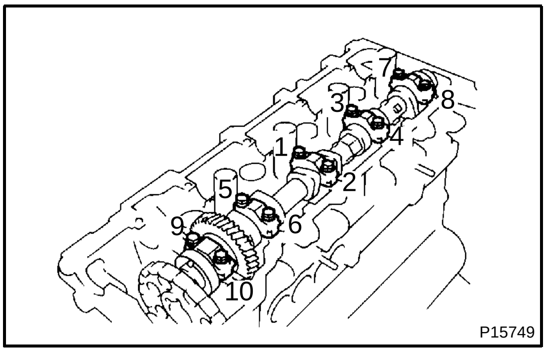
(a) Install intake camshaft.

(1) Apply MP grease to the thrust portion of the intake camshaft.

(2) Place the intake camshaft with knock pin facing upward of camshaft angle on the cylinder head.



(3) Install the bearing caps in their proper locations.



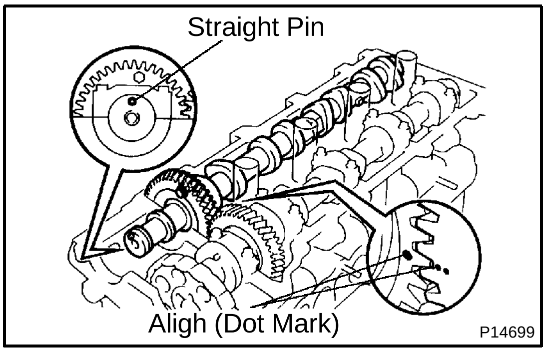
(4) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

(5) Install and uniformly tighten the 10 bearing cap bolts in the sequence shown.

Torque: 15.5 N·m (160 kgf·cm, 12 ft·lbf)

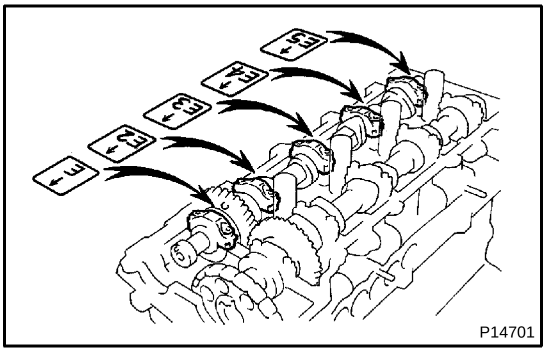
CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX
3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

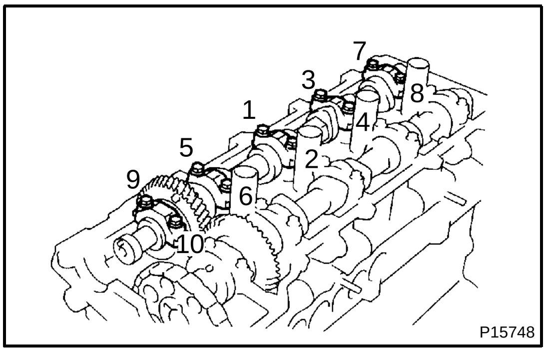


(b) Install exhaust camshaft.
  (1) Apply MP grease to the thrust portion of the exhaust camshaft.
  (2) Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks (1 and 2 dots) on each gear.

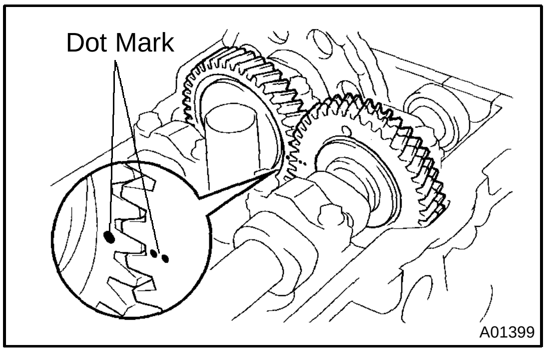
NOTICE:
There are also timing marks (for TDC) on each gear as shown in the illustration. Do not use these marks.



  (3) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.
  (4) Install the bearing caps in their proper locations.
  (5) Apply light coat of engine oil on the threads and under the heads of the bearing cap bolts.

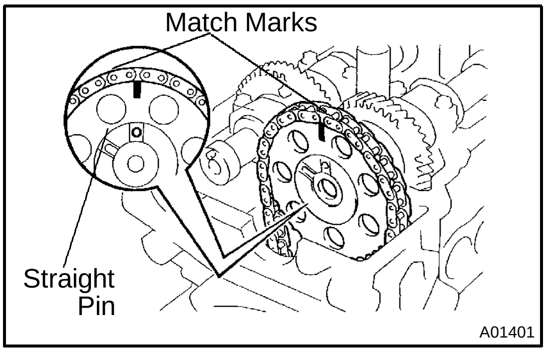


  (6) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.
  Torque: 15.5 N·m (160 kgf·cm, 12 ft·lbf)
  (7) Remove the service bolt.
  (8) Check that the intake and exhaust camshafts turn smoothly.



5. SET NO. 1 CYLINDER TO TDC/COMPRESSION

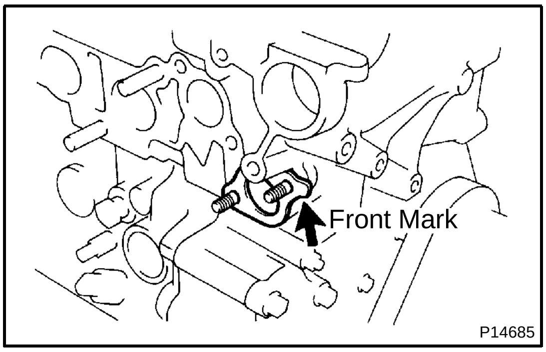
(a) Turn the crankshaft pulley clockwise, and align its groove with the timing mark "0" of the timing chain cover.
(b) Turn the camshafts so that the timing marks with 1 and 2 dots will be in straight line on the cylinder head surface as shown in the illustration.



6. INSTALL CAMSHAFT TIMING GEAR

HINT:
Check that the matchmarks on the camshaft timing gear and timing chain are aligned.
(a) Place the gear over the straight pin of the intake camshaft.
(b) Hold the intake camshaft with a wrench, install and torque the bolt.
Torque: 73.5 N·m (750 kgf·cm, 54 ft·lbf)

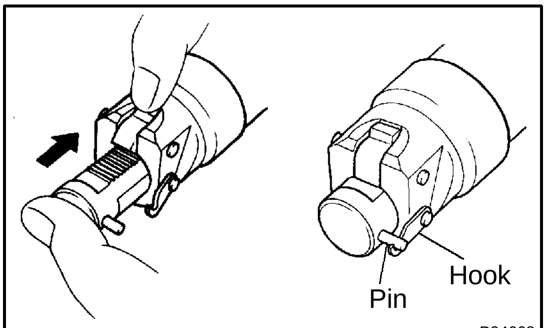
CONTINUED



P14685

7. INSTALL CHAIN TENSIONER

(a) Place a new gasket so that the front mark is toward the front side.



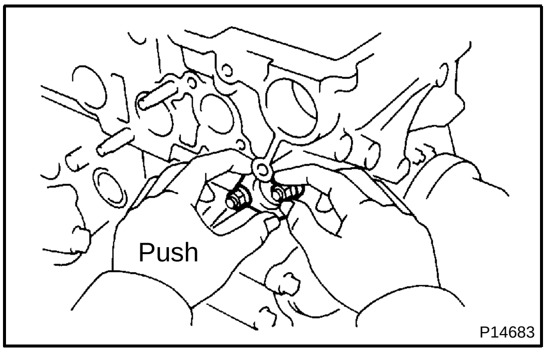
P04668

(b) Release the ratchet pawl, fully push in the plunger and apply the hook to the pin so that the plunger cannot spring out.

(c) Turn the crankshaft pulley clockwise to provide some slack for the chain on the tensioner side.

NOTICE:

Do not turn the pulley counterclockwise.



P14683

(d) Push the tensioner by hand until it touches the head installation surface, then install the 2 nuts.

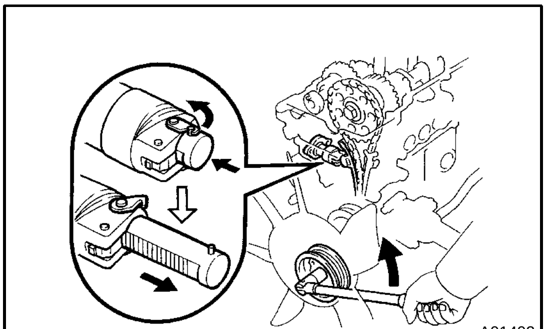
(e) Tighten the 2 nuts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

(f) Check that the hook of the tensioner is not released.

NOTICE:

If the plunger springs out during installation of the chain tensioner, repeat the operation in step (b) before installing the tensioner.



A01402

8. SET CHAIN TENSIONER

Turn the crankshaft to the left so that the hook of the chain tensioner is released from the pin of the plunger, causing the plunger to spring out and the slipper to be pushed in to the chain.

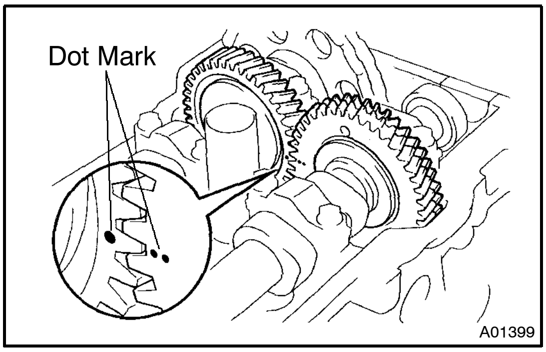
A01597

HINT:

If the plunger does not spring out, press the slipper into the chain tensioner with a screwdriver or your finger so that the hook is released and the plunger springs out.

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX



9. CHECK VALVE TIMING

(a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.

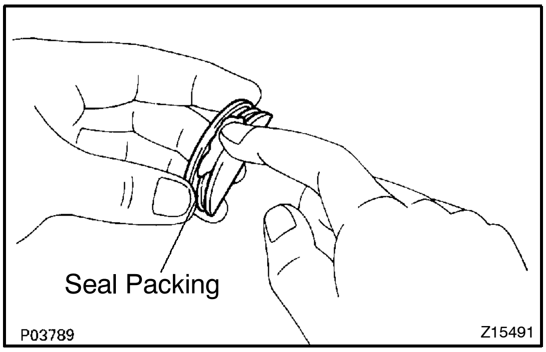
NOTICE:
Always turn the crankshaft clockwise.

(b) Check that the timing marks (1 and 2 dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration.
If not, turn the crankshaft 1 revolution (360°) and align the marks as above.

10. CHECK AND ADJUST VALVE CLEARANCE

(See page EM-9)

Valve clearance (Cold):
Intake
0.15 - 0.25 mm (0.006 - 0.010 in.)
Exhaust
0.25 - 0.35 mm (0.010 - 0.014 in.)



11. INSTALL SEMI-CIRCULAR PLUGS

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the cylinder head installation surface of the semi-circular plugs.
Seal packing:
Part No. 08826-00080 or equivalent

(c) Install the semi-circular plug to the cylinder head.

12. INSTALL CYLINDER HEAD COVER

13. INSTALL ENGINE WIRE BRACKETS

14. INSTALL SPARK PLUGS

15. INSTALL CYLINDER HEAD REAR COVER

Install a new gasket and the rear cover with the 3 bolts.
Torque: 13.5 N·m (135 kgf·cm, 10 ft·lbf)

16. INSTALL WATER OUTLET

(a) Install a new gasket and the water outlet with the 2 bolts.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

17. INSTALL EXHAUST MANIFOLD

(a) Install a new gasket and the exhaust manifold with the 6 nuts.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

(b) Install the heat insulator with the 2 bolts and 2 nuts.
Torque: 5.5 N·m (55 kgf·cm, 48 in.·lbf)

18. INSTALL INTAKE MANIFOLD

Install a new gasket and the intake manifold with the 3 bolts and 2 nuts.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

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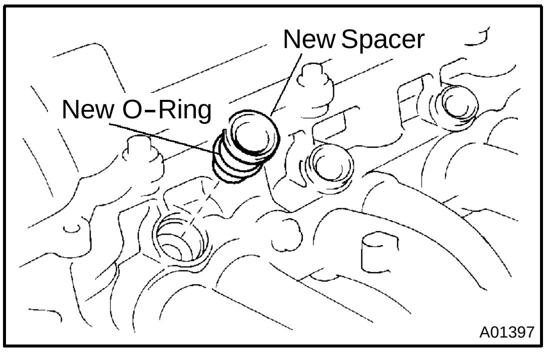


19. INSTALL INJECTORS AND DELIVERY PIPE
(See page FI–22)

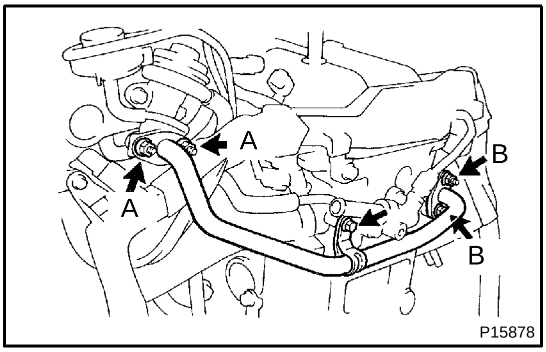
HINT:
When using a new cylinder head, spacers must be installed.
Apply a light coat of gasoline to a new O–ring and install it to a new spacer.

20. INSTALL FUEL RETURN PIPE
Torque:8.8 N·m (90 kgf·cm, 78 in·lbf)

21. INSTALL FUEL INLET PIPE

22. INSTALL AIR INTAKE CHAMBER ASSEMBLY
(a) Install a new gasket and the air intake chamber assembly with the 3 bolts and 2 nuts.
Torque:21 N·m (210 kgf·cm, 15 ft·lbf)
(b) Connect these hoses:
- EVAP hose to throttle body
- Brake booster vacuum hose to union
- Water bypass hose to water bypass pipe
- Water bypass hose to cylinder head rear cover

23. INSTALL INTAKE CHAMBER STAY
Torque:20 N·m (200 kgf·cm, 15 ft·lbf)



24. INSTALL EGR PIPE
Install 2 new gaskets and EGR pipe with the bolt and 4 nuts.
Torque:
Bolt: 18 N·m (185 kgf·cm, 13 ft·lbf)
Nut A: 19 N·m (195 kgf·cm, 14 ft·lbf)
Nut B: 20 N·m (200 kgf·cm, 15 ft·lbf)

25. CONNECT INJECTOR CONNECTORS

26. CONNECT ENGINE WIRE

27. INSTALL IGNITION COILS

28. INSTALL PCV HOSES

29. FILL WITH ENGINE COOLANT

30. START ENGINE AND CHECK FOR LEAKS

31. VEHICLE ROAD TEST
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

32. RECHECK ENGINE COOLANT LEVEL

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
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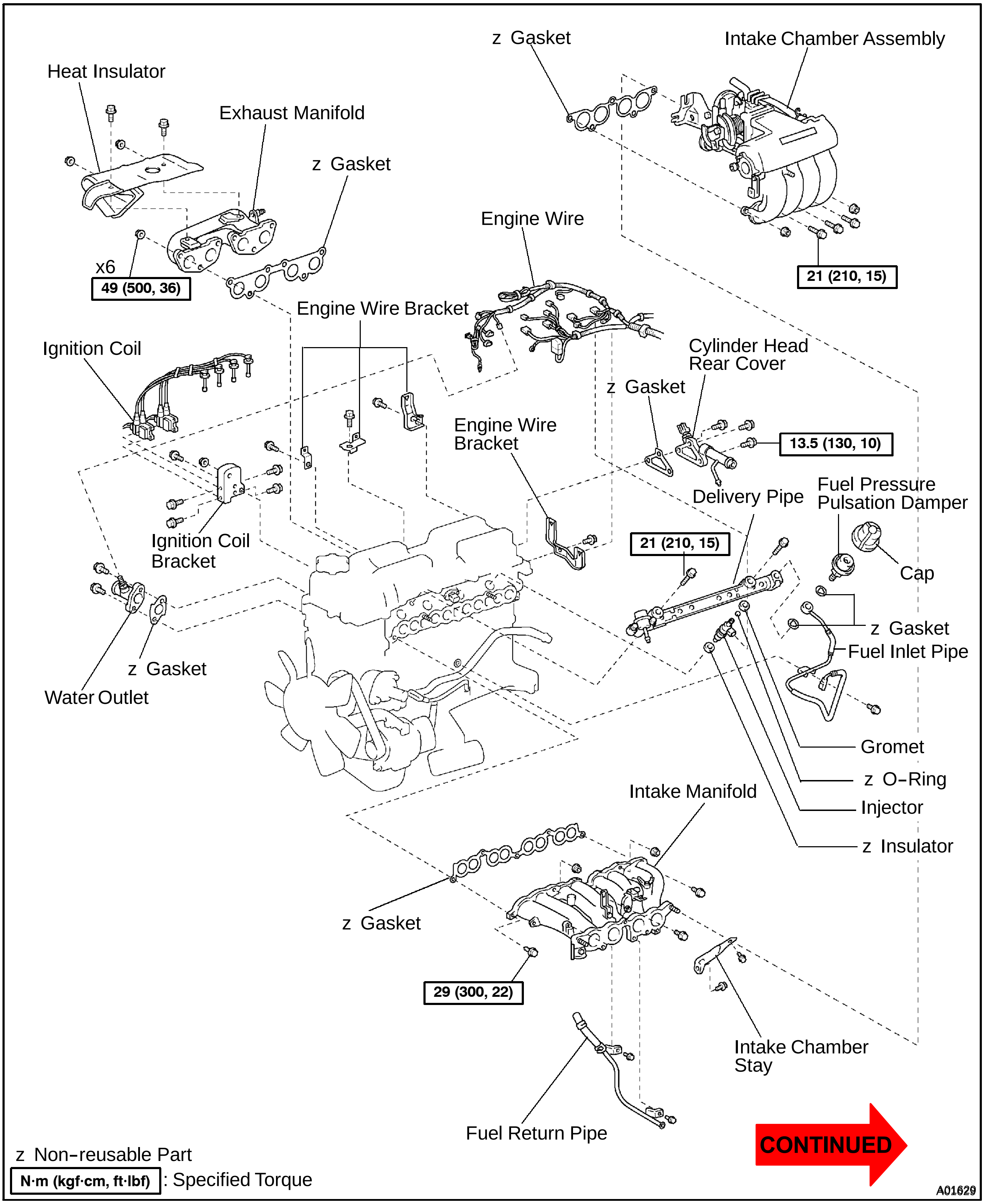
CYLINDER HEAD (3RZ–FE)

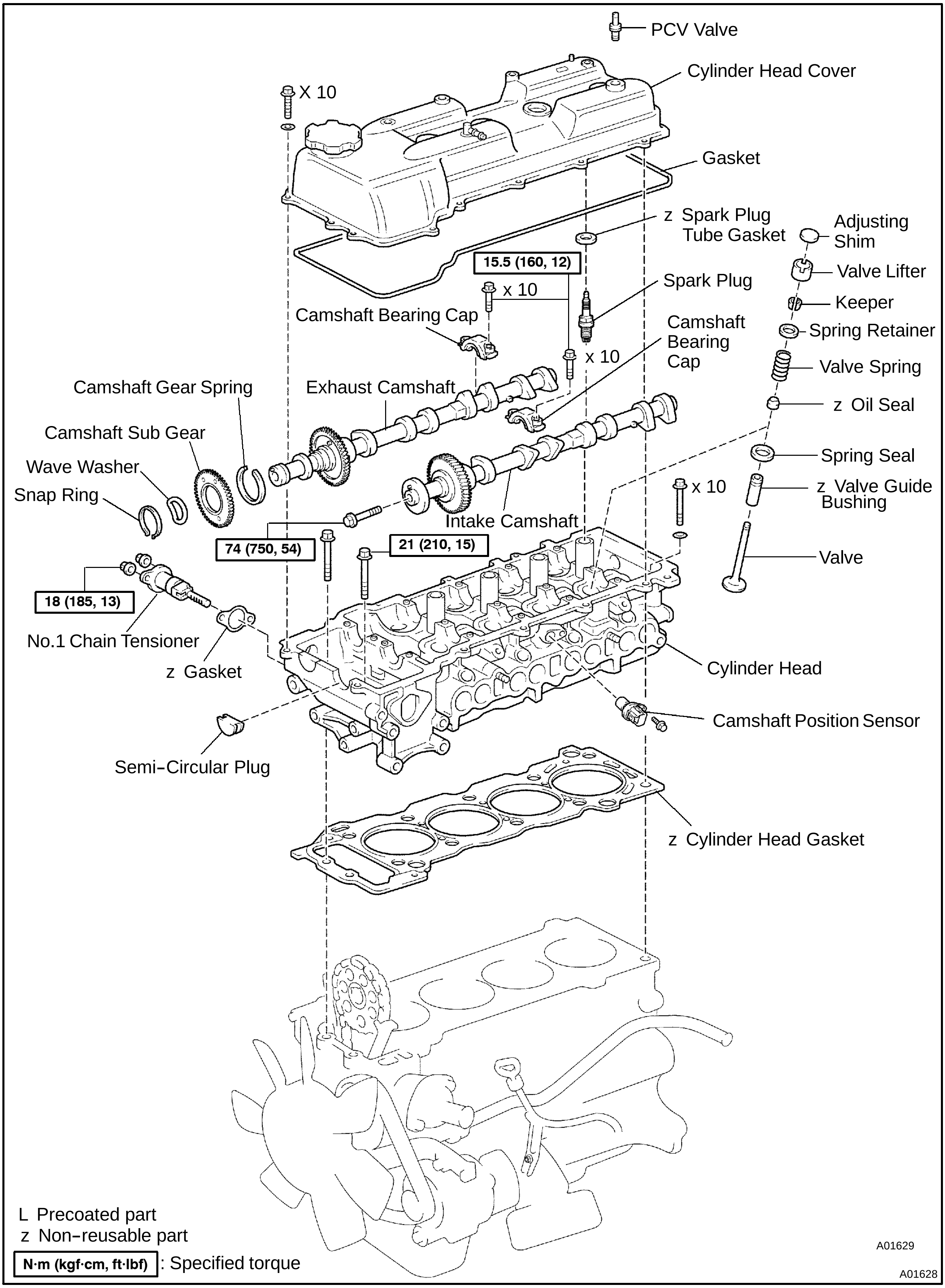
COMPONENTS

EM09A–01



z Non–reusable Part

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


PCV Valve
Cylinder Head Cover
X 10
Gasket
z Spark Plug Tube Gasket
Adjusting Shim
15.5 (160, 12)
x 10
Valve Lifter
Spark Plug
Keeper
Camshaft Bearing Cap
Camshaft Bearing Cap
Spring Retainer
x 10
Valve Spring
Camshaft Gear Spring
Exhaust Camshaft
z Oil Seal
Camshaft Sub Gear
Spring Seal
Wave Washer
x 10
z Valve Guide Bushing
Snap Ring
Intake Camshaft
74 (750, 54)
21 (210, 15)
Valve
18 (185, 13)
No.1 Chain Tensioner
Cylinder Head
z Gasket
Camshaft Position Sensor
Semi–Circular Plug
z Cylinder Head Gasket
L Precoated part
z Non–reusable part
N·m (kgf·cm, ft·lbf) : Specified torque
A01629
A01628

ENGINE MECHANICAL – CYLINDER BLOCK (2RZ-FE, 3RZ-F)

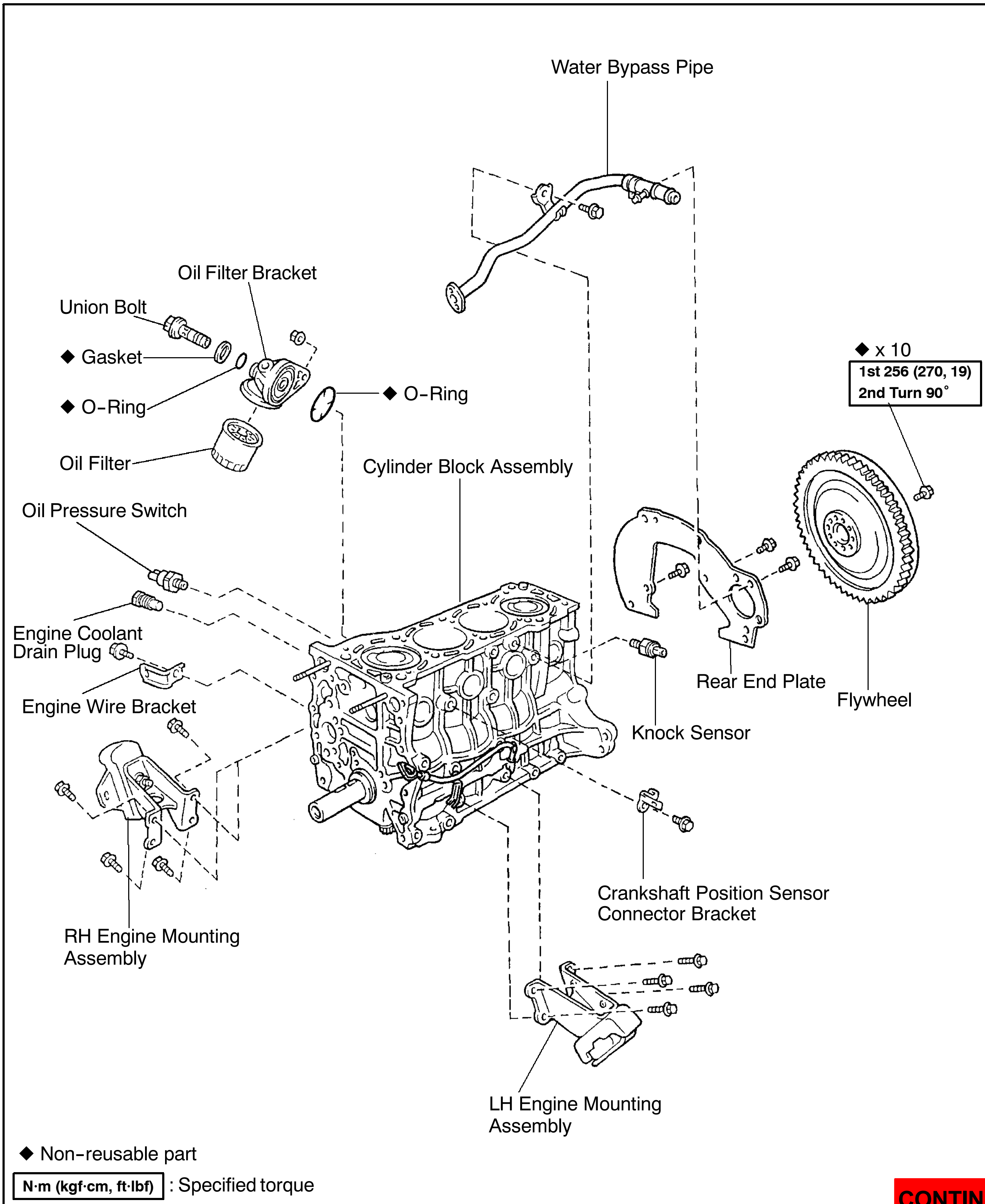
CONTINUED

ENGINE MECHANICAL – CYLINDER BLOCK (2RZ-FE, 3RZ-F)

CYLINDER BLOCK (2RZ-FE, 3RZ-F)

COMPONENTS

EM09B-01



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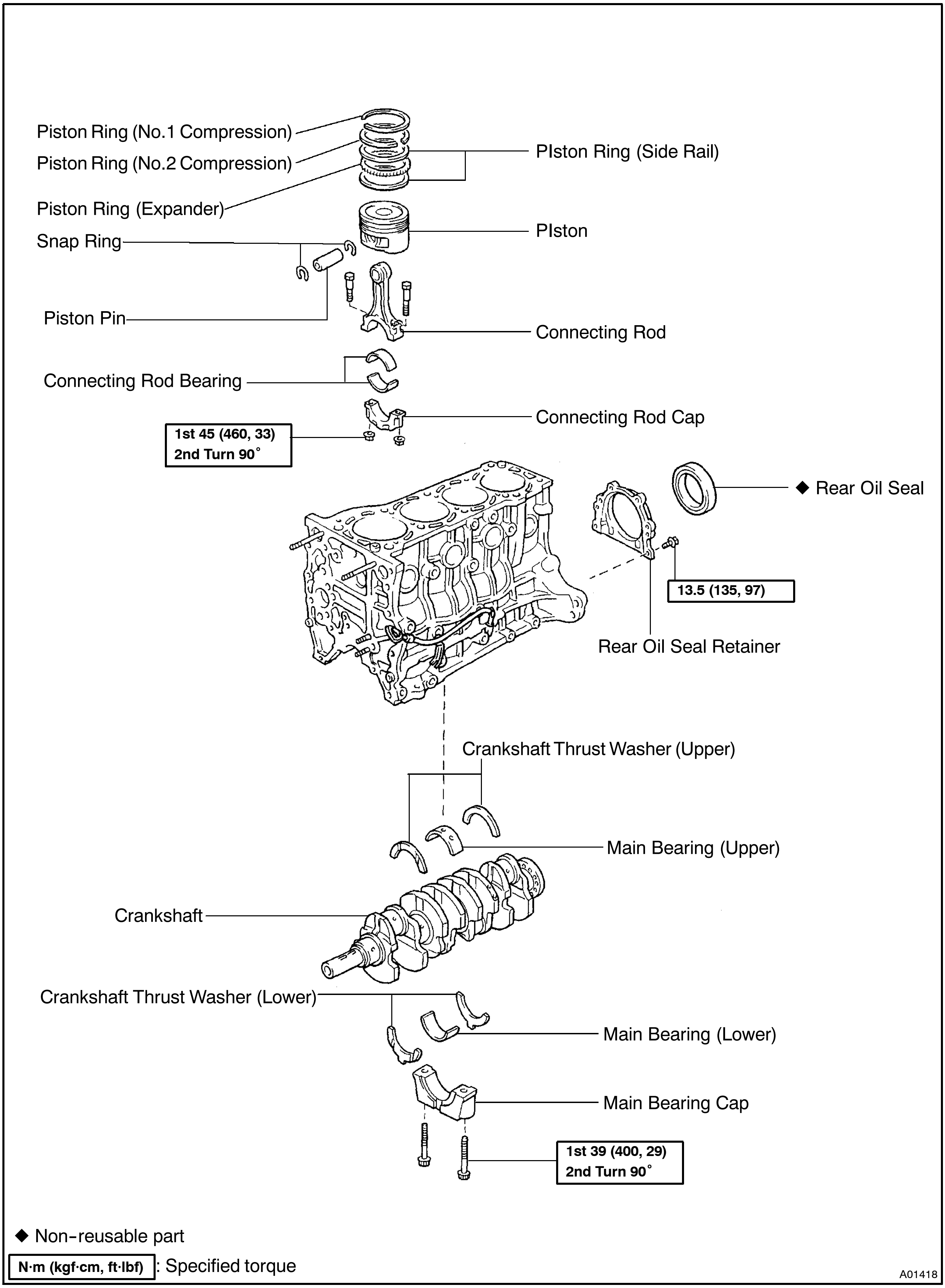
Piston Ring (No.1 Compression)
Piston Ring (No.2 Compression)
PIston Ring (Side Rail)
Piston Ring (Expander)
Snap Ring
PIston
Piston Pin
Connecting Rod
Connecting Rod Bearing
Connecting Rod Cap
1st 45 (460, 33)
2nd Turn 90°
◆ Rear Oil Seal
13.5 (135, 97)
Rear Oil Seal Retainer
Crankshaft Thrust Washer (Upper)
Main Bearing (Upper)
Crankshaft
Crankshaft Thrust Washer (Lower)
Main Bearing (Lower)
Main Bearing Cap
1st 39 (400, 29)
2nd Turn 90°
◆ Non-reusable part
N·m (kgf·cm, ft·lbf) : Specified torque
A01418

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EM09C–01

DISASSEMBLY

1. REMOVE FLYWHEEL

Remove the 10 bolts and flywheel.

2. REMOVE REAR END PLATE

Remove the 3 bolts and rear end plate.

3. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY

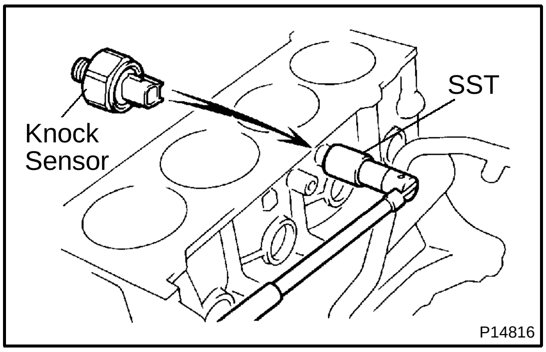
4. REMOVE CYLINDER HEAD

(See page EM–40)

5. REMOVE TIMING CHAINS, GEARS AND SPROCKET

(See page EM–21)

6. REMOVE KNOCK SENSOR



Using SST, remove the knock sensor.

SST 09816–30010

7. REMOVE WATER BYPASS PIPE

Remove the bolt and water bypass pipe.

8. REMOVE OIL FILTER

(See page LU–11)

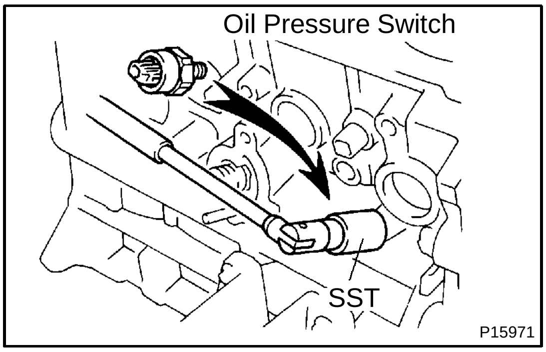
9. REMOVE OIL FILTER BRACKET

(a) Remove the nut, union bolt, gasket and oil filter bracket.

(b) Remove the O–ring from the union bolt.

10. REMOVE ENGINE COOLANT DRAIN PLUG

11. REMOVE OIL PRESSURE SWITCH



Using SST, remove the oil pressure switch.

SST 09816–30010

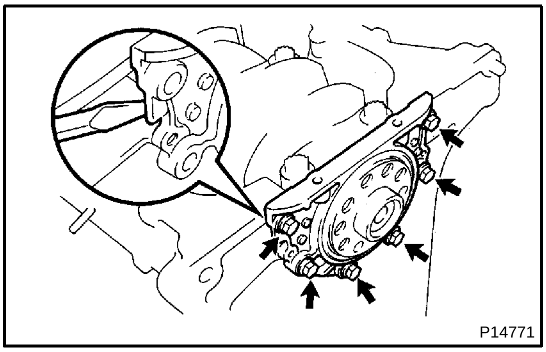
12. REMOVE RH AND LH ENGINE MOUNTING ASSEMBLIES

Remove the 4 bolts and mounting assembly.

13. REMOVE ENGINE WIRE BRACKET

14. REMOVE CRANKSHAFT POSITION SENSOR CONNECTOR BRACKET

15. REMOVE REAR OIL SEAL RETAINER



(a) Remove the 6 bolts.

(b) Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and cylinder block.

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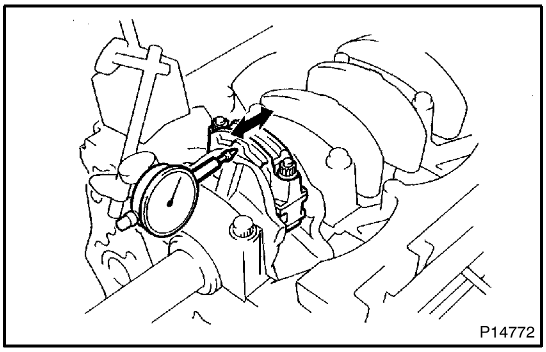


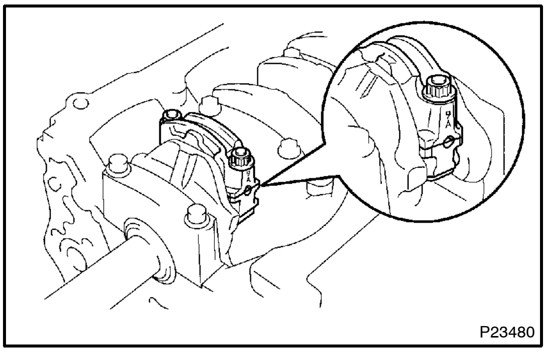
P14772

16. CHECK CONNECTING ROD THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:
0.160 - 0.312 mm (0.0063 - 0.0123 in.)
Maximum thrust clearance:
0.35 mm (0.0138 in.)

If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

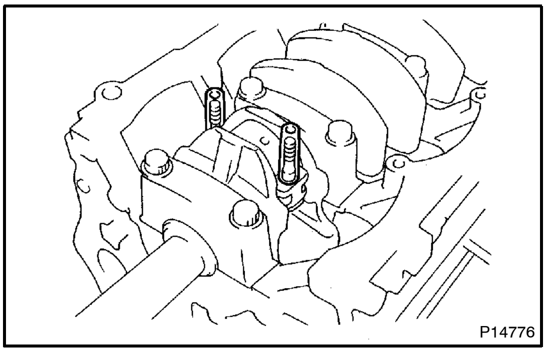


P23480

17. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
(b) Remove the connecting rod cap nuts.
(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

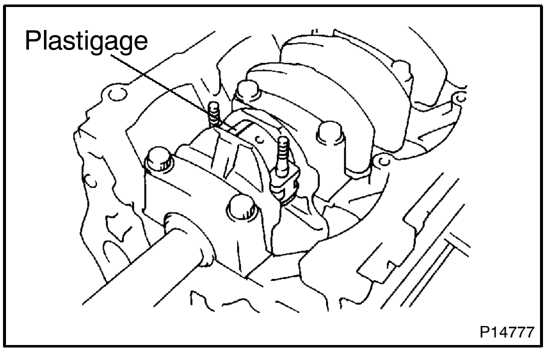
HINT:
Keep the lower bearing inserted with the connecting rod cap.



P14776

(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.
(e) Clean the crank pin and bearing.
(f) Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



P14777

(g) Lay a strip of Plastigage across the crank pin.
(h) Install the connecting rod cap with the 2 nuts.

(See page EM-77)

Torque:
1st 45 N·m (460 kgf·cm, 33 ft·lbf)
2nd Turn 90°

NOTICE:
Do not turn the crankshaft.

(i) Remove the 2 nuts and connecting rod cap.
(See procedure (b) and (c) above)

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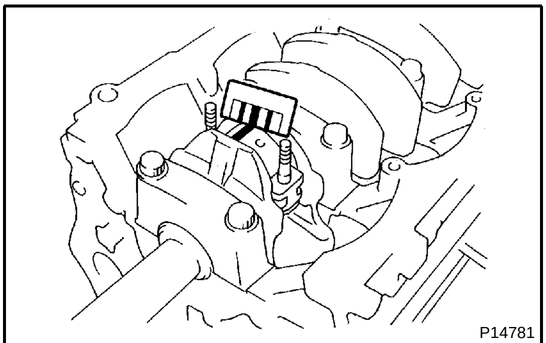


P14781

(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD

0.030 – 0.055 mm (0.0012 – 0.0022 in.)

U/S 0.25

0.031 – 0.071 mm (0.0012 – 0.0026 in.)

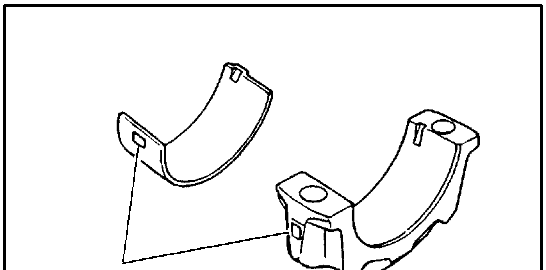
Maximum oil clearance:

0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.

HINT:

If using a standard bearing, replace with one having the same number as marked on the bearing cap. There are 3 sizes of standard bearings, marked ”4”, ”5” and ”6” accordingly.



EM7237 Z10578

Reference:

Connecting rod big end inside diameter:

STD Mark ”4”	56.000 – 56.006 mm (2.2047 – 2.2050 in.)
STD Mark ”5”	56.006 – 56.012 mm (2.2050 – 2.2052 in.)
STD Mark ”6”	56.012 – 56.018 mm (2.2052 – 2.2054 in.)
U/S 0.25	56.000 – 56.018 mm (2.2047 – 2.2054 in.)

Crankshaft crank pin diameter:

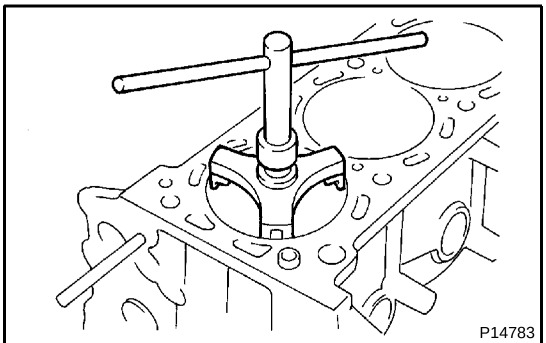
STD	52.987 – 53.000 mm (2.0861 – 2.0866 in.)
U/S 0.25	52.745 – 52.755 mm (2.0766 – 2.0770 in.)

Standard sized bearing center wall thickness:

STD Mark ”4”	1.482 – 1.485 mm (0.0583 – 0.0585 in.)
STD Mark ”5”	1.485 – 1.488 mm (0.0585 – 0.0586 in.)
STD Mark ”6”	1.488 – 1.491 mm (0.0586 – 0.0587 in.)
U/S 0.25	1.601 – 1.607 mm (0.0630 – 0.0633 in.)

(k) Completely remove the Plastigage.

18. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES



P14783

(a) Using a ridge reamer, remove the all carbon from the top of the cylinder.

(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.

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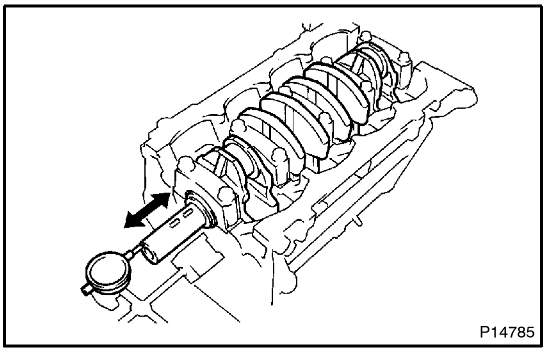


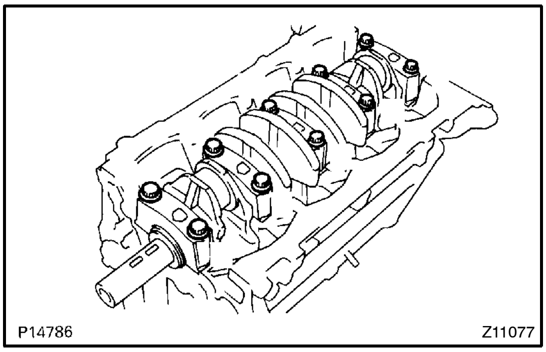
19. CHECK CRANKSHAFT THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:
0.020 – 0.220 mm (0.0008 – 0.0087 in.)
Maximum thrust clearance:
0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the thrust washers as a set.

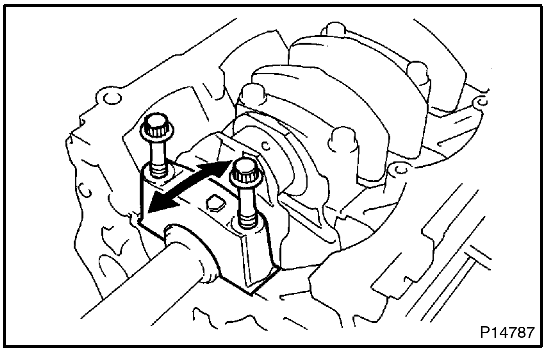
Thrust washer thickness:
2.440 – 2.490 mm (0.0961 – 0.0980 in.)



20. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

(a) Uniformly loosen and remove the main bearing cap bolts, in several passes, in the sequence shown.

(b) Using the removed main bearing cap bolts, pry the main bearing cap back and forth, and remove the main bearing caps, lower bearings and (No.3 main bearing cap only) lower thrust washers.



HINT:

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

(c) Lift out the crankshaft.

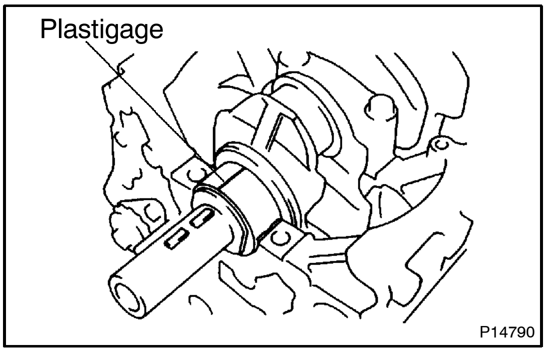
HINT:

Keep the upper bearings and upper thrust washers together with the cylinder block.

(d) Clean each main journal and bearing.

(e) Check each main journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(f) Place the crankshaft on the cylinder block.

(g) Lay a strip of Plastigage across each journal.

(h) Install the main bearing caps.
(See page EM–77)

Torque:
1st 39 N·m (400 kgf·cm, 29 ft·lbf)
2nd Turn 90°

NOTICE:
Do not turn the crankshaft.

(i) Remove the main bearing caps.
(See procedure (a) and (b) above)

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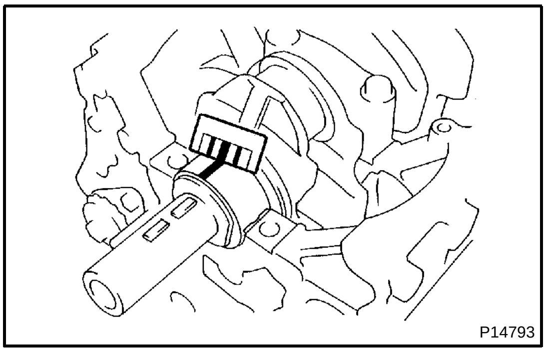
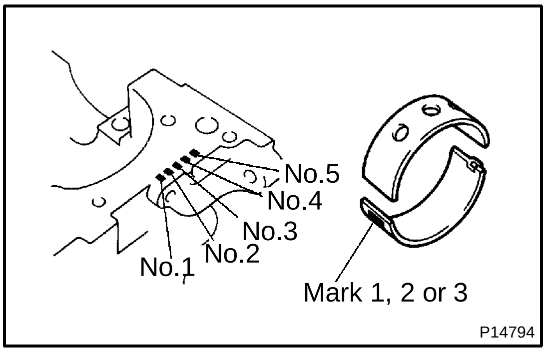

P14793



P14794

(j) Measure the Plastigage at its widest point.

Standard clearance:
STD
No.3
0.030 – 0.055 mm (0.0012 – 0.0022 in.)
Others
0.024 – 0.049 mm (0.0009 – 0.0019 in.)
U/S 0.25
No.3
0.030 – 0.070 mm (0.0012 – 0.0028 in.)
Others
0.025 – 0.065 mm (0.0010 – 0.0026 in.)
Maximum clearance:
0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.

HINT:
If using a standard bearing, replace with one having the same number as marked on the block. There are 3 sizes of standard bearings, marked
"1", "2" and "3" accordingly.

Reference:
Cylinder block main journal bore diameter:

STD Mark "1"	64.004 – 64.010 mm (2.5198 – 2.5201 in.)
STD Mark "2"	64.011 – 64.016 mm (2.5201 – 2.5203 in.)
STD Mark "3"	64.017 – 64.022 mm (2.5203 – 2.5205 in.)
U/S 0.25	64.000 – 64.024 mm (2.5197 – 2.5206 in.)

Crankshaft Journal diameter:

STD No.3	59.981 – 59.994 mm (2.2615 – 2.3620 in.)
STD Others	59.987 – 60.000 mm (2.3617 – 2.3622 in.)
U/S 0.25 No.3	59.740 – 59.750 mm (2.3520 – 2.3524 in.)
U/S 0.25 Others	59.745 – 59.755 mm (2.3522 – 2.3526 in.)

Bearing center wall thickness:

STD Mark "1"	1.987 – 1.990 mm (0.0782 – 0.0783 in.)
STD Mark "2"	1.991 – 1.993 mm (0.0784 – 0.0785 in.)
STD Mark "3"	1.994 – 1.996 mm (0.0785 – 0.0786 in.)
U/S 0.25	2.106 – 2.112 mm (0.0829 – 0.0831 in.)

(k) Completely remove the Plastigage.

21. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.
(b) Remove the upper main bearings and upper thrust washers from the cylinder block.

HINT:
Arrange the main bearings and thrust washers in correct order.

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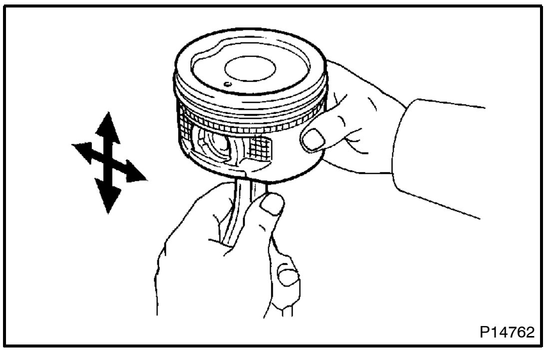
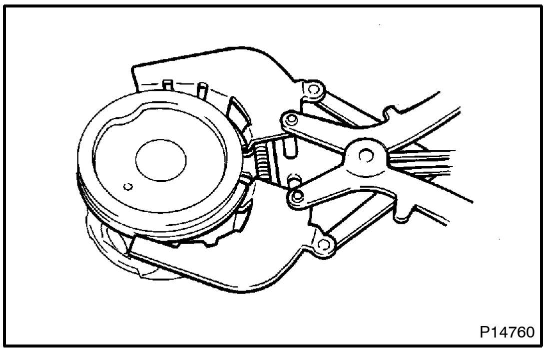


22. CHECK FIT BETWEEN PISTON AND PISTON PIN

Try to move the piston back and forth on the piston pin.
If any movement is felt, replace the piston and pin as a set.



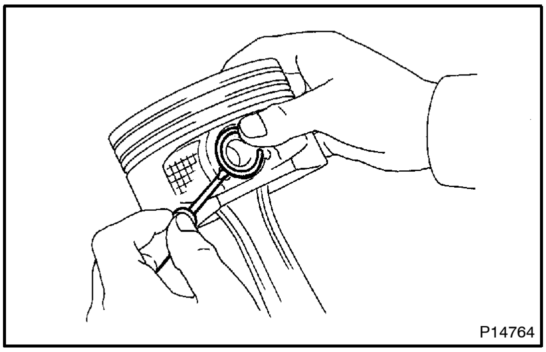
23. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the 2 compression rings.

(b) Remove the 2 side rails and oil ring by hand.

HINT:

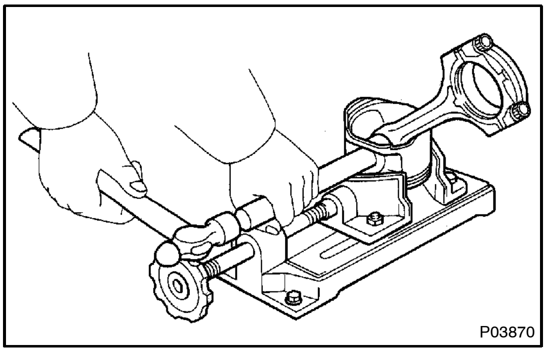
Arrange the rings in correct order only.



24. DISCONNECT CONNECTING ROD FROM PISTON

(a) Using a small screwdriver, pry out the 2 snap rings.

(b) Gradually heat the piston to 80 – 90°C (176 – 194 °F).



(c) Using plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings correct order.

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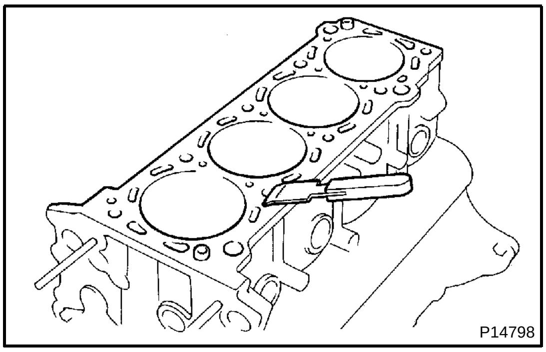
INSPECTION

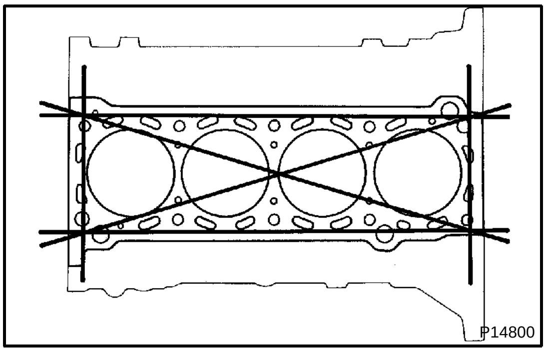


1. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. CLEAN CYLINDER BLOCK

Using a soft brush and solvent, thoroughly clean the cylinder block.

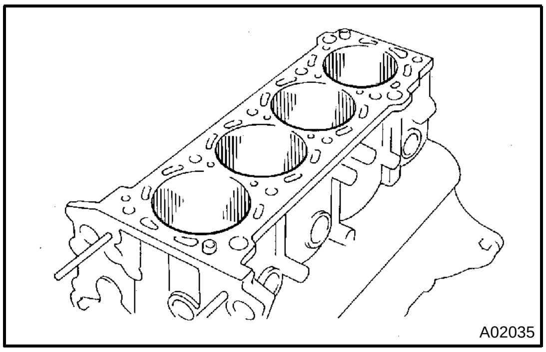


3. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

Using a precision straight edge and thickness gauge, measure the surfaces contacting the cylinder head gasket for warpage.

Maximum warpage:
0.05 mm (0.0020 in.)

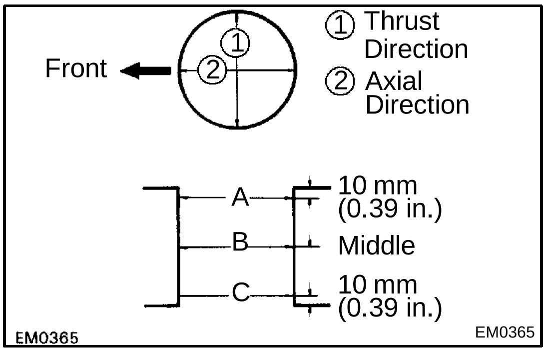
If warpage is greater than maximum, replace the cylinder block.



4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the 4 cylinders. If necessary, replace the cylinder block.

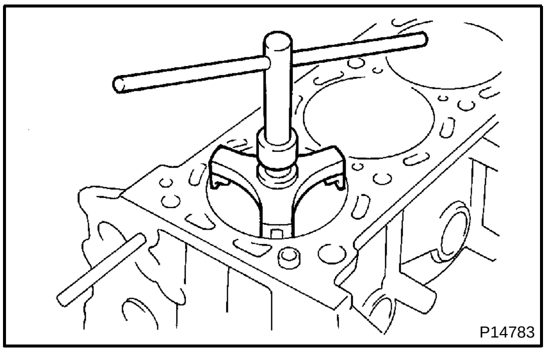


5. INSPECT CYLINDER BORE DIAMETER

Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

Standard diameter:
94.990 – 95.003 mm (3.7400 – 3.7403 in.)
Maximum diameter:
95.06 mm (3.7425 in.)

If the diameter is greater than maximum, rebore all the 4 cylinders. If necessary, replace the cylinder block.



6. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

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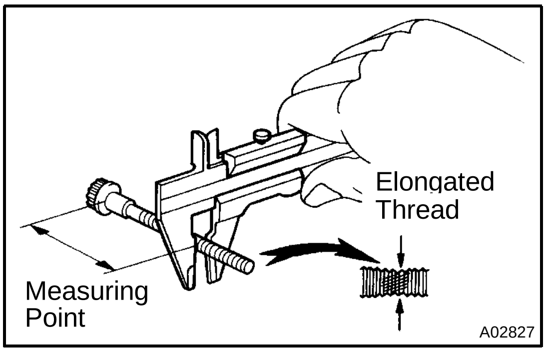
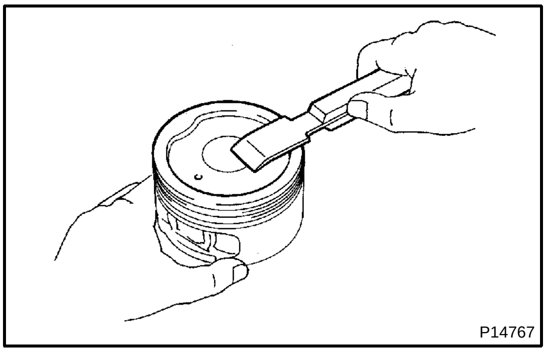


7. INSPECT MAIN BEARING CAP BOLTS

Using vernier calipers, measure the minimum diameter of the elongated thread at the measuring point.

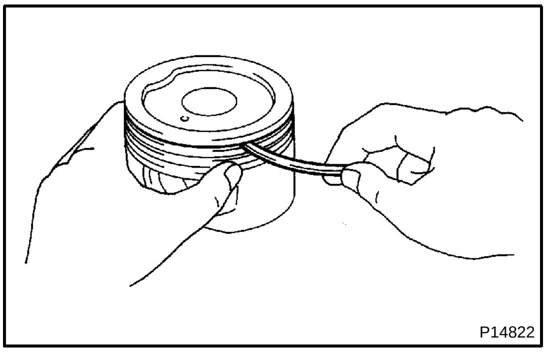
Standard outside diameter:
10.76 - 10.97 mm (0.4236 - 0.4319 in.)
Minimum outside diameter:
10.40 mm (0.4094 in.)

If the diameter is less than minimum, replace the bolt.



8. CLEAN PISTON

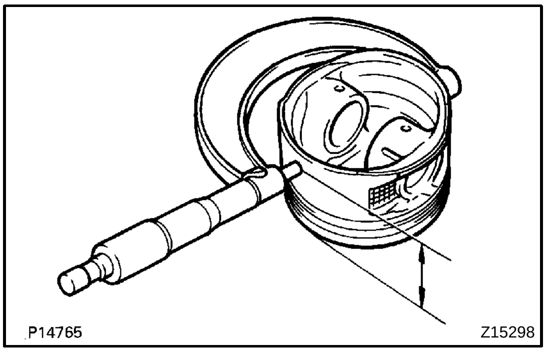
(a) Using a gasket scraper, remove the carbon from the piston top.



(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
(c) Using solvent and a brush, thoroughly clean the piston.

NOTICE:
Do not use a wire brush.

9. INSPECT PISTON OIL CLEARANCE



(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 35.5 mm (1.40 in.) from the piston head.

Piston diameter:
STD
2RZ-FE: 94.923 - 94.933 mm (3.7371 - 3.7375 in.)
3RZ-F: 94.933 - 94.943 mm (3.7375 - 3.7379 in.)
O/S 0.50
2RZ-FE: 95.423 - 95.433 mm (3.7568 - 3.7572 in.)
3RZ-F: 95.433 - 95.443 mm (3.7572 - 3.7576 in)

(b) Measure the cylinder bore diameter in the thrust directions.
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:
2RZ-FE: 0.057 - 0.080 mm (0.0022 - 0.0031 in.)
3RZ-F: 0.047 - 0.070 mm (0.0019 - 0.0028 in.)

If the oil clearance is greater than maximum, replace all the 4 pistons and rebore all the 4 cylinders. If necessary, replace the cylinder block.

HINT:(Use new cylinder block): Use a piston with the same number mark as the cylinder bore diameter marked on the cylinder block.

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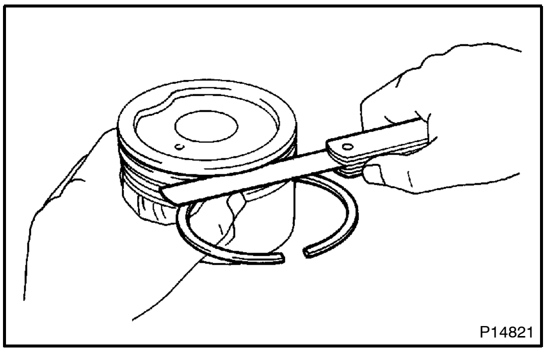


10. INSPECT PISTON RING GROOVE CLEARANCE

Using a thickness gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

Ring groove clearance:

No.1

2RZ–FE: 0.020 – 0.070 mm (0.0008 – 0.0028 in.)

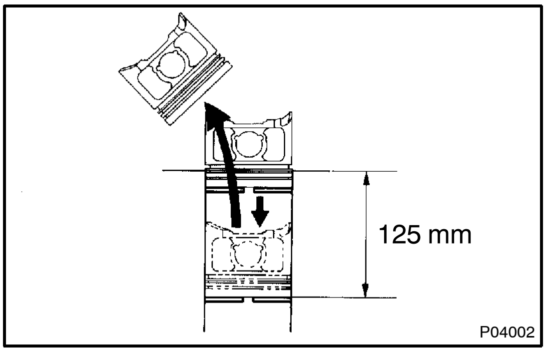
3RZ–F: 0.030 – 0.080 mm (0.0012 – 0.0031 in.)

No.2

2RZ–FE: 0.030 – 0.070 mm (0.0012 – 0.0028 in.)

3RZ–F: 0.040 – 0.080 mm (0.0016 – 0.0031 in.)

If the clearance is not as specified, replace the piston.



11. INSPECT PISTON RING END GAP

(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 125 mm (4.92 in.) from the top of the cylinder block.

(c) Using a thickness gauge, measure the end gap.

Ring end gap:

No.1

2RZ–FE: 0.300 – 0.400 mm (0.0118 – 0.0157 in.)

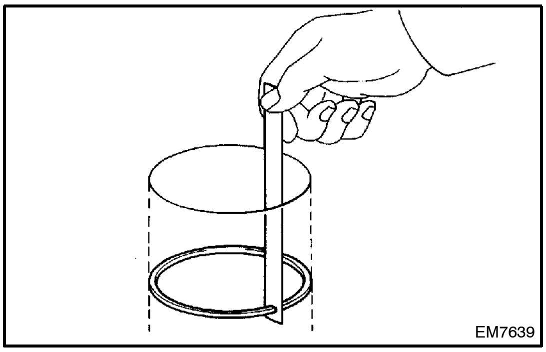
3RZ–F: 0.300 – 0.430 mm (0.0118 – 0.0169 in.)

No.2

2RZ–FE: 0.400 – 0.500 mm (0.0157 – 0.0197 in.)

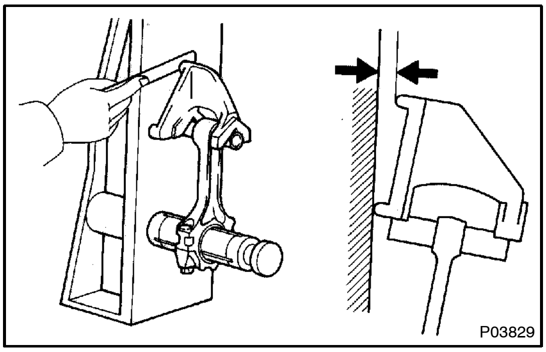
3RZ–F: 0.450 – 0.600 mm (0.0177 – 0.0236 in.)

If the end gap is not as specified, replace the piston ring. If the end gap is not as specified, even with a new piston ring, rebore all the 4 cylinders or replace the cylinder block.



12. INSPECT PISTON PIN FIT

At 80 – 90°C (176 – 194°F), you should be able to push the piston pin into the piston pin hole with your thumb.



13. INSPECT CONNECTING ROD ALIGNMENT

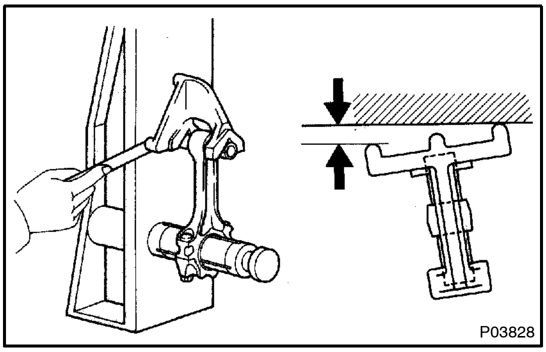
Using a rod aligner and thickness gauge, check the connecting rod alignment.

- Check for out–of–alignment.

Maximum out–of–alignment:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If out–of–alignment is greater than maximum, replace the connecting rod assembly.



- Check for twist

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If twist is greater than maximum, replace the connecting rod assembly.

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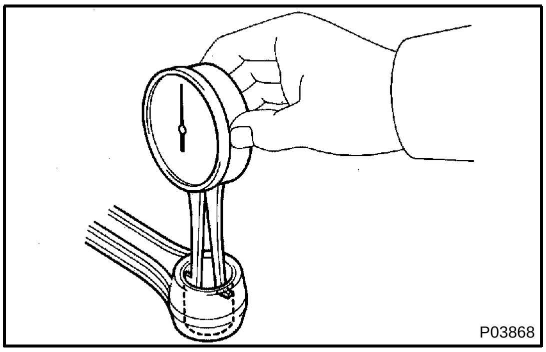
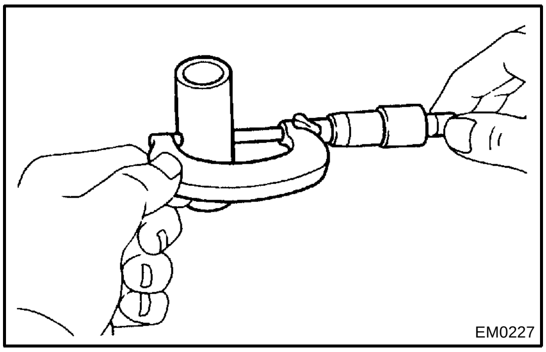


14. INSPECT PISTON PIN OIL CLEARANCE

(a) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:

24.008 – 24.017 mm (0.9452 – 0.9455 in.)



(b) Using a micrometer, measure the piston pin diameter.

Piston pin diameter:

24.000 – 24.009 mm (0.9449 – 0.9452 in.)

(c) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

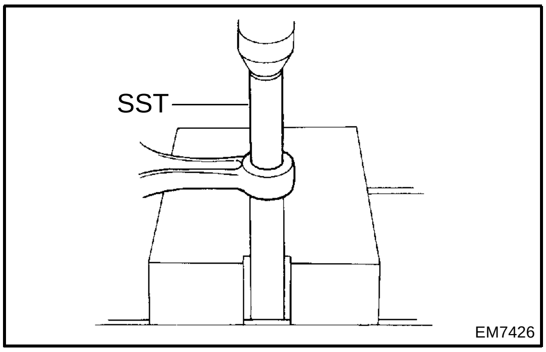
Standard oil clearance:

0.005 – 0.011 mm (0.0002 – 0.0004 in.)

Maximum oil clearance:

0.015 mm (0.0006 in.)

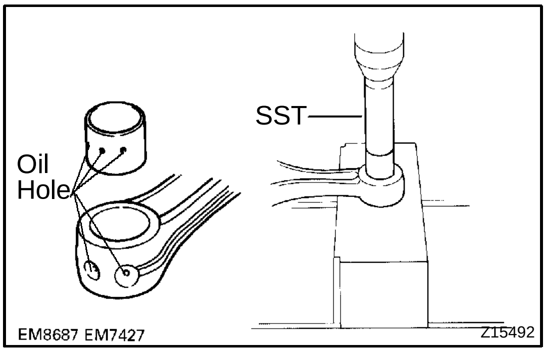
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.



15. IF NECESSARY, REPLACE CONNECTING ROD BUSHING

(a) Using SST and a press, press out the bushing.

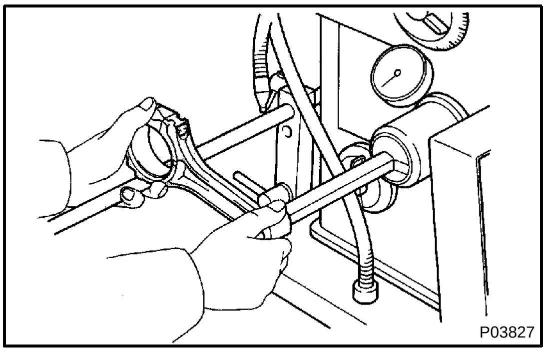
SST 09207–76010



(b) Align the oil holes of a new bushing and the connecting rod.

(c) Using SST and a press, press in the bushing.

SST 09207–76010



(d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step 14 above) between the bushing and piston pin.

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CLICK HERE TO VIEW CHAPTER INDEX
3RZ-F,3RZ-FE Pages From Supplement
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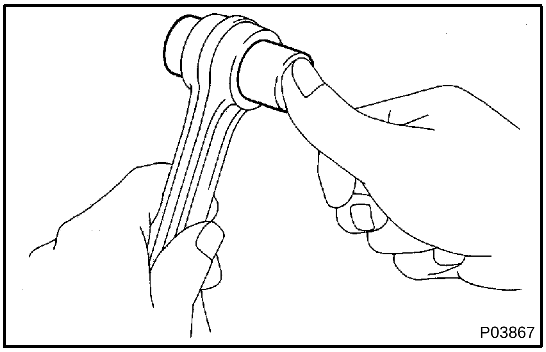
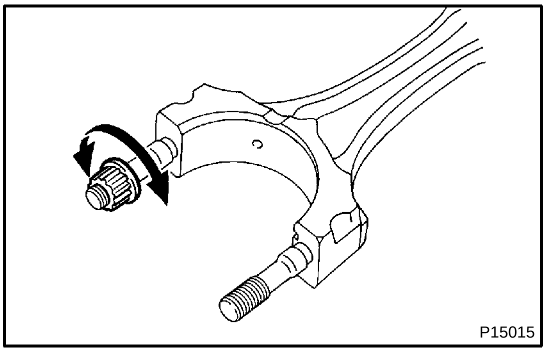
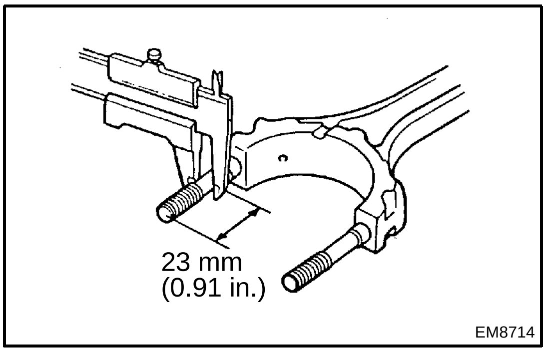


(e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.





16. INSPECT CONNECTING ROD BOLTS

(a) Install the cap nut to the connecting rod bolt. Check that the cap nut can be turned easily by hand to the end of the thread.

(b) If the cap nut cannot be turned easily, measure the minimum outside diameter of the connecting rod bolt with vernier calipers.

Standard outside diameter:
7.80 – 7.90 mm (0.3071 – 0.3110 in.)
Minimum outside diameter:
7.60 mm (0.2992 in.)

HINT:

- If the location of minimum diameter can not be judged by visual inspection, measure the outer diameter at the location shown in the illustration.
- If the outside diameter is less than limit, replace the connecting rod bolt and nut as a set.

17. CYLINDER BORING

HINT:

Bore all the 4 cylinders for the oversized piston outside diameter.

Replace all the piston rings with ones to match the oversized pistons.

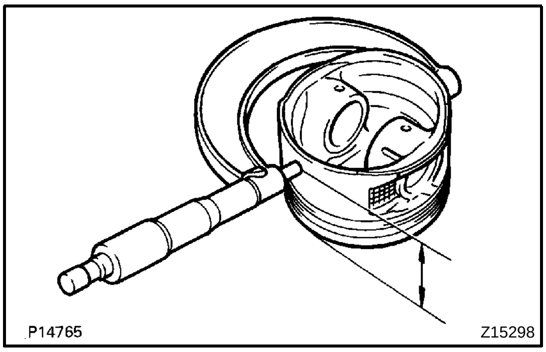
(a) Select oversized pistons

Oversized piston diameter:
O/S 0.50
95.423 – 95.433 mm (3.7568 – 3.7572 in.)

(b) Calculate amount bore cylinders

HINT:

- Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 35.5 mm (1.40 in.) from the piston head.
- Calculate the amount of each cylinder is to be rebored as follows:



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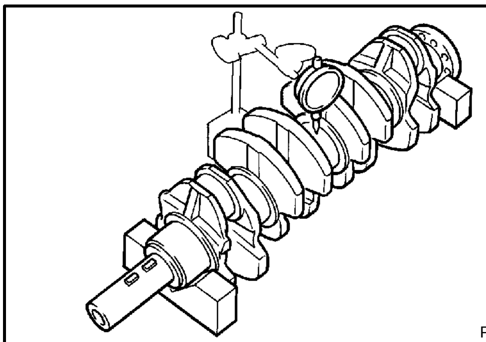
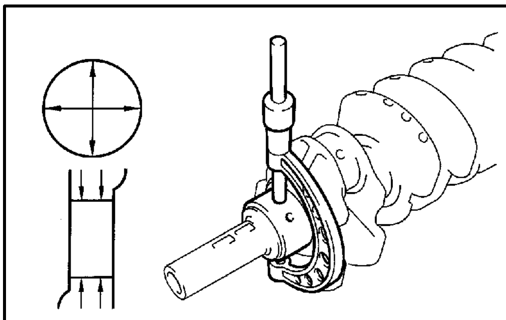
Size to be rebored = P + C – H
P = Piston diameter
C = Piston clearance
0.057 – 0.080 mm (0.0022 – 0.0031 in.)
H = Allowance for honing
0.020 mm (0.0008 in.) or less

(c) Bore and hone cylinder to calculated dimensions
Maximum honing:
0.02 mm (0.0008 in.)

NOTICE:
Excess honing will destroy the finished roundness.


P14803


P14813

18. INSPECT CRANKSHAFT FOR RUNOUT

(a) Place the crankshaft on V–blocks.
(b) Using a dial indicator, measure the circle runout at the center journal.
Maximum circle runout:
0.03 mm (0.0012 in.)

If the circle runout is greater than maximum, replace the crankshaft.

19. INSPECT MAIN JOURNALS AND CRANK PINS

(a) Using a micrometer, measure the diameter of each main journal and crank pin.
Main journal diameter:
STD
No.3
59.981 – 59.994 mm (2.2615 – 2.3620 in.)
Others
59.987 – 60.000 mm (2.3617 – 2.3622 in.)
U/S 0.25
No.3
59.740 – 59.750 mm (2.3520 – 2.3524 in.)
Others
59.745 – 59.755 mm (2.3522 – 2.3526 in.)
Crank pin diameter:
STD
52.987 – 53.000 mm (2.0861 – 2.0866 in.)
U/S 0.25
52.745 – 52.755 mm (2.0766 – 2.0770 in.)

If the diameter is not as specified, check the oil clearance (See page EM–71). If necessary, grind or replace the crankshaft.

CONTINUED

(b) Check each main journal and crank pin for taper and out–of–round as shown.

Maximum taper and out–of–round:
0.005 mm (0.0002 in.)

If the taper and out–of–round is greater than maximum, replace the crankshaft.

20. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

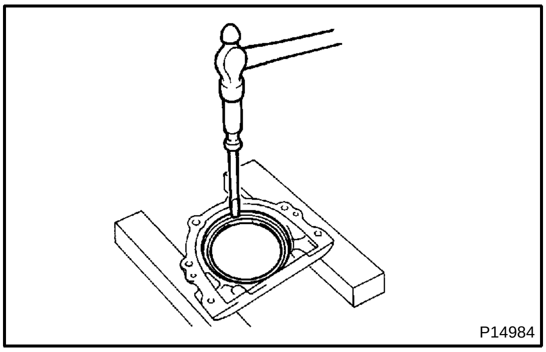
- Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure).
- Install new main journal and/or crank pin undersized bearings.

REASSEMBLY

1. REPLACE CRANKSHAFT FRONT OIL SEAL

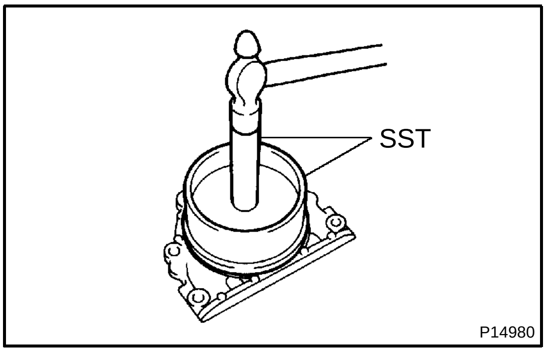
(See page LU-8)

2. REPLACE CRANKSHAFT REAR OIL SEAL

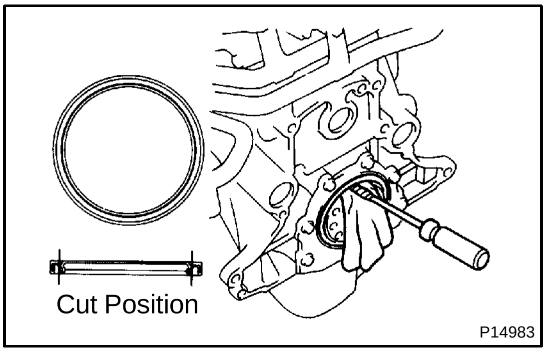


HINT:
There are 2 methods (A and B) to replace the oil seal which are as follows:

(a) If rear oil seal retainer is removed from cylinder block:
   (1) Using a screwdriver and a hammer, tap out the oil seal.

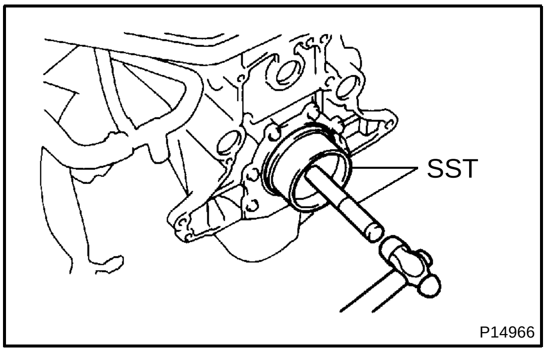


   (2) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil seal retainer edge.
   SST 09223-15030, 09950-70010 (09951-07150)
   (3) Apply MP grease to the oil seal lip.



(b) If rear oil seal retainer is installed to cylinder block:
   (1) Using a knife, cut off the oil seal lip.
   (2) Using a screwdriver, pry out the oil seal.

NOTICE:
Be careful not to damage the crankshaft. Tape the screwdriver tip.



   (3) Apply MP grease to a new oil seal lip.
   (4) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
   SST 09223-15030, 09950-70010 (09951-07150)

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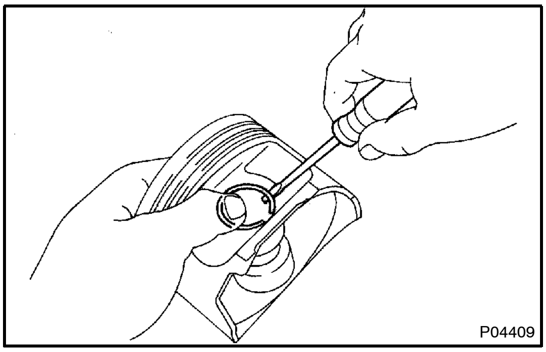
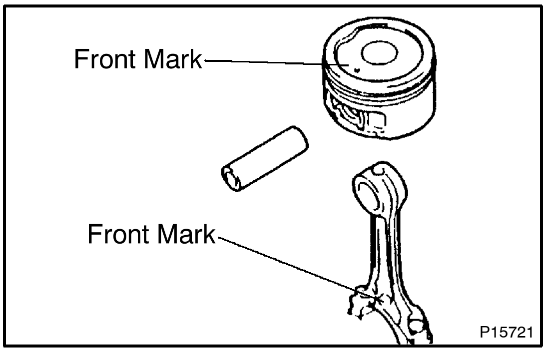

P04409

3. ASSEMBLE PISTON AND CONNECTING ROD

(a) Install a new snap ring on one side of the piston pin hole.

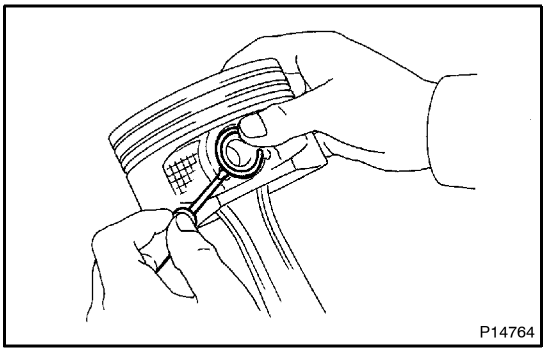
(b) Gradually heat the pistion to 80 – 90 °C (176 – 194 °F).



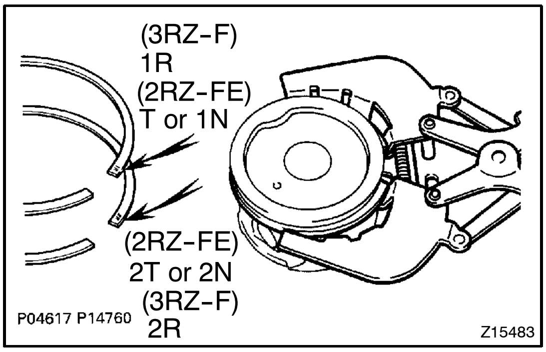
P15721

(c) Coat the piston pin with engine oil.

(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.


P14764

(e) Install a new snap ring on the other side of the piston pin hole.



P04617 P14760 Z15483

4. INSTALL PISTON RINGS

(a) Install the oil ring expander and 2 side rails by hand.

(b) Using a piston ring expander, install the 2 compression ring with the corde mark facing upward.

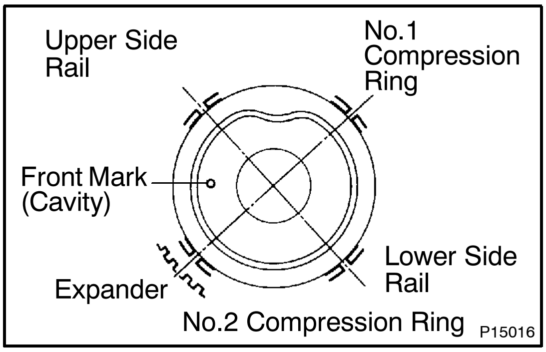
Code mark:

2RZ-FE: No.1: "T" or "1N"

2RZ-FE: No.2: "2T" or "2N"

3RZ-F: No.1: "1R"

3RZ-F: No.2: "2R"



P15016

(c) Position the piston rings so that the ring ends are as shown.

NOTICE:

Do not align the ring ends.

5. INSTALL BEARINGS

(a) Align the bearing claw with the groove of the connecting rod or connecting rod cap.

(b) Install the bearings in the connecting rod and connecting rod cap.

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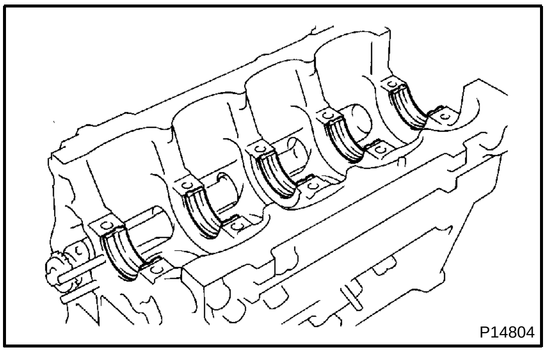
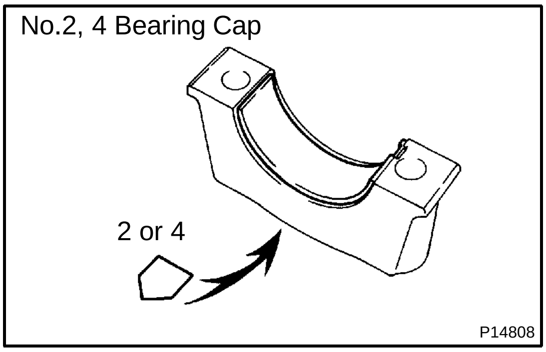


6. INSTALL MAIN BEARINGS

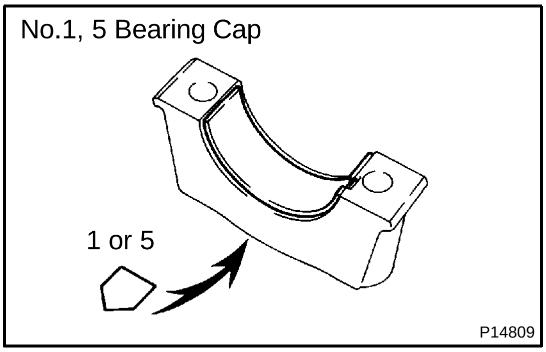
(a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.

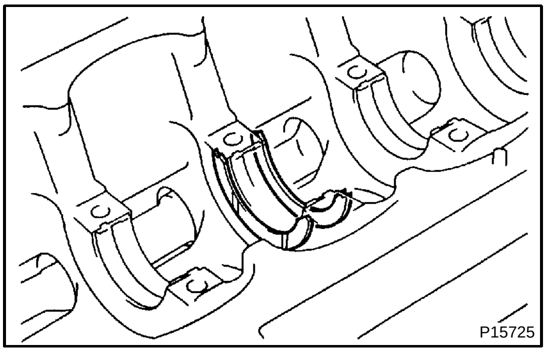


(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

HINT:

A number is marked on each main bearing cap to indicate the installation position.

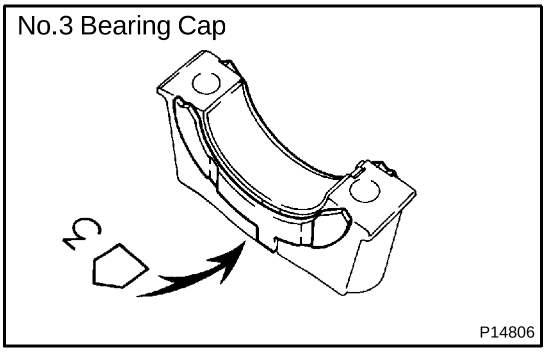




7. INSTALL UPPER THRUST WASHERS

Install the 2 thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

8. PLACE CRANKSHAFT ON CYLINDER BLOCK



9. PLACE MAIN BEARING CAPS AND LOWER THRUST WASHERS ON CYLINDER BLOCK

(a) Install the 2 thrust washers on the No.3 bearing cap with the grooves facing outward.

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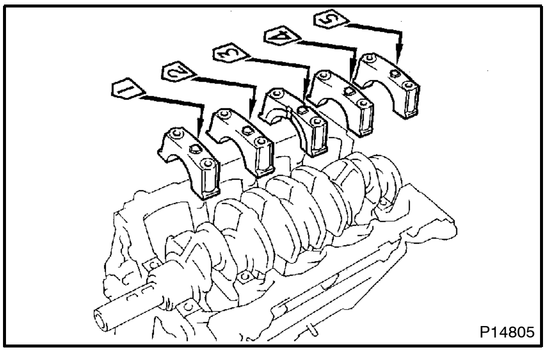
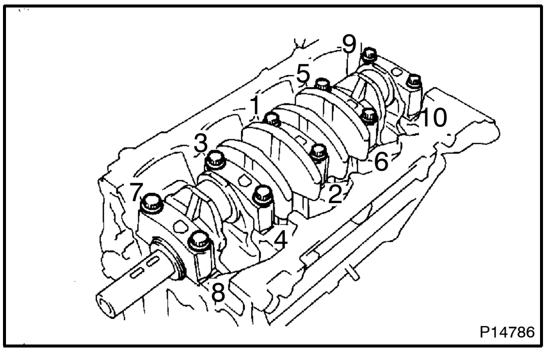


(b) Install the 5 main bearing caps in their proper locations.

HINT:

Each bearing cap has a number and front mark.



10. INSTALL MAIN BEARING CAP BOLTS

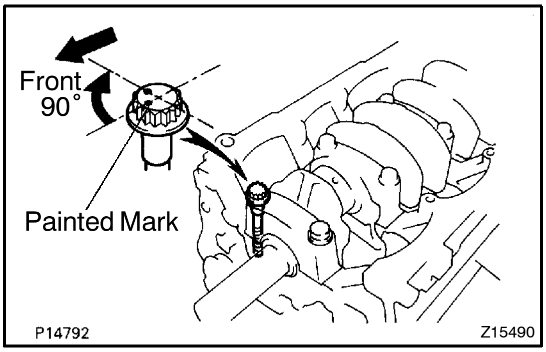
HINT:

- The main bearing cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any of the main bearing cap bolts is broken or deformed, replace it.

(a) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.

(b) Install and uniformly tighten the 10 bolts of the main bearing caps, in several passes, in the sequence shown.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)



If any one of the main bearing cap bolts does not meet the torque specification, replace the main bearing cap bolt.

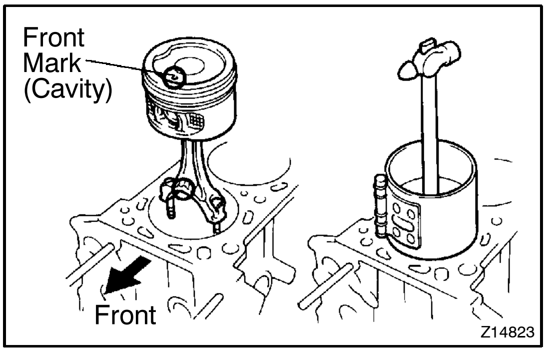
(c) Mark the front of the main bearing cap bolt with paint.

(d) Retighten the main bearing cap bolts by 90° in the numerical order shown above.

(e) Check that the painted mark is now at a 90° angle to the front.

(f) Check the crankshaft thrust clearance.

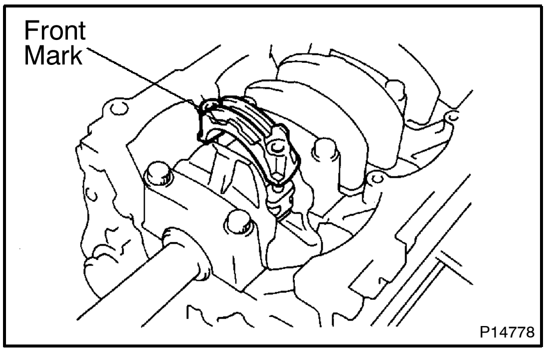
(See page EM–64)



11. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

(a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

(b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



12. PLACE CONNECTING ROD CAP ON CONNECTING ROD

(a) Match the numbered connecting rod cap with the connecting rod.

(b) Install the connecting rod cap with the front mark facing forward.

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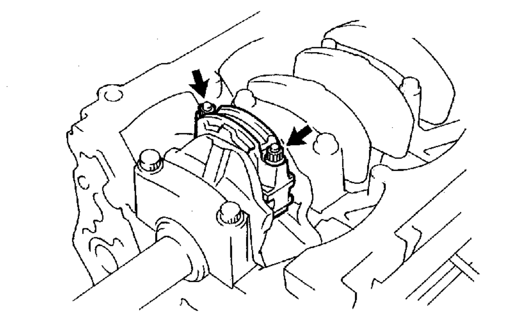


P14774

13. INSTALL CONNECTING ROD CAP NUTS

HINT:

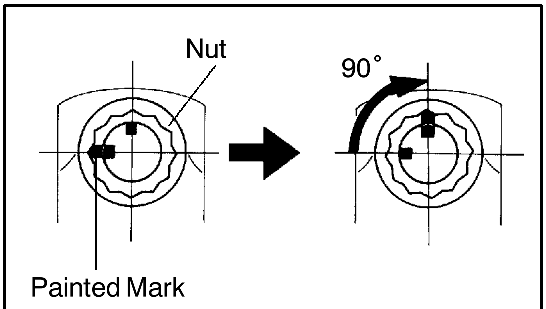
- The connecting rod cap nuts are tightened in 2 progressive steps (steps (b) and (d)).
- If any connecting rod bolt is broken or deformed, replace it.

(a) Apply a light coat of engine oil on the threads and under the nuts of the connecting rod cap.

(b) Install and alternately tighten the nuts of the connecting rod cap in several passes.

Torque: 45 N·m (460 kgf·cm, 33 ft·lbf)

If any one of the connecting rod cap nuts does not meet the torque specification, replace the connecting rod bolt and cap nut as a set.



P04615

(c) Mark the front of the connecting rod cap nut and bolt with paint.

(d) Retighten the connecting rod cap nuts 90° as shown.

(e) Check that the painted mark on the nut is at a 90° angle in relation to the mark on the bolt.

(f) Check that the crankshaft turns smoothly.

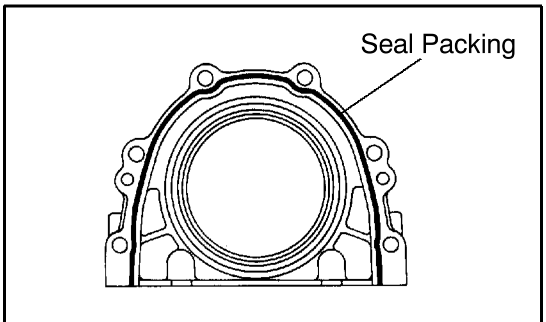
(g) Check the connecting rod thrust clearance.

(See page EM-64)

14. INSTALL REAR OIL SEAL RETAINER

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the retainer and cylinder block.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue solvent, clean both sealing surfaces.



P14810

(b) Apply seal packing to the retainer as shown in the illustration.

Seal packing:

Part No. 08826-00080 or equivalent

- Install a nozzle that has been cut to a 2 - 3 mm (0.08 - 0.12 in.) opening.

HINT:

Avoid applying an excessive amount to the surface.

CONTINUED

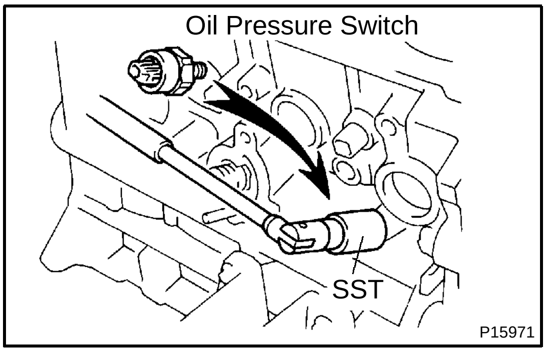
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the retainer with the 6 bolts.
Torque: 13.5 N·m (135 kgf·cm, 9.7 ft·lbf)

15. INSTALL CRANKSHAFT POSITION SENSOR CONNECTOR BRACKET

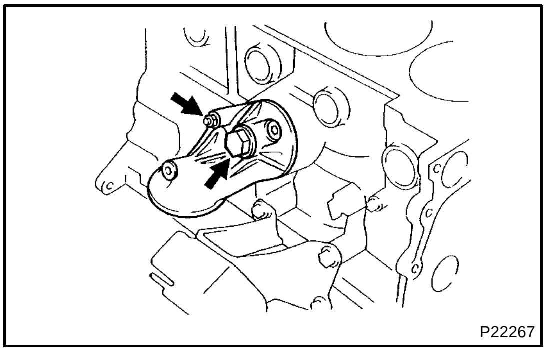
16. INSTALL ENGINE WIRE BRACKET

17. INSTALL RH AND LH ENGINE MOUNTING ASSEMBLIES
Torque: 52 N·m (520 kgf·cm, 38 ft·lbf)



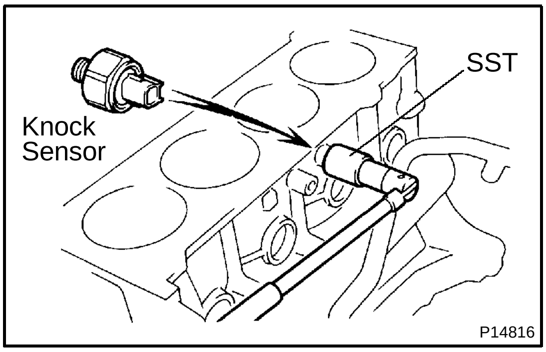
18. INSTALL OIL PRESSURE SWITCH
(a) Apply adhesive to 2 or 3 threads of the oil pressure switch.
Adhesive:
Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent
(b) Using SST, install the oil pressure switch.
SST 09816–30010

19. INSTALL ENGINE COOLANT DRAIN COCK
Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf)



20. OIL FILTER BRACKET
(a) Install a new O–ring to the union bolt.
(b) Install a new gasket, the union bolt, nut and oil filter bracket.
Torque:
Union bolt: 68.5 N·m (700 kgf·cm, 51 ft·lbf)
Nut: 12 N·m (120 kgf·cm, 8.9 ft·lbf)

21. INSTALL OIL FILTER
(See page LU–1)



22. INSTALL WATER BYPASS PIPE
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

23. INSTALL KNOCK SENSOR
Using SST, install the knock sensor.
SST 09816–30010
Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

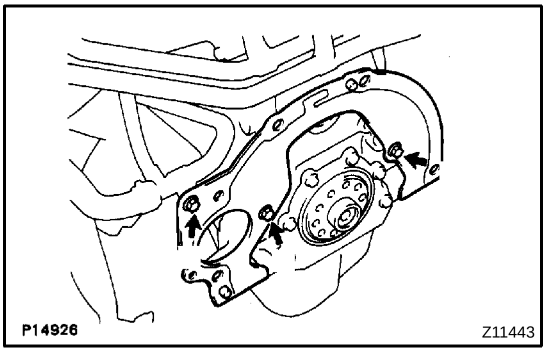
CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

24. INSTALL TIMING CHAINS, GEARS AND SPROCKETS
(See page EM-25)

25. INSTALL CYLINDER HEAD
(See page EM-54)

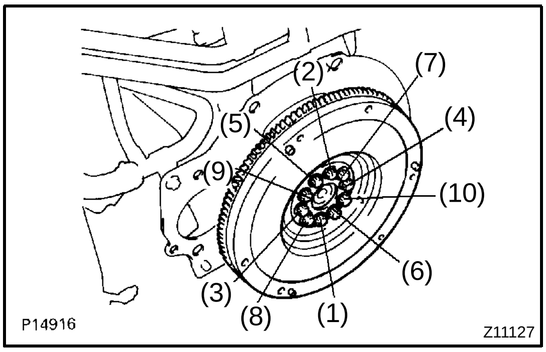
26. REMOVE ENGINE STAND



27. INSTALL REAR END PLATE

Install the rear end plate with the 3 bolts.

Torque:
Bolt A: 18 N·m (185 kgf·cm, 13 ft·lbf)
Bolt B: 20 N·m (200 kgf·cm, 14 ft·lbf)



28. INSTALL FLYWHEEL

Install and uniformly tighten 10 new bolts to the flywheel, in several passes, in the sequence shown.

Torque: **26.5 N·m (270 kgf·cm, 19 ft·lbf)**

BACK TO MAIN INDEX

EMISSION CONTROL

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
1RZ, 2RZ–E Engine Repair Manual For Emission Control	ERM103E
3RZ–F Engine Repair Manual For Emission Control	RM055E

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

CLICK HERE TO VIEW CHAPTER INDEX

EMISSION CONTROL SYSTEM

EC03K-01

PURPOSE

S 1RZ:, 3RZ-F:

System	Abbreviation	Function
Positive crankcase ventilation	PCV	Reduces HC
Fuel evaporative emission control	EVAP	Reduces evaporative HC
Throttle positioner	TP	Reduces HC and CO
Spark control	SC	Improves drivability-cold
Auxiliary system:		
(1) Automatic hot air intake	HAI	Improves drivability-cold
(2) Choke opener	CO	Improves drivability-cold
(3) Choke breaker	CB	Improves drivability-cold
(4) Auxiliary acceleration pump	AAP	Improves drivability-cold
(5) High altitude compensation	HAC	Improves drivability
(6) Secondary air bleed	–	Improves drivability

S 1RZ–E:, 2RZ–FE:, 3RZ–FE:

The emission control systems are installed to reduce the amount of CO, HC and NOx exhausted from the engine ((3), (4) and (5)), to prevent the atmospheric release of blow–by gas–containing HC (1) and evaporated fuel containing HC being released from the fuel tank (2).

The function of each system is shown in these table.

System	Abbreviation	Function
(1) Positive Crankcase Ventilation	PCV	Reduces blow–by gas (HC)
(2) Evaporative Emission Control	EVAP	Reduces evaporated HC
(3) Exhaust Gas Recirculation	EGR	Reduces NOx *2
(4) Three–Way Catalytic Converter	TWC	Reduces CO, HC and NOx *2
(5) Electronic fuel injection *1	EFI	Injects a precisely timing, optimum amount of fuel for reduce exhaust emissions.

Remark: *1 For inspection and repair of the EFI system, refer to the EFI section this manual.
Remark: *2 2RZ–FE only.

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

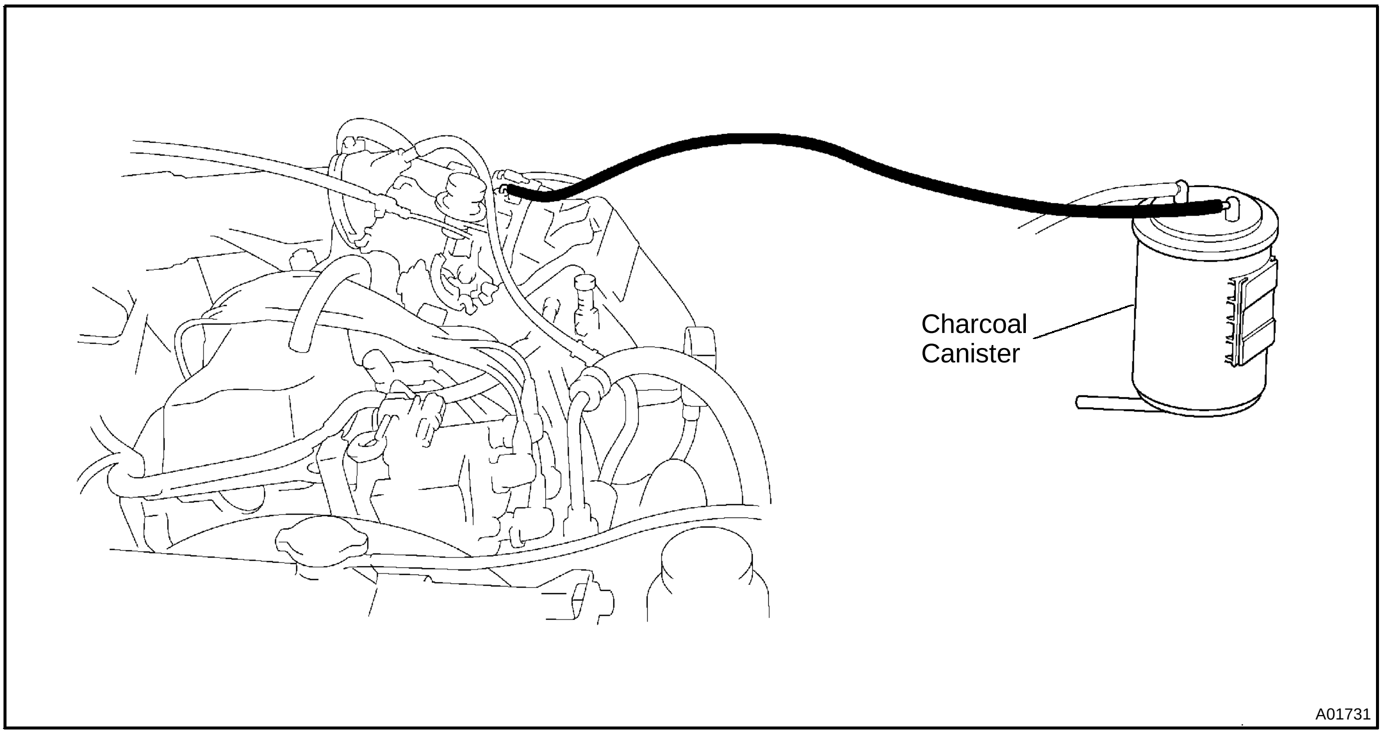
3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

PARTS LAYOUT AND SCHEMATIC DRAWING

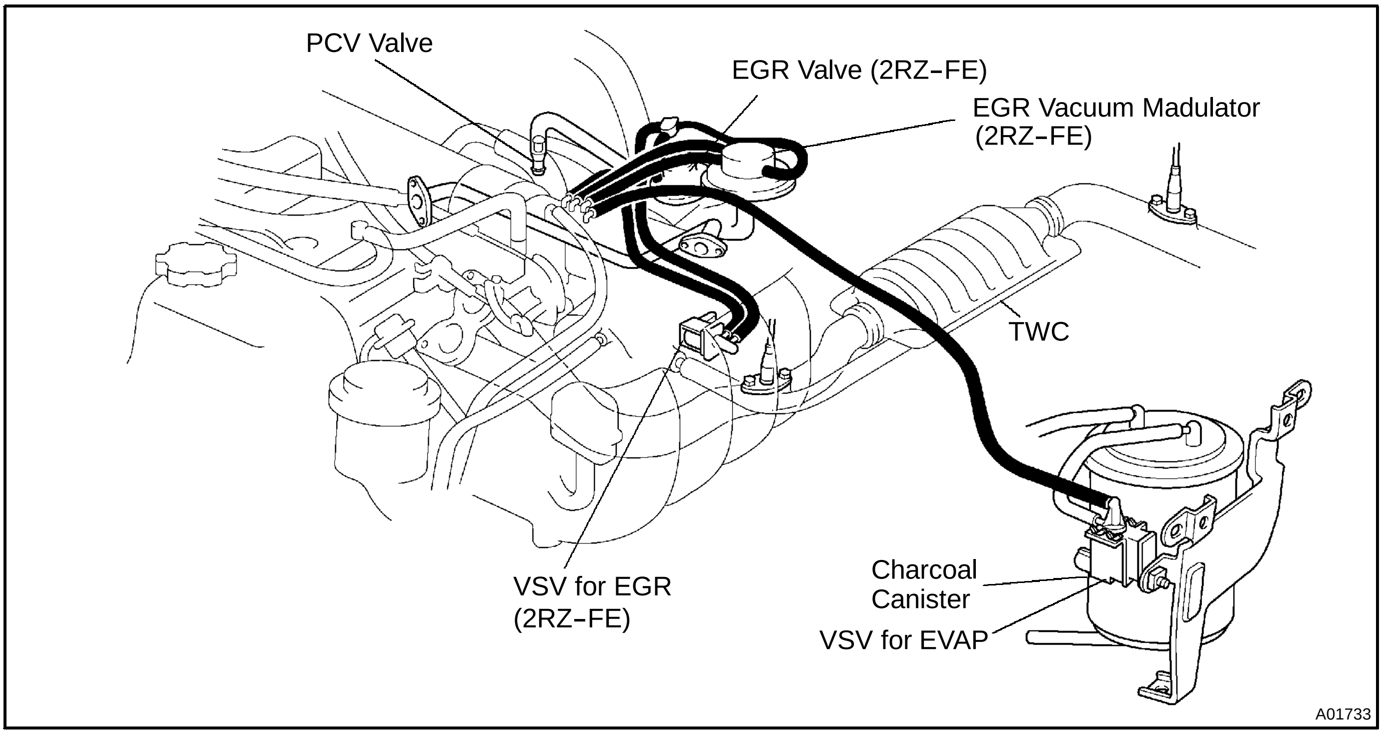
EC03L-01

LOCATION

1. 1RZ-FE:



2. 2RZ-FE:, 3RZ-FE:

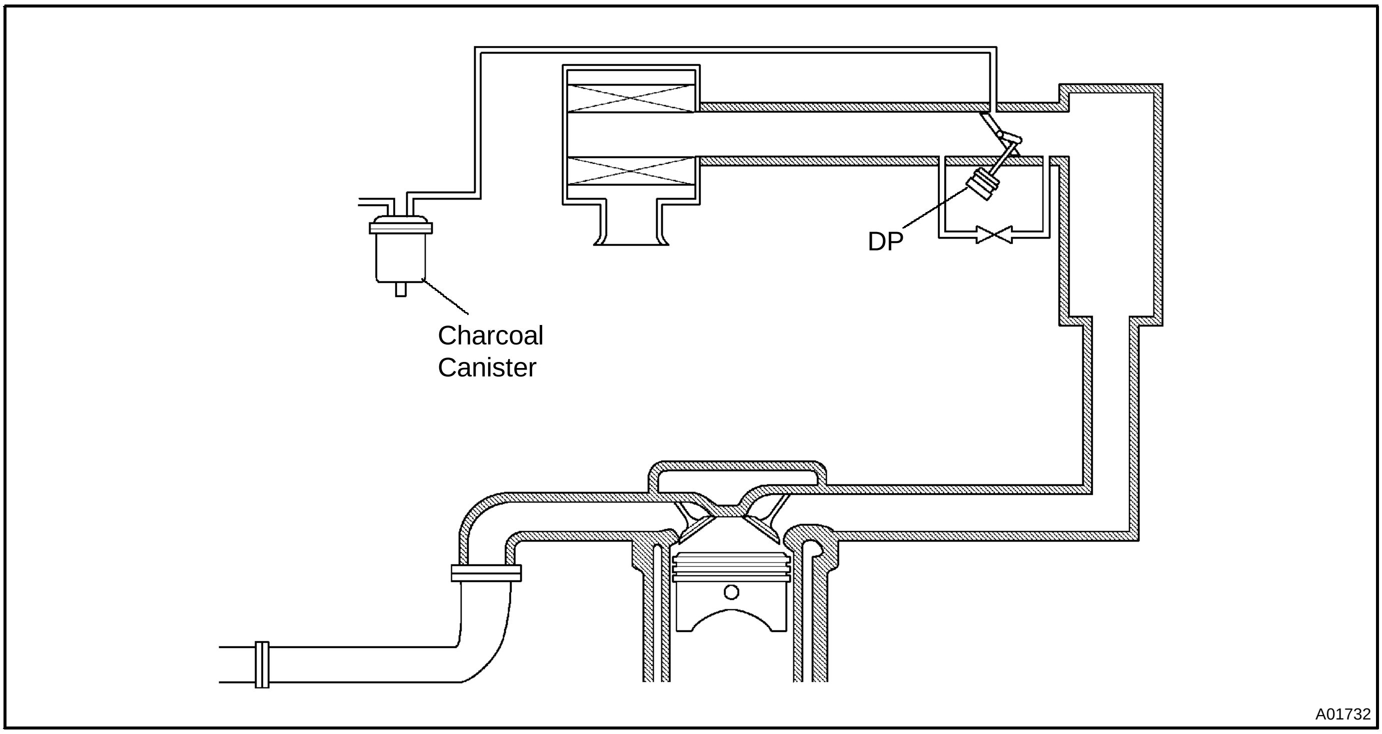


CONTINUED

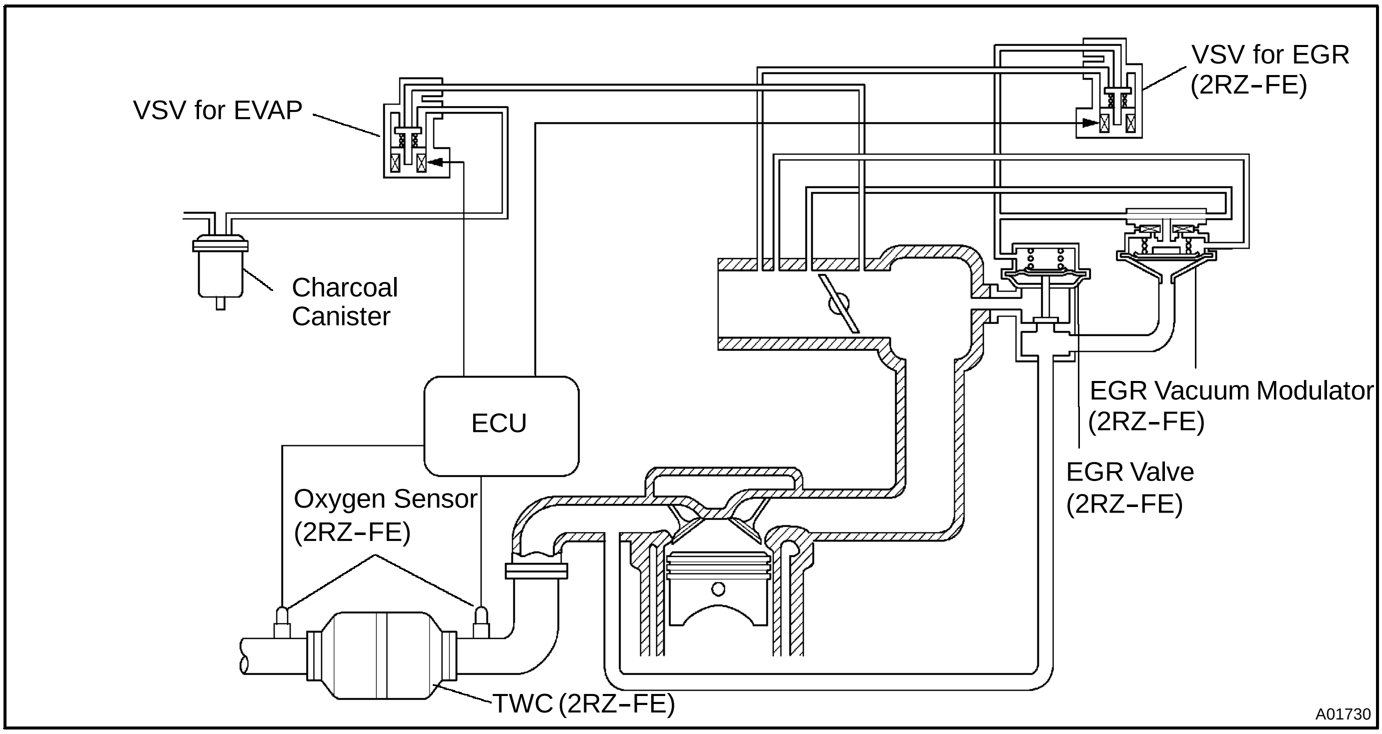
EC03M-01

DRAWING

1. 1RZ-E:



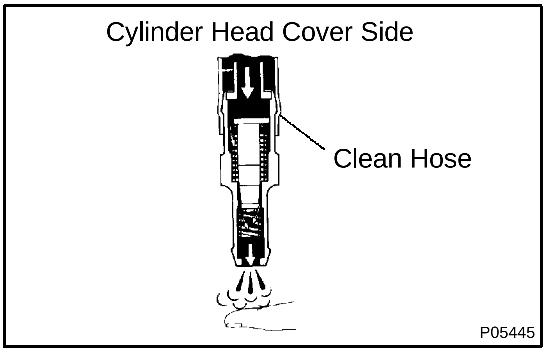
2. 2RZ-FE:, 3RZ-FE:



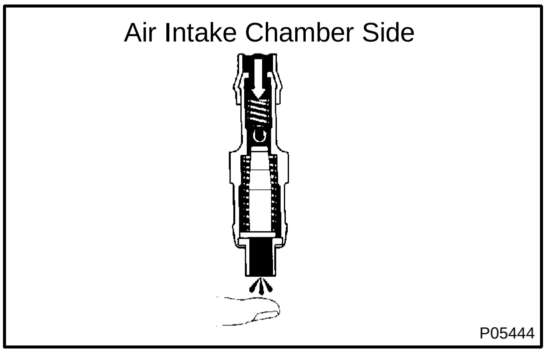
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

EC03N-01

INSPECTION



P05445



P05444

1. REMOVE PCV VALVE

2. INSTALL CLEAN HOSE TO PCV VALVE

3. INSPECT PCV VALVE OPERATION

(a) Blow air into the cylinder head cover side, and check that air passes through easily.

CAUTION:

Do not suck air through the valve.

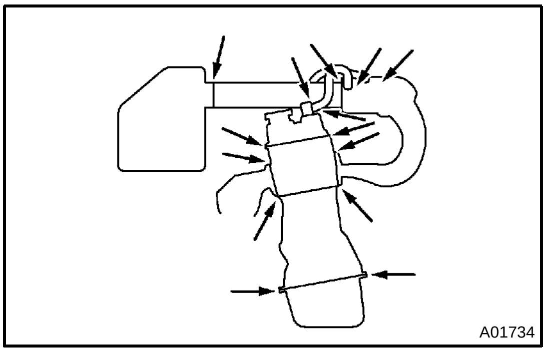
Petroleum substances inside the valve are harmful.

(b) Blow air into the air intake chamber side, and check that air passes through with difficulty.

If operation is not as specified, replace the PCV valve.

4. REMOVE CLEAN HOSE FROM PCV VALVE

5. REINSTALL PCV VALVE



A01734

6. VISUALLY INSPECT HOSES AND CONNECTIONS

Check for cracks, leaks or damage.

CLICK HERE TO VIEW CHAPTER INDEX

EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

EC03O-01

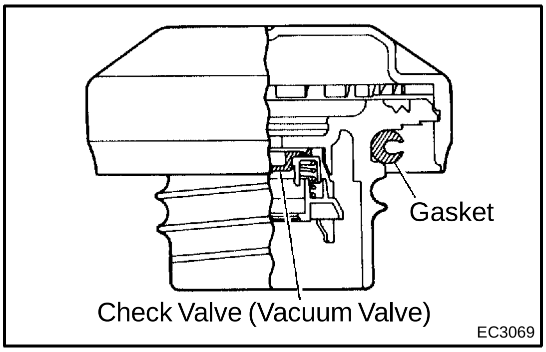
INSPECTION

1. VISUALLY INSPECT LINES AND CONNECTIONS

Look for loosen connections, sharp bends or damage.

2. VISUALLY INSPECT FUEL TANK

Look for deformation, cracks or fuel leakage.



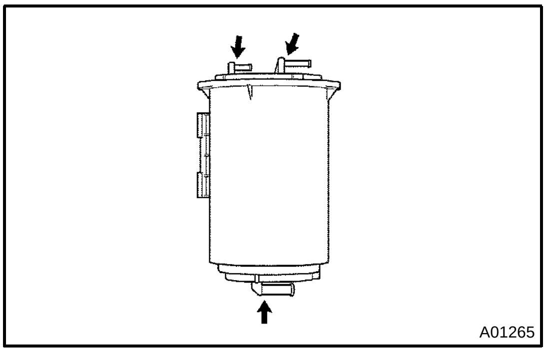
EC3069

3. VISUALLY INSPECT FUEL TANK CAP

Check if the cap and/or gasket are deformed or damaged.
If necessary, repair or replace the cap.

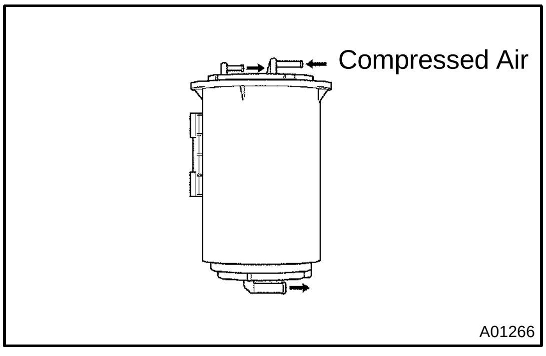
**4. 1RZ–FE:, 2RZ–FE:, 3RZ–FE:
REMOVE CHARCOAL CANISTER**

**5. 2RZ–FE:, 3RZ–FE:
REMOVE VSV**


A01265

6. VISUALLY INSPECT CHARCOAL CANISTER

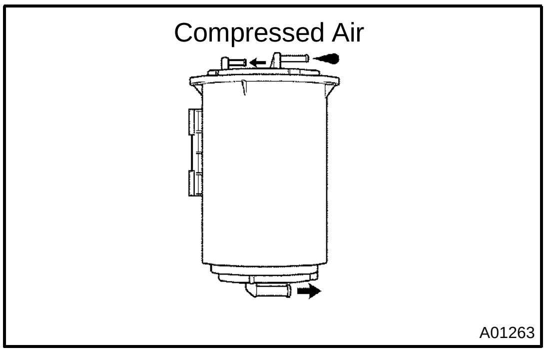
Look for cracks or damage.



A01266

7. CHECK FOR CLOGGED FILTER, AND STUCK CHECK VALVE AND DIAPHRAGM

(a) Using low pressure compressed air (6.66 kPa, 68 gf/cm^2, 0.97 psi), blow into tank pipe and check that air flows without resistance from the other pipes.



A01263

(b) Blow air (6.66 kPa, 68 gf/cm^2, 0.97 psi) into purge pipe and check that air does not flow from the tank pipe and air flows without resistance from the other pipe.

If a problem is found, replace the charcoal canister.

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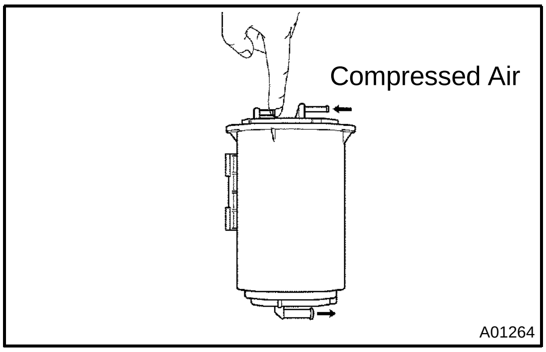


8. CLEAN FILTER CANISTER

(a) Clean the filter by blowing (294 kPa, 3 kgf/cm^2, 43 psi) of compressed air into tank pipe while holding purge pipe closed.

NOTICE:

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

9. 2RZ–FE, 3RZ–FE:
REINSTALL VSV

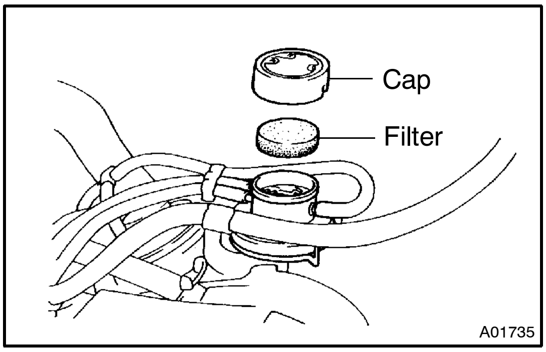
10. 1RZ–E, 2RZ–FE, 3RZ–FE:
REINSTALL CHARCOAL CANISTER

CLICK HERE TO VIEW CHAPTER INDEX
3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

EXHAUST GAS RECIRCULATION (EGR) SYSTEM (2RZ-FE)

EC03P-01

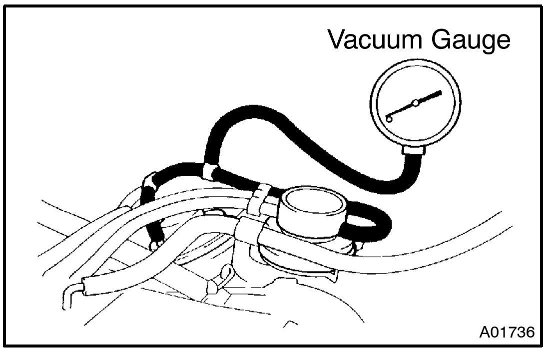
INSPECTION



1. INSPECT AND CLEAN FILTER IN EGR VACUUM MODULATOR

(a) Remove the cap and filter.
(b) Check the filter for contamination or damage.
(c) Using compressed air, clean the filter.
(d) Reinstall the filter and cap.

HINT:
Install the filter with the coarser surface facing the atmospheric side (outward).

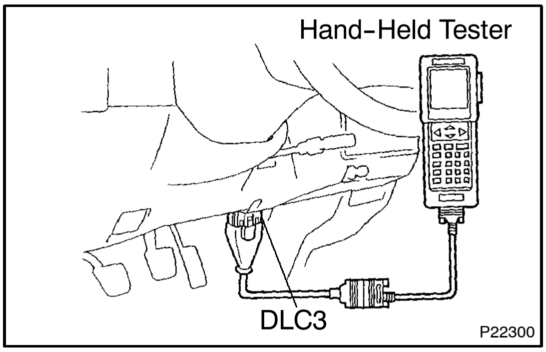


2. INSTALL VACUUM GAUGE

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

3. INSPECT SEATING OF EGR VALVE

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



4. CONNECT HAND-HELD TESTER.

(a) Connect the hand-held tester to the DLC3.
(b) Please refer to the hand-held tester operators manual for further details.

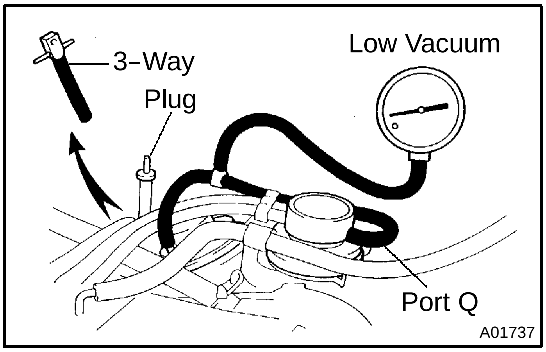
5. INSPECT VSV OPERATION WITH COLD ENGINE

(a) The engine coolant temperature should be below 50˚C (122˚F).
(b) Check that the vacuum gauge indicates zero at 3,000 rpm.
(c) Check that the EGR pipe is not hot.

6. INSPECT OPERATION OF VSV AND EGR VACUUM MODULATOR

(a) Select the active test mode on the hand-held tester (VSV is closed.).

CONTINUED

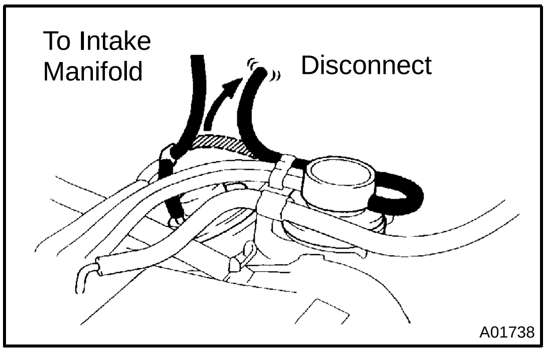


(b) If you have no hand–held tester, check these procedures:
  (1) Remove the 3–way connector with the vacuum hose.
  (2) Connect the vacuum hose (from port Q of EGR vacuum modulator) to the EGR valve.
  (3) Plug the vacuum hose (from VSV for EGR).
(c) Check that the vacuum gauge indicates low vacuum at 3,000 rpm.

7. DISCONNECT HAND–HELD TESTER.

8. REMOVE VACUUM GAUGE

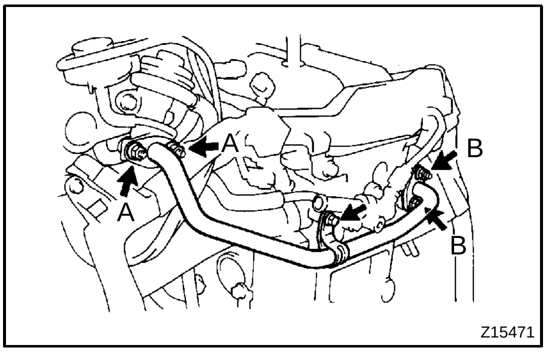
Remove the vacuum gauge, and reconnect the vacuum hoses to the proper locations.



9. INSPECT EGR VALVE

(a) Apply vacuum directly to the EGR valve with the engine idling.
(b) Check that the engine runs rough or dies.
(c) Reconnect the vacuum hoses to the proper locations.

IF NO PROBLEM IS FOUND WITH THIS INSPECTION, SYSTEM IS NORMAL; OTHERWISE INSPECT EACH PART



10. REMOVE EGR PIPE

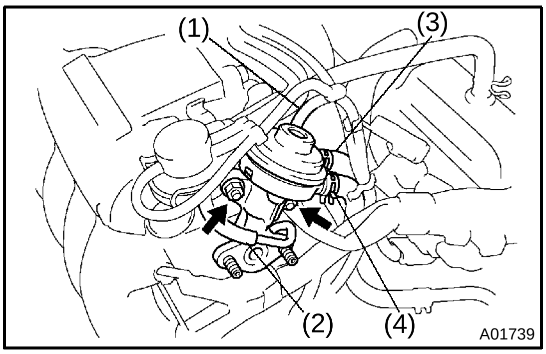
Remove the bolt, 4 nuts, EGR pipe and 2 gaskets.

HINT:

At the time of assembly, please refer to the following items.

Install the EGR pipe with a 2 new gaskets.

Torque:
Bolt: 18 N.m (185 kgf·cm, 13 ft·lbf)
Nut A: 19 N.m (195 kgf·cm, 14 ft·lbf)
Nut B: 20 N.m (200 kgf·cm, 15 ft·lbf)



11. REMOVE EGR VALVE

(a) Disconnect these hoses:
  (1) Vacuum hose
  (2) EGR hose
  (3) Water bypass hose (from ISC valve)
  (4) Water bypass hose (from water bypass pipe)
(b) Remove the 2 nuts, EGR valve and gasket.

Torque: 19 N.m (195 kgf·cm, 14 ft·lbf)

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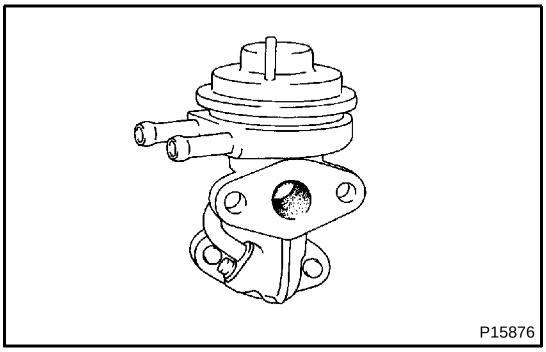
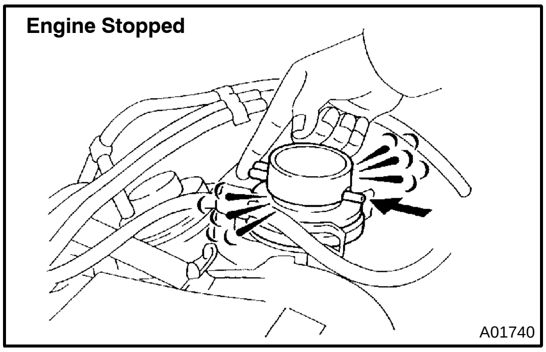


12. INSPECT EGR VALVE

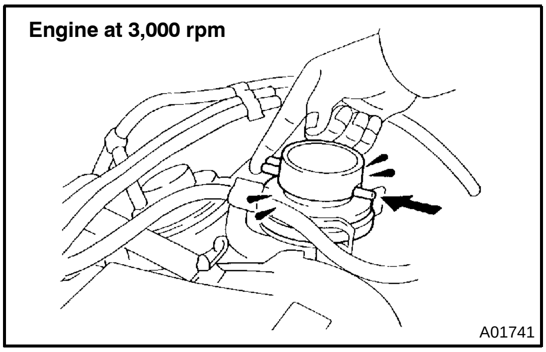
Check for sticking and heavy carbon deposits.
If a problem is found, replace the EGR valve.



13. DISCONNECT VACUUM HOSES FROM EGR VACUUM MODULATOR

14. INSPECT EGR VACUUM MODULATOR OPERATION

(a) Block ports P and R with your finger.
(b) Blow air into port Q, and check that the air passes through to the air filter side freely.



(c) Start the engine, and maintain speed at 3,000 rpm.
(d) Repeat the above test. Check that there is a strong resistance to air flow.

If operation is not as specified, replace the EGR vacuum modulator.

15. RECONNECT VACUUM HOSES TO EGR VACUUM MODULATOR

THREE-WAY CATALYTIC CONVERTER (TWC) SYSTEM(2RZ-FE)

EC03Q-01

INSPECTION

1. CHECK TWC FOR DENTS OR DAMAGE

If any part of the protector is damaged or dented to the extent that it touches the three-way catalytic converter, repair or replace it.

2. CHECK EXHAUST PIPE CONNECTIONS FOR LOOSENESS OR DAMAGE

3. CHECK EXHAUST PIPE CLAMPS FOR WEAKNESS, CRACKS OR DAMAGE

4. CHECK HEAT INSULATOR FOR DAMAGE

5. CHECK FOR ADEQUATE CLEARANCE BETWEEN TWC AND HEAT INSULATOR

EC03R-01

REPLACEMENT

1. REMOVE CONVERTER

(a) Jack up the vehicle.
(b) Check that the converter is cool.
(c) Remove the oxygen sensor.
(d) Remove the bolts and nuts at the front pipe.
(e) Remove the converter and gasket.

2. REINSTALL CONVERTER

(a) Place new gaskets on the front pipe.
Torque: 48 N·m (490 kgf·cm, 35 ft·lbf)
(b) Install oxygen sensor.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

ELECTRONIC FUEL INJECTION

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
1RZ, 2RZ, 2RZ–E Engine Repair Manual	RM167E
2RZ, 2RZ–E Engine Repair Manual	RM558E
3RZ–F, 3RZ–FE Engine Repair Manual	RM521E
1RZ–E Engine Repair Manual Suplement	RM467E

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

CLICK HERE TO VIEW CHAPTER INDEX

EFI SYSTEM

FI00P-01

PRECAUTION

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

HINT:

Any diagnostic trouble code retained by the ECU will be erased when the battery negative (–) terminal cable is removed from the battery.

Therefore, if necessary, read the diagnostic trouble code(s) before removing the negative (–) terminal cable from the battery.

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

3. KEEP GASOLINE AWAY FROM RUBBER OR LEATHER PARTS

4. MAINTENANCE PRECAUTIONS

(a) Precaution when the connecting gauge.

(1) 2RZ–FE:, 3RE–FE:
Use battery as the power source for the timing light, etc.

(2) 1RZ–E:
Use battery as the power source for the timing light, tachometer, etc.

(3) 1RZ–E:
Connect the tester probe of a tachometer to the terminal IG ⊖ of the check connector.

(b) In the event of engine misfire, these precautions should be taken.

(1) Check proper connection of battery terminals, etc.

(2) Handle high–tension cords carefully.

(3) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.

(4) When cleaning the engine compartment, be especially careful to protect the electrical system from water.

(c) Precautions when the handling heated oxygen sensors.

(1) Do not allow oxygen sensor to drop or hit against an object.

(2) Do not allow the sensor to come into contact with water.

2RZ–FE:, 3RZ–FE:

If Vehicle is Equipped with Mobile Radio System (ham, cb, etc.)

2RZ–FE:, 3RZ–FE:

If the vehicle is equipped with a mobile communication system, refer to the precaution in the IN section.

5. AIR INDUCTION SYSTEM

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

CONTINUED

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

(c) Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch to OFF or disconnecting the negative (–) terminal cable from the battery.

HINT:
Always check the diagnostic trouble code before disconnecting the battery terminal cable.

(d) When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (–) cable terminals.

(e) Do not permit parts to receive a severe impact during removal or installation. Handle all EFI parts carefully, especially the ECU.

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

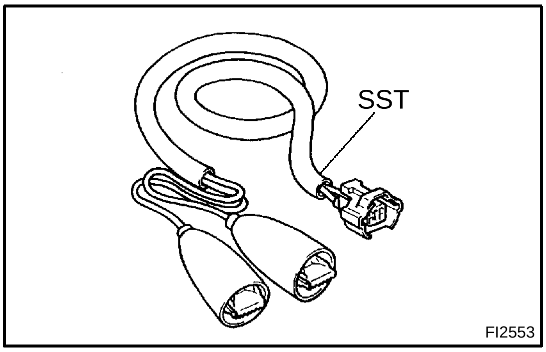
(g) Do not open the ECU cover.

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

(i) Parts should be replaced as an assembly.

(j) Care is required when pulling out and inserting wiring connectors.
  (1) Release the lock and pull out the connector, pulling on the connectors.
  (2) Fully insert the connector and check that it is locked.

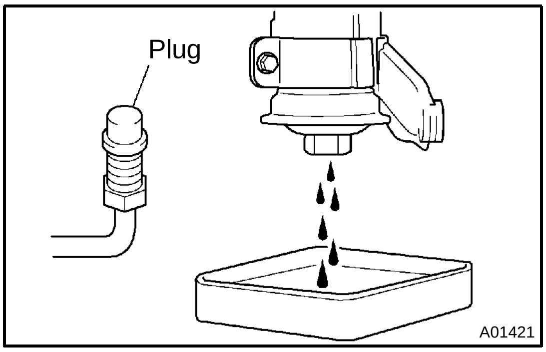
(k) When inspecting a connector with a volt/ohmmeter.
  (1) Carefully take out the water–proofing rubber if it is a water–proof type connector.
  (2) Insert the test probe into the connector from wiring side when checking the continuity, amperage or voltage.
  (3) Do not apply unnecessary force to the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



(l) Use SST for inspection or test of the injector or its wiring connector.
SST 09842–30070

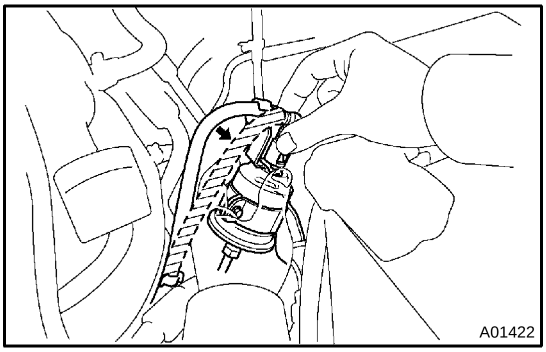
CONTINUED

6. FUEL SYSTEM

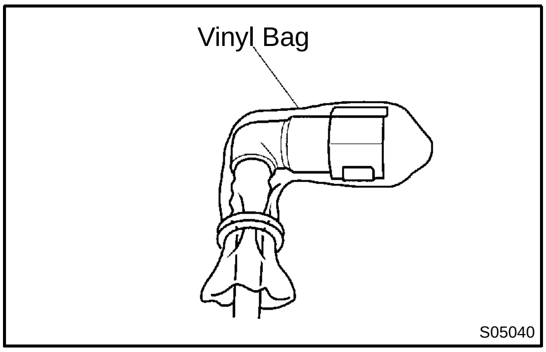


(a) When disconnecting the high pressure fuel line, a large amount of gasoline will spill out, so observe these procedures:

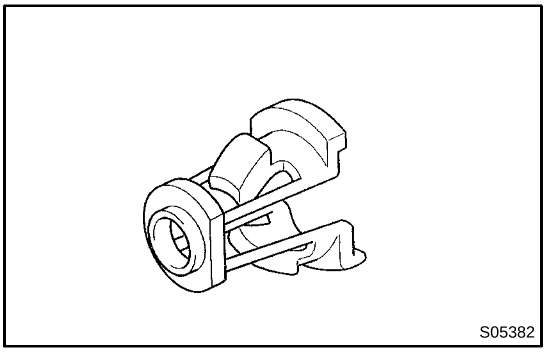
(1) Put a container under the connector.
(2) Slowly loosen the connection.
(3) Disconnect the connection.
(4) Plug the connection with a rubber plug.



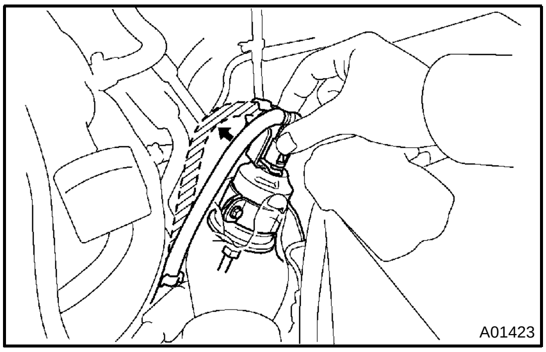
(5) When the connector and the pipe are stuck, pinch the retainer between the hands, push and pull the connector to free to disconnect and pull it out. Do not use any tool at this time.
(6) Inspect if these is any dirt or the likes on the seal surface of the disconnected pipe and clean it away.



(7) Prevent the disconnected pipe and connector from damagiing and mixing foreing objects by covering them with a vinyl bag.



(8) Do not reuse the retainer removed from the pipe.
(9) Must use hands without using tools when to remove the retainer from the pipe.
(10) Check if these is any damage or foreing objects on the connected part of the pipe.



(11) Match the axis of the connector with axis of the pipe, and push in the connector until retainer markes a "click" sounnd. In case that the connections is tight, apply little amount of new engine oil on the tip of the pipe.
(12) After having finished the connection, check if the pipe and the connector are securely connected by pulling them.
(13) Check if these is any fuel leakage.

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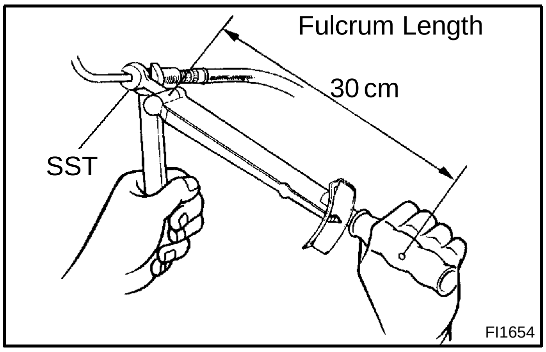


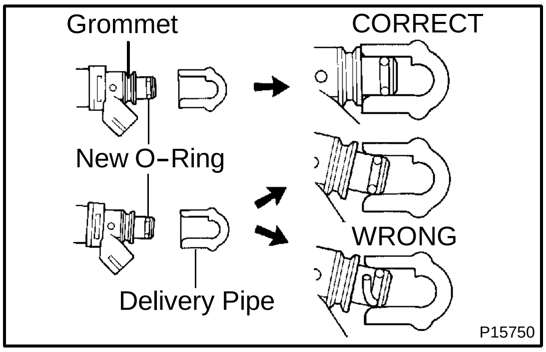
(14) (Flare Nut Type)
Apply a light coat of engine oil to the flare and tighten the flare nut by hand.

(15) (Flare Nut Type)
Using SST, tighten the flare nut to the specified torque.

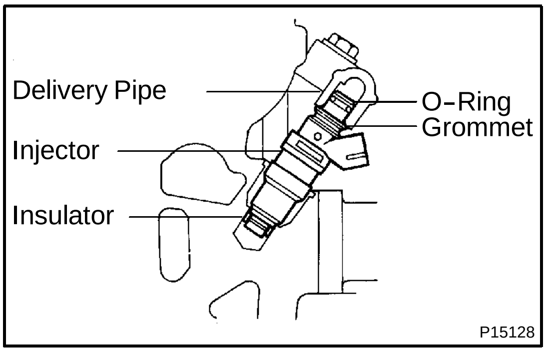
SST 09631–22020

Torque: 28 N·m (285 kgf·cm, 21 ft·lbf)

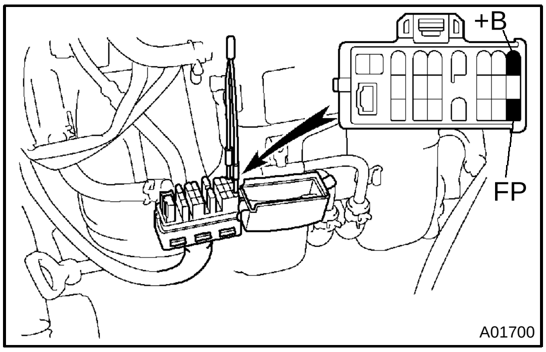
HINT:
Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).



(b) Observe these precautions when removing and installing the injectors.
(1) Never reuse the O–ring.
(2) When placing a new O–ring on the injector, take care not to damage it in any way.
(3) Coat a new O–ring with spindle oil or gasoline before installing–never use engine, gear or brake oil.

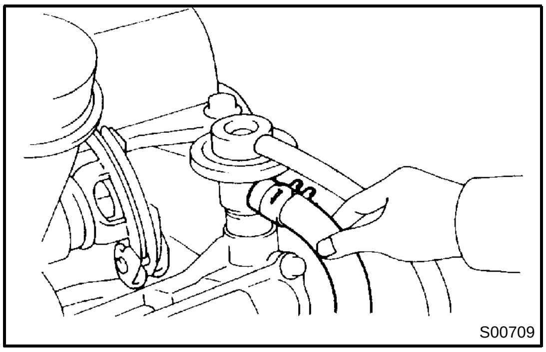


(c) Install the injector to the delivery pipe and cylinder head as shown in the illustration.



(d) 1RZ–E:
Check that these are no fuel leaks after performing maintenance any where on the fuel system.
(1) Using SST, connect terminals +B and FP the check connector.
SST 09843–18020
(2) Turn the ignition switch ON.

NOTICE:
Do not start the engine.

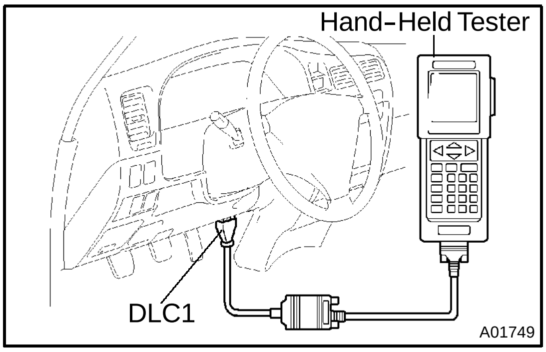


(3) Pinch the fuel return hose.
The pressure in the high pressure line will rise to approx. 400 kPa (4 kgf/cm^2, 57 psi). In this start, check to see that these are no leaks from any part of the fuel system.

NOTICE:
Away pinch the hose. Avoid bending as it may cause the hose to crack.

SST 09843–18020

CONTINUED

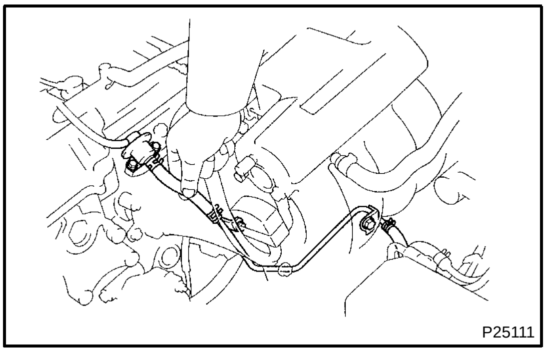


(e) 2RZ–FE:, 3RZ–FE:
Check that there are no fuel leaks after doing maintenance anywhere on the fuel system.

(1) Connect the hand–held tester to the DLC3.
(2) Turn ignition switch ON and hand–held tester main switch ON.

NOTICE:
Do not start the engine

(3) Select the active test mode on the hand–held tester.
(4) Please refer to the hand–held tester operator's manual for further details.



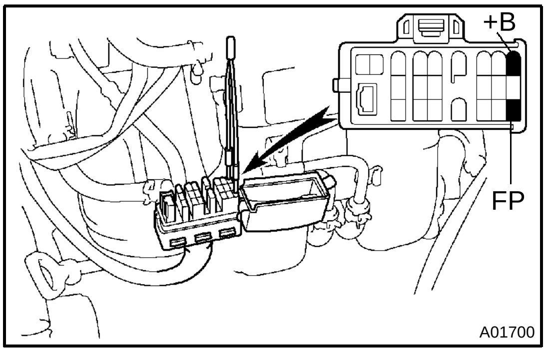
(5) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector.
(See page FI–6)
(6) Pinch the fuel return hose. The pressure in high pressure line will rise to approx. 400 kPa (4 kgf/cm^2, 57 psi). In this state, check to see that there are no leaks from any part of the fuel system.

NOTICE:
Always pinch the hose. Avoid bending as it may cause to hose to crack.

(7) Turn the ignition switch to LOCK.
(8) Disconnect the hand–held tester from the DLC3.

FUEL PUMP
ON-VEHICLE INSPECTION

FI00Q-01



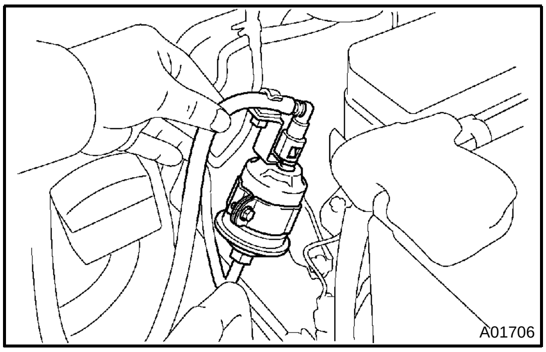
1. 1RZ-E:
CHECK FUEL PUMP OPERATION

(a) Using SST, connect terminals +B and FP of the check connector.
SST 09843-18020

(b) Turn the ignition switch ON.

NOTICE:

Do not start the engine.



(c) Check that these is pressure in the hose from the fuel filter.

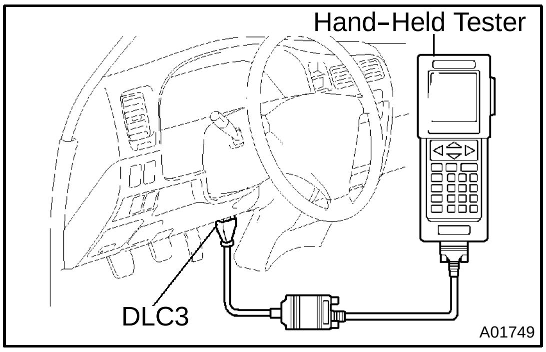
HINT:

If these is fuel pressure, you will hear the sound of fuel flowing.
If these is no pressure, check the following parts:

- H-fuse
- Fuses
- EFI main relay
- Circuit opening relay
- Fuel pump
- Fuel pump wiring connections

(d) Turn the ignition switch OFF.

(e) Remove the SST from the check connector.
SST 09843-18020



2. 2RZ-FE:, 3RZ-FE:
CHECK FUEL PUMP OPERATION

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

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

NOTICE:

Do not start the engine.

(c) Select the active test mode on the hand-held tester.

(d) Please refer to the hand-held tester operator's manual for further details.

(e) If you have no hand-held tester, connect the positive (+) and negative (-) leads from the battery to the fuel pump connector. (See page FI-6)

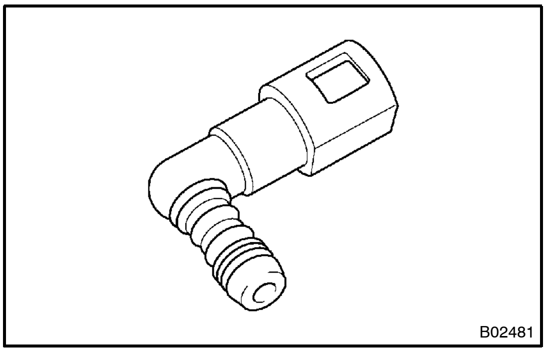
CONTINUED

(f) Check that there is pressure in the inlet hose from the fuel filter.

HINT:
At this time, you will hear fuel return noise.
If there is no pressure, check these parts:

- H-fuse
- Fuses
- EFI main relay
- Circuit opening relay
- Fuel pump
- Fuel pump wiring connections

(g) Turn the ignition switch to OFF.
(h) Remove the hand-held tester.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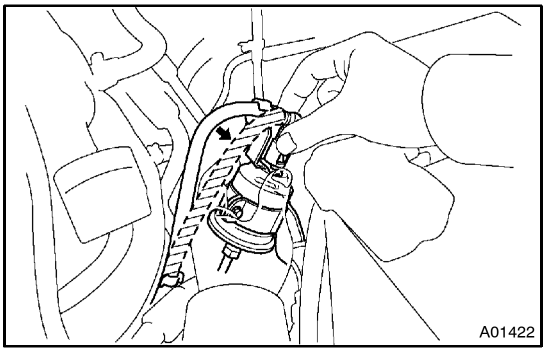

A01422

3. CHECK FUEL PRESSURE

(a) Check the battery positive voltage is above 12 V.
(b) Disconnect the negative (–) terminal cable from the battery.
(c) Purchase the new fuel pipe and take out the fuel tube connector from its pipe.

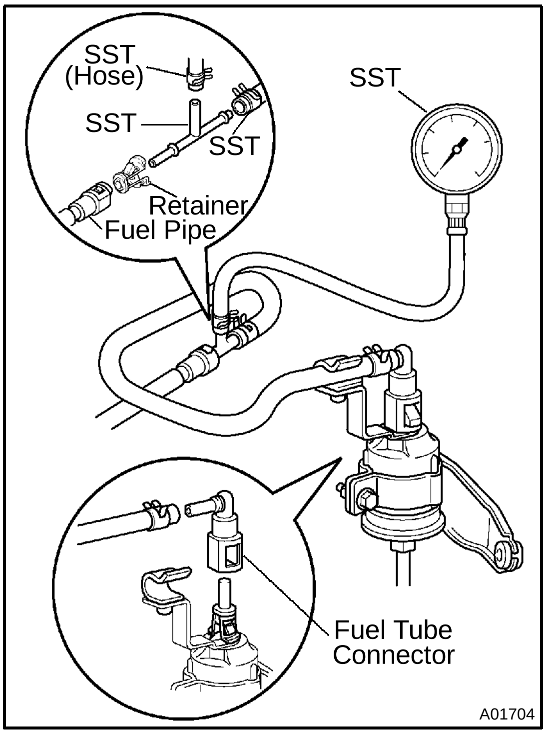
Part No.
1RZ-FE: 23801-75060
2RZ-FE: 23801-75070
3RZ-FE: 23801-75080

(d) Remove the fuel hose from the clamp.
(e) Disconnect the fuel pipe (fuel tube connector) from the fuel filter outlet.

CAUTION:

- **Perform disconnecting operations of the fuel tube connector (quick type) after observing the precautions.**
- **As there is retained pressure in the fuel pipe line, prevent it from splashing inside the engine compartment.**

CONTINUED



(f) Install SST (pressure gauge) as shown in the illustration by using SST and fuel tube connector.
SST 09268–41046, 09268–41**091**, 09268–45012

(g) Wipe off any splattered gasoline.

(h) Reconnect the negative (–) terminal cable to the battery.

(i) 1RZ–E:
Using SST, connect terminals +B and FP of the check connector.
SST 09843–18020

(j) 2RZ–FE:, 3RZ–FE:
Connect the hand–held tester to the DLC3.
(See step 2 check fuel pump operation (a) to (e))

(k) Measure the fuel pressure
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm^2, 38 – 44psi)

If pressure is high, replace the fuel pressure regulator.
If pressure is low, check these parts:
- Fuel hose and connections
- Fuel pump
- Fuel filter
- Fuel pressure regulator

(l) 2RZ–FE:, 3RZ–FE:
Disconnect the hand held tester from the DLC3.

(m) 1RZ–E:
Reconnect the SST from the check connector.
SST 09843–18020

(n) Start the engine.

(o) Measure the fuel pressure at idle.
Fuel pressure:
206 – 255 kPa (2.1 – 2.6 kgf/cm^2, 31 – 37psi)

(p) Stop the engine.

(q) Check that the fuel pressure remains as specified 5 minutes after the engine has stopped.
Fuel pressure:
147 kPa (1.5 kgf/cm^2, 21psi) or more

If pressure is not as specified, check the fuel pump, pressure regulator and/ or injectors.

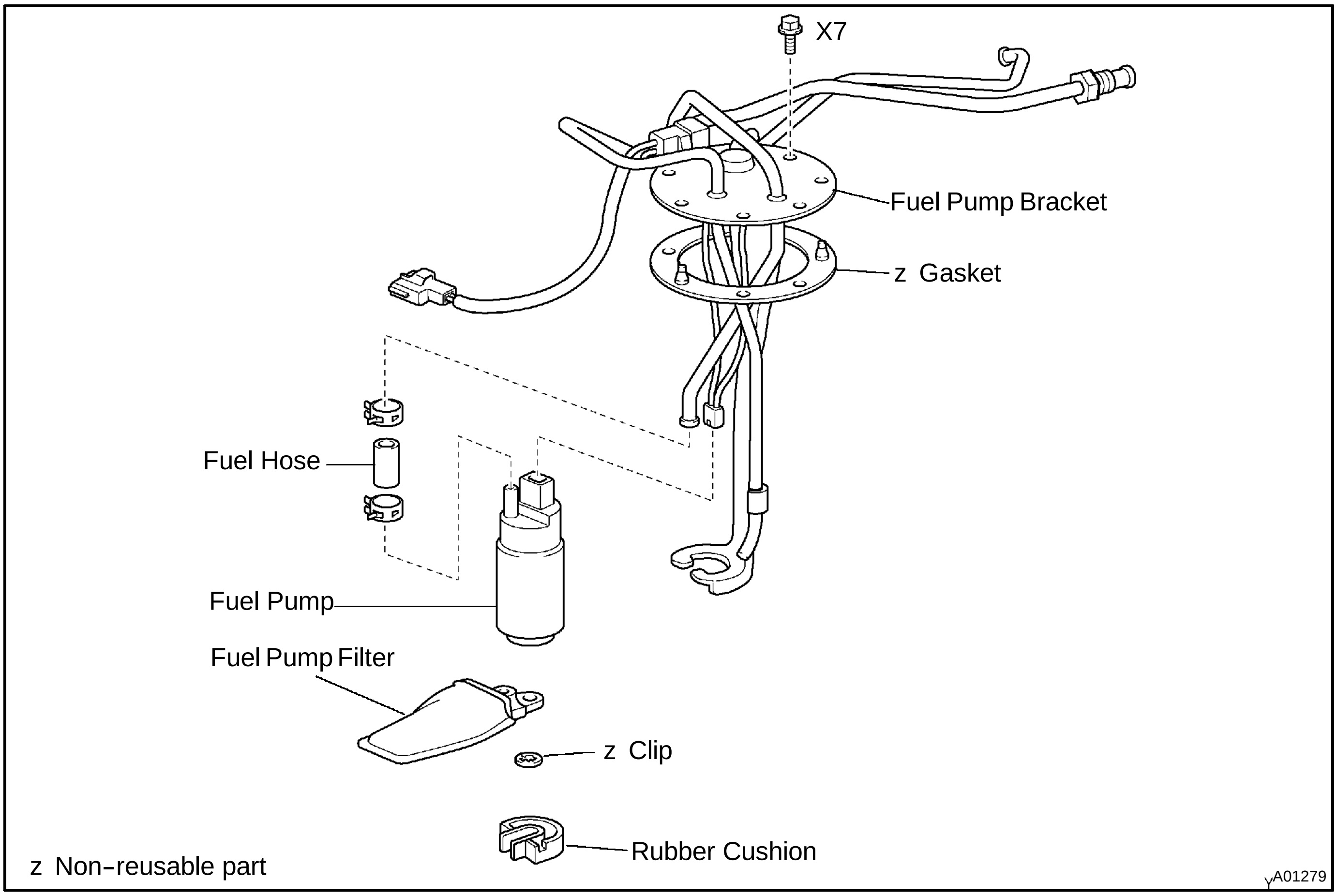
(r) After checking fuel pressure, disconnect the negative (–) terminal cable from the battery and carefully remove the SST and fuel tube connector to prevent gasoline from splashing.
SST 09268–41046, 09268–41**091**, 09268–45012

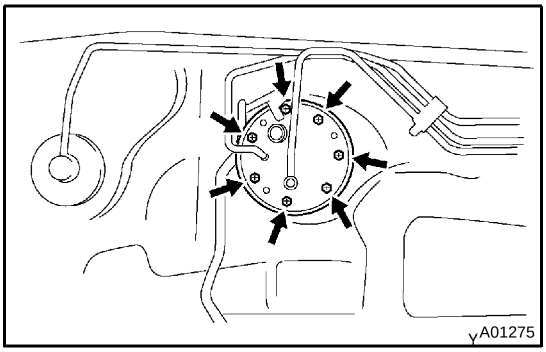
(s) Reconnect the negative (–) terminal cable to the battery.

(t) Check for fuel leaks.

FI00R-01

COMPONENTS





FI00S–01

REMOVAL

CAUTION:

Do not smoke or work near an open flame when working on the fuel pump.

1. REMOVE FUEL TANK
2. REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK

(a) Remove the 7 bolts.

Torque: 4 N·m (35 kgf·cm, 40 in.·lbf)

(b) Pull out the pump bracket assembly.

(c) Remove the gasket from the pump bracket.

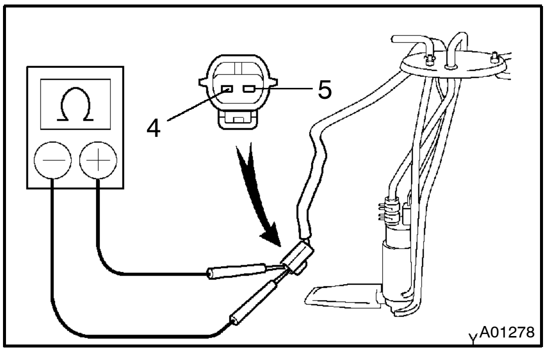
HINT:

At the time of assembly, please refer to the following items.

Install the pump bracket with a new gasket.

FI00T–01

DISASSEMBLY

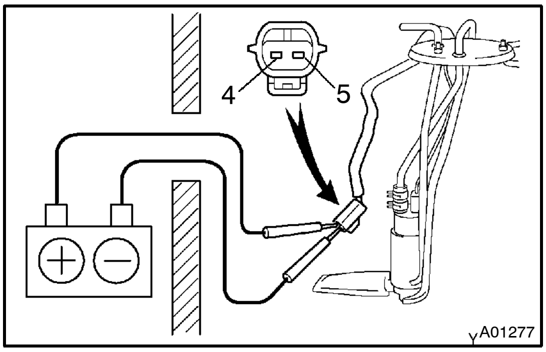


1. INSPECT FUEL PUMP RESISTANCE

Using an ohmmeter, measure the resistance between the terminals 4 and 5.

Resistance: At 20°C (68°F): 0.2 – 3.0 Ω

If the resistance is not as specified, replace the fuel pump and/or lead wire.



2. INSPECT FUEL PUMP OPERATION

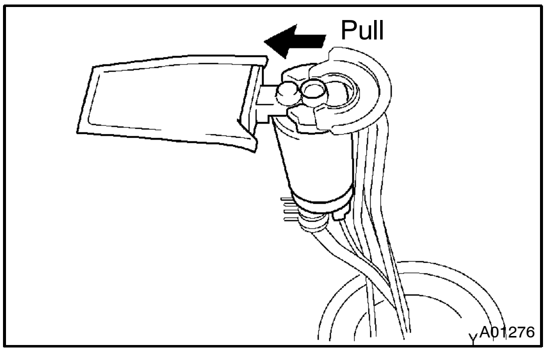
Connect the positive (+) lead from the battery to terminal 4 of the connector, and the negative (–) lead to terminal 5. Check that the fuel pump operates.

NOTICE:

- **These tests must be done quickly (within 10 seconds) to prevent the coil from burning out.**
- **Keep the fuel pump as far away from the battery as possible.**
- **Always do the switching at the battery side.**

If operation is not as specified, replace the fuel pump and/or lead wire.

3. REMOVE FUEL PUMP LEAD WIRE

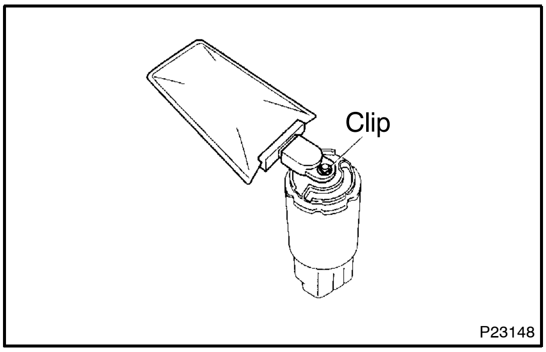


4. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

(a) Pull off the lower side of the fuel pump from the pump bracket.

(b) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.

(c) Remove the rubber cushion from the fuel pump.



5. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

(a) Using a small screwdriver, remove the clip.

(b) Pull out the pump filter.

HINT:

At the time of assembly, please refer to the following items.

Install the pump filter with the new clip.

FI00U–01

REASSEMBLY

Reassembly is in the reverse order of disassembly.

(See page FI–11)

CLICK HERE TO VIEW CHAPTER INDEX

FI00V–01

INSTALLATION

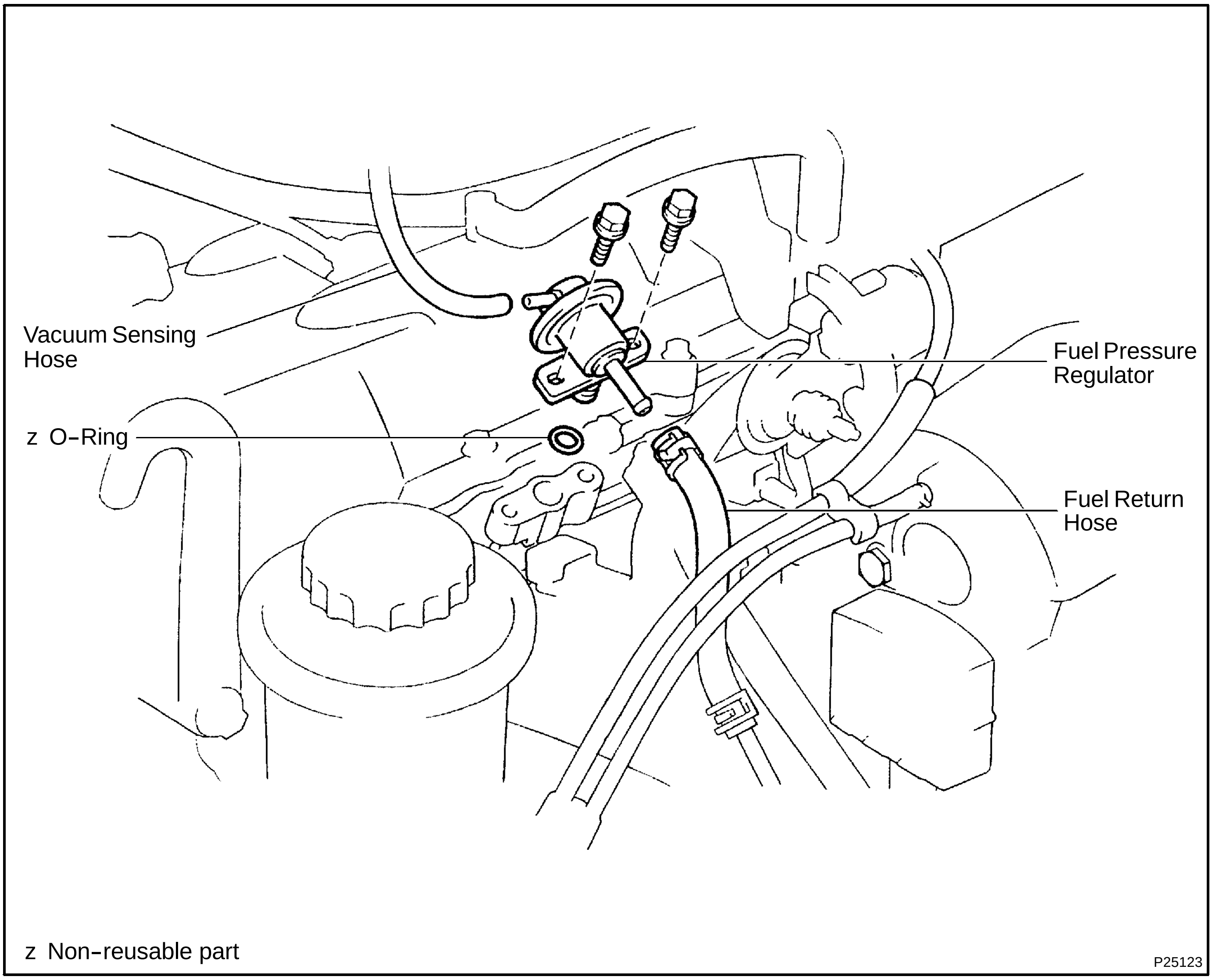
Installation is in the reverse order of removal.

(See page FI–10)

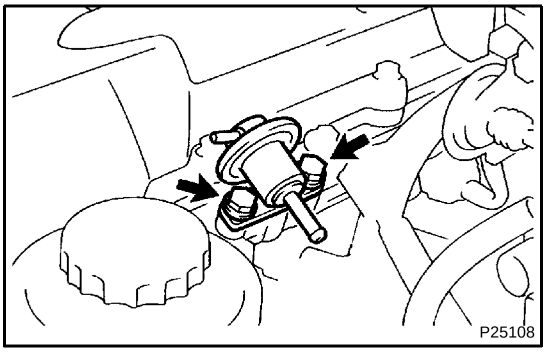
FUEL PRESSURE REGULATOR (2RZ-FE)

COMPONENTS

FI00W-01



FI00X–01


P25108

REMOVAL

1. DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR
2. DISCONNECT FUEL RETURN HOSE FROM FUEL PRESSURE REGULATOR

HINT:
Put a suitable container or shop towel under the pressure regulator.

3. REMOVE FUEL PRESSURE REGULATOR

(a) Remove the 2 bolts and fuel pressure regulator.
Torque: 8.0 N·m (80 kgf·cm, 69 in.·lbf)

(b) Remove the O–ring.

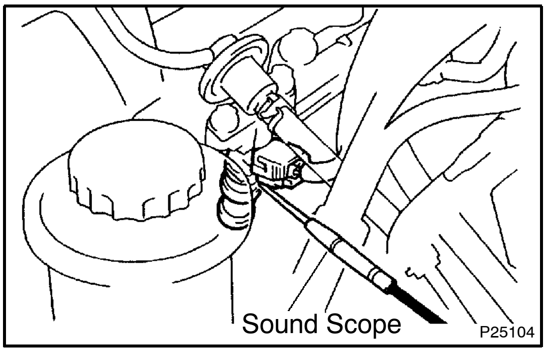
HINT:
At the time of assembly, please refer to the following items.
Install the pressure regulator with the new O–ring.

FI00Y–01

INSTALLATION

Installation is in the reverse order of removal.

(See page FI–25)



INJECTOR (2RZ-FE, 3RZ-FE)

FI00Z-01

ON-VEHICLE INSPECTION

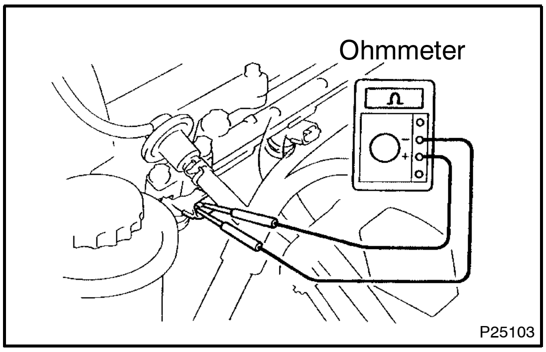
1. INSPECT INJECTOR OPERATION

Check operation sound from each injector.

(a) With the engine running or cranking, use a sound scope to check that there is normal operating noise in proportion to engine speed.

(b) If you have no sound scope, you can check the injector transmission operation with your finger.

If no sound or unusual sound is heard, check the wiring connector, injector or injection signal from the ECM.



2. INSPECT INJECTOR RESISTANCE

(a) Remove the throttle body.

(See page FI-42)

(b) Disconnect the injector connectors.

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

Resistance: At 20°C (68°F): 12 – 16 Ω

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

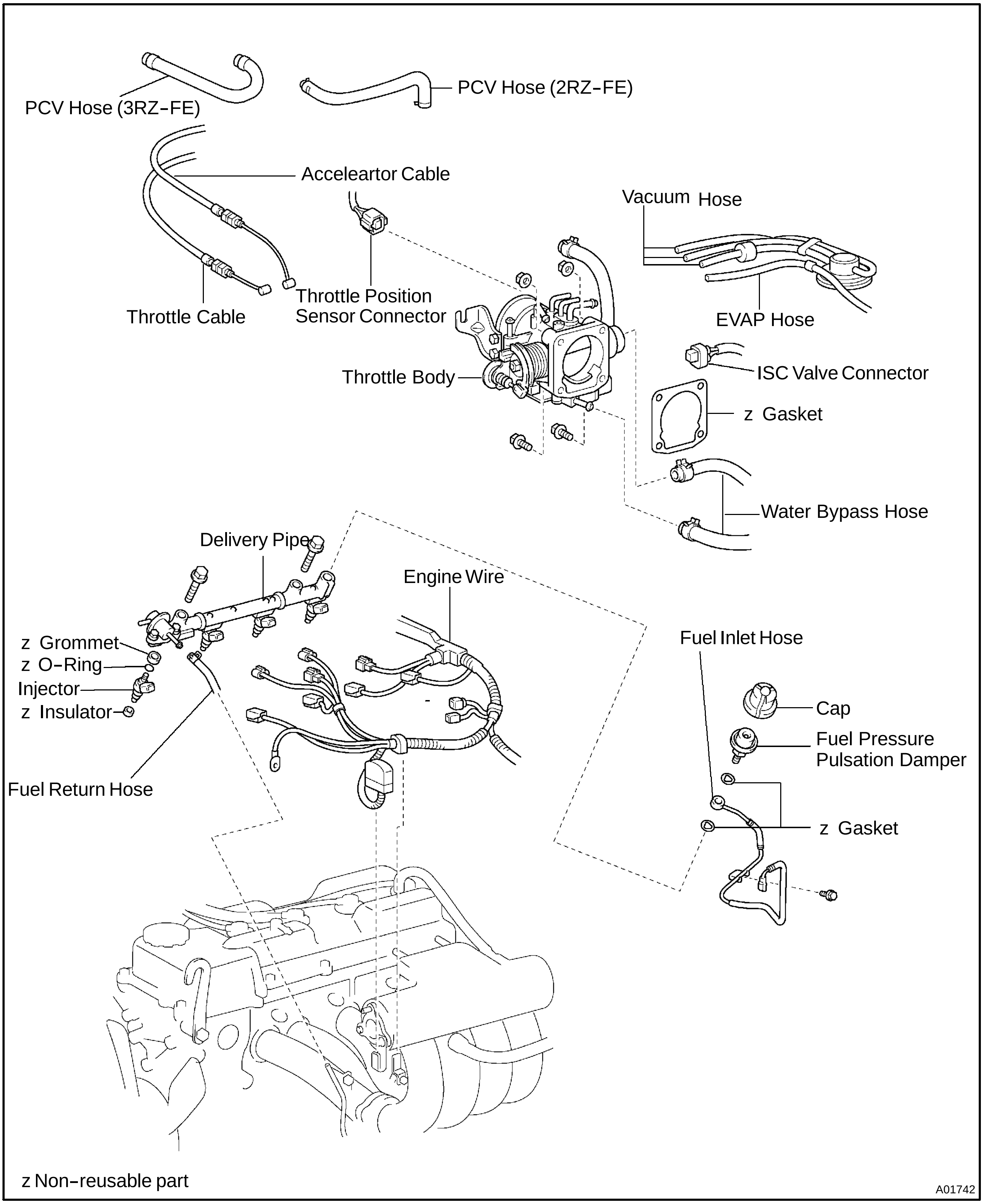
(d) Reconnect the injector connectors.

(e) Install the throttle body.

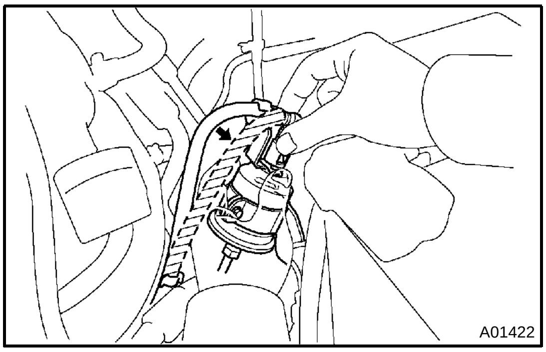
(See page FI-44)

FI010-01

COMPONENTS



FI011-01



REMOVAL

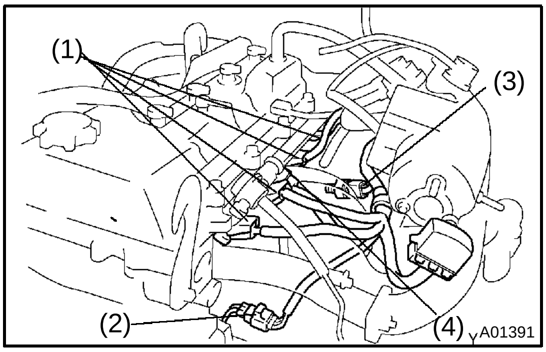
1. DISCONNECT FUEL INLET PIPE

(a) Remove the fuel hose from the clamp.

(b) Disconnect the fuel inlet pipe (fuel tube connector) from the fuel filter.

CAUTION:

- **Perform disconnecting operations of the fuel tube connector (quick type) after observing the precautions.**
- **As there is retained pressure in the fuel pipe line, prevent it from splashing inside the engine compartment.**



2. REMOVE THROTTLE BODY

(See page FI-42)

3. DISCONNECT ENGINE WIRE

(a) Disconnect these connectors:

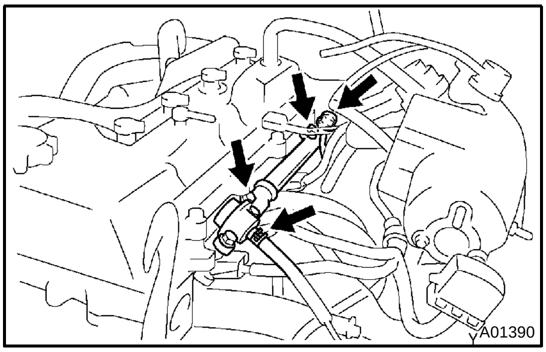
(1) 4 injector connectors

(2) Crankshaft position sensor connector

(3) Knock sensor connector

(4) Camshaft position sensor

(b) Disconnect the DLC1 and wire clamp from the brackets.



4. REMOVE DELIVERY PIPE AND INJECTORS

(a) Disconnect the vacuum sensing hose from the fuel pressure regulator.

(b) Disconnect the fuel return hose from the fuel pressure regulator.

(c) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet pipe from the delivery pipe.

HINT:

- Put a suitable container or shop rag under the delivery pipe.
- Slowly loosen the union bolt.

(d) Remove the 2 bolts and delivery pipe together with the 4 injectors.

NOTICE:

Be careful not to drop the injectors when removing the delivery pipe.

(e) Remove the 4 insulators from the 4 spacers.

(f) Pull out the 4 injectors from the delivery pipe.

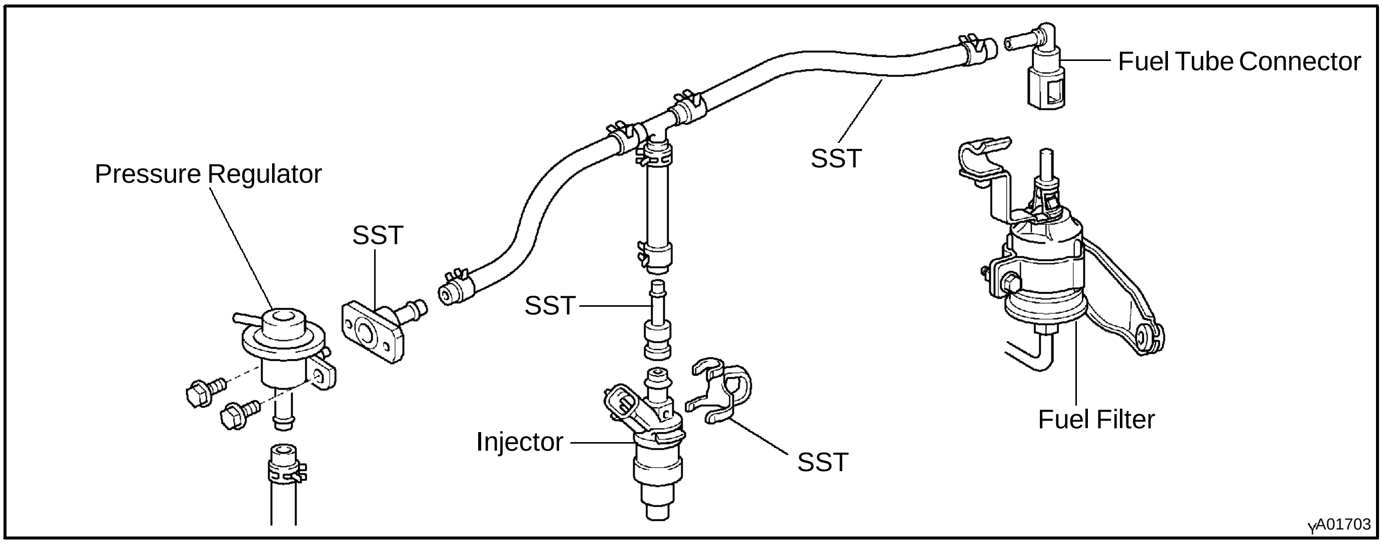
(g) Remove the O–ring and grommet from each injector.

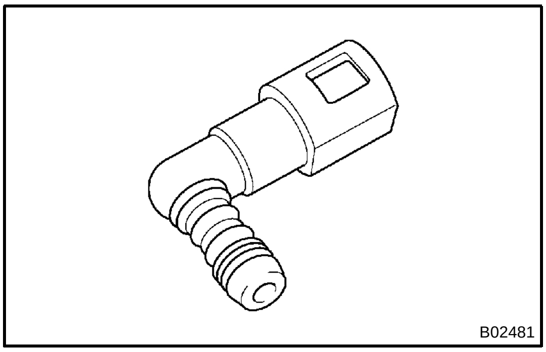
FI012-01

INSPECTION

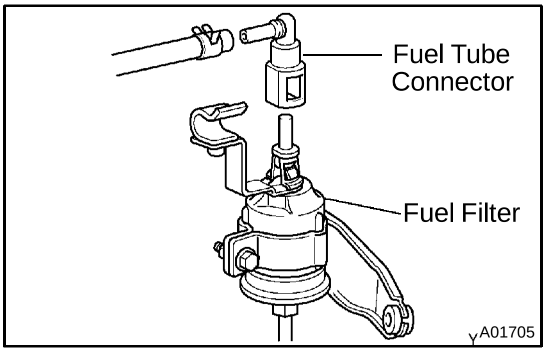
1. INSPECT INJECTOR INJECTION

CAUTION:
Keep injector clean of sparks during the test.





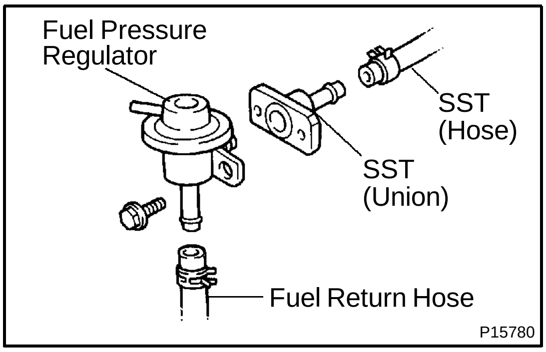
(a) Purchase the new fuel pipe and take out the fuel tube connector from its pipe.
Part No.:
1RZ-FE: 23801 - 75060
2RZ-FE: 23801 - 75070
3RZ-FE: 23801 - 75080



(b) Connect SST (hose) and fuel tube connector to the fuel filter outlet.
SST 09268-41046

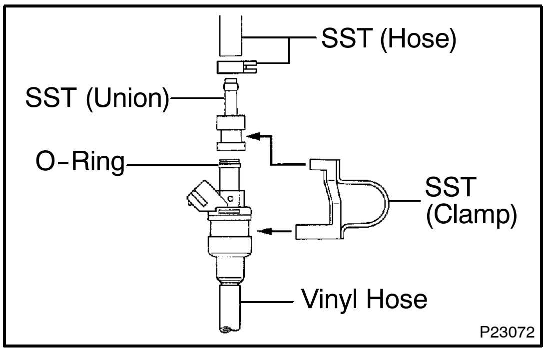
CAUTION:
Perform connecting operations of the fuel tube connector (quick type) after observing the precautions.

HINT:
Use the vehicle's fuel filter.



(c) Remove the fuel pressure regulator from the delivery pipe.
(d) Install the O-ring to the fuel inlet of pressure regulator.
(e) Connect SST (hose) to the fuel inlet of the pressure regulator with SST (union) and the 2 bolts.
SST 09268-41046 (09268-41091)
(f) Connect the fuel return hose to the fuel outlet of the pressure regulator.

CONTINUED



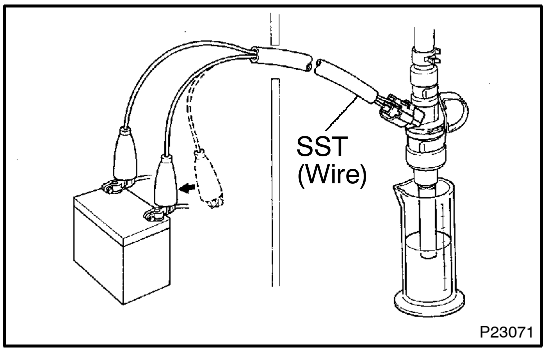
(g) Install the O-ring to the injector.

(h) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268-41046

(i) Put the injector into a graduated cylinder.

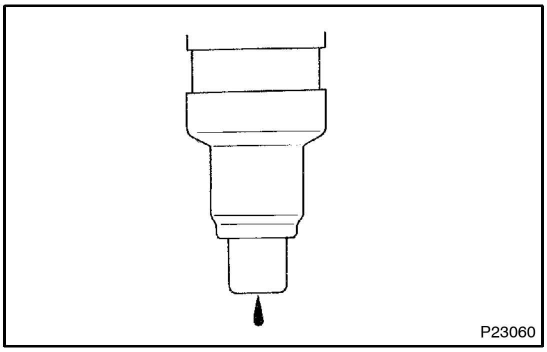
HINT:
Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.

(j) Connect the hand-held tester to the DLC3.
(See page FI-6)



(k) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842-30070
2RZ-FE:
Volume: 64 - 78 cm^3 (4.0 - 4.8 cu in.) per 15 seconds
Difference between each injector:
14 cm^3 (0.3 cu in.) or less
3RZ-FE:
Volume: 72 - 78 cm^3 (4.4 - 5.2 cu in.) per 15 secondsDifference between each injector:
14 cm^3 (0.3 cu in.) or less

If the injection volume is not as specified, replace the injector.



2. INSPECT LEAKAGE

(a) In the condition above, disconnect the test probes of SST (wire) from the battery and check the fuel leakage from the injector.
SST 09842-30070
Fuel drop: 1 drop or less per 3 minutes

(b) Turn the ignition switch to OFF.

(c) Disconnect the negative (-) terminal cable from the battery.

(d) Remove the SST and hand-held tester.
SST 09268-41046

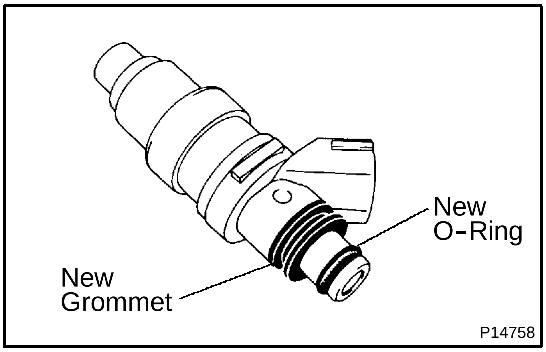
(e) Reinstall the fuel pressure regulator and fuel inlet pipe.

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

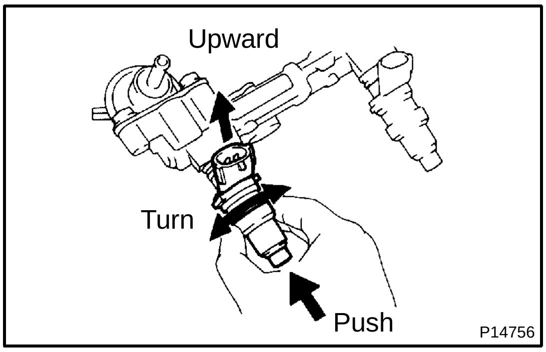
FI013-01

INSTALLATION

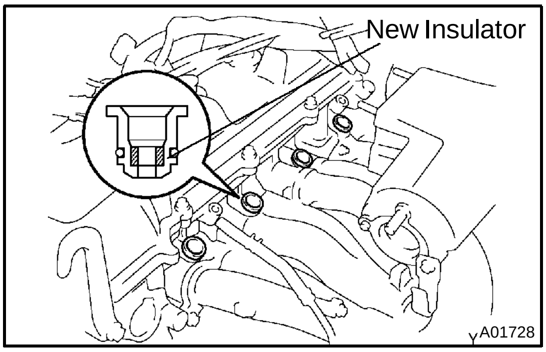


1. INSTALL INJECTORS TO DELIVERY PIPE

(a) Install a new grommet to the injector.
(b) Apply a light coat of gasoline to a new O–ring and install it to the injector.

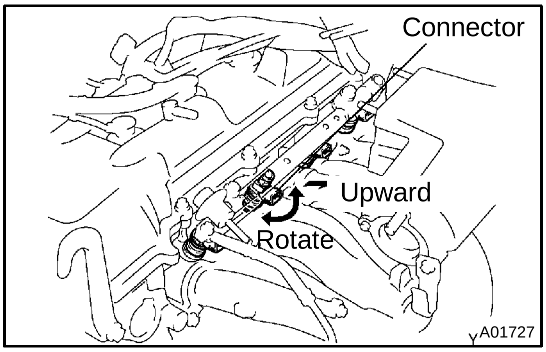


(c) While turning the injector left and right, install it to the delivery pipe. Install the 4 injectors.
(d) Position the injector connector upward.



2. INSTALL INJECTORS AND DELIVERY PIPE

(a) Place the 4 new insulators and in position on the spacers.
(b) Place the 4 injectors together with the delivery pipe in position on the cylinder head.
(c) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.



(d) Check that the injectors rotate smoothly.

HINT:

If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.

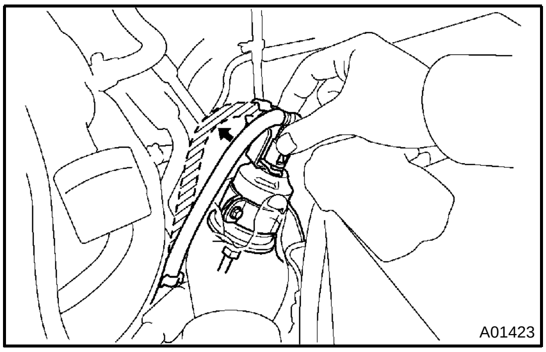
(e) Position the injector connector upward.
(f) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)
(g) Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the pulsation dumper.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
(h) Connect the fuel return hose to the fuel pressure regulator.
(i) Connect the vacuum sensing hose to the fuel pressure regulator.

3. CONNECT ENGINE WIRE

4. INSTALL THROTTLE BODY

(See page FI–44)

CONTINUED


A01423

5. CONNECT FUEL INLET PIPE

(a) Connect the fuel inlet pipe (fuel tube connector) to the fuel filter.

CAUTION:

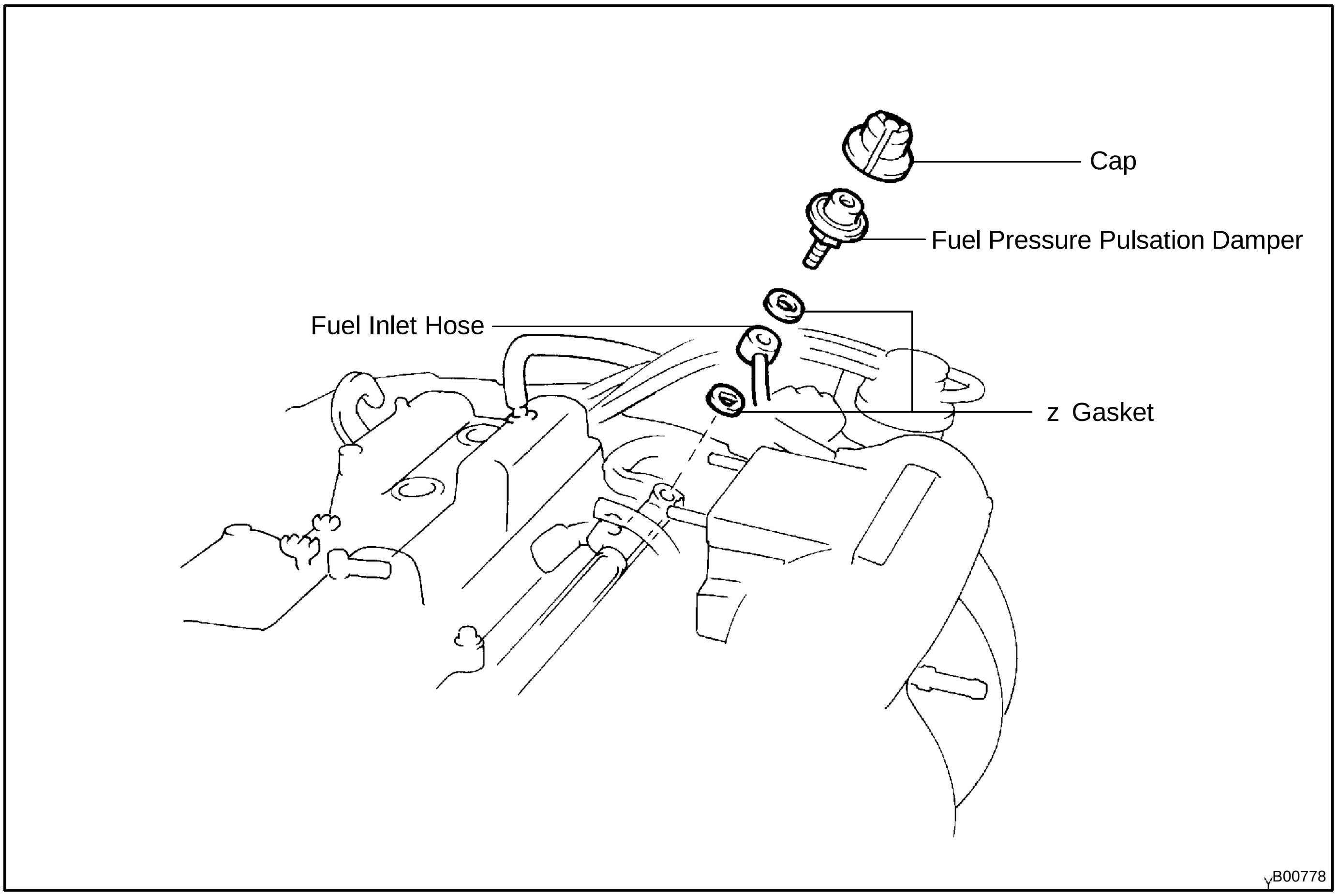
Perform connecting operations of the fuel tube connector (quick type) after observing the precautions.

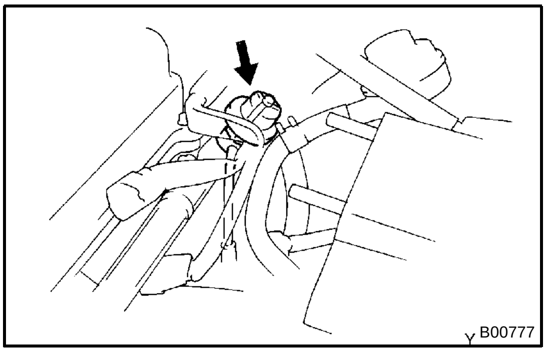
(b) Install the fuel hose to the clamp.

FUEL PRESSURE PULSATION DAMPER (2RZ-FE, 3RZ-FE)

COMPONENTS

FI014-01





FI015–01

REMOVAL

REMOVE FUEL PRESSURE PULSATION DAMPER

(a) Using SST, remove the pulsation damper and upper gasket.

SST 09612 – 24014 (09617 – 24011)

(b) Disconnect the fuel inlet pipe from the fuel delivery pipe and lower gasket.

HINT:

At the time of assembly, please refer to the following items.

Install the pressure pulsation damper with the new 2 gaskets.

FI016-01

INSTALLATION

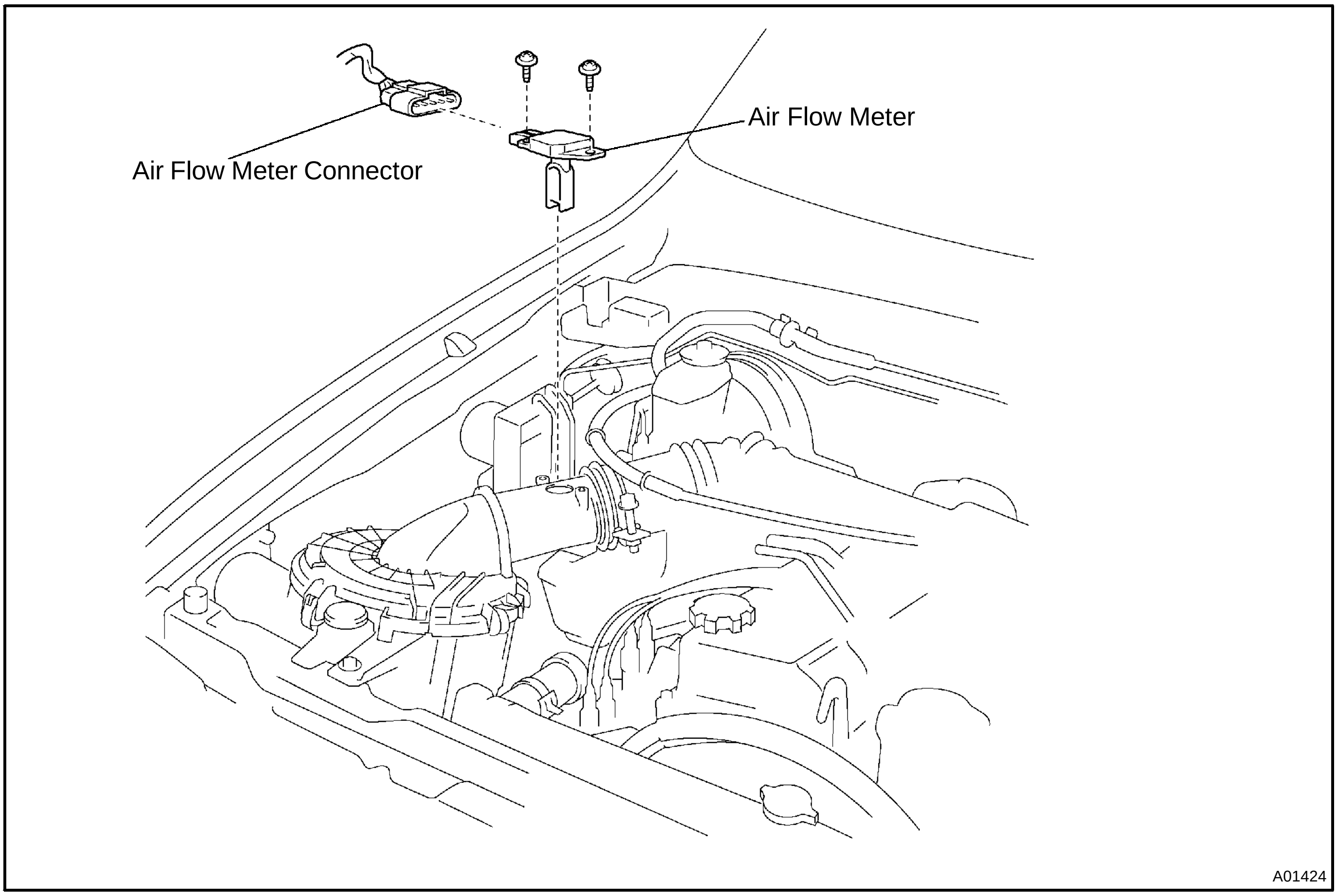
Installation is in the reverse order of removal.

(See page FI-25)

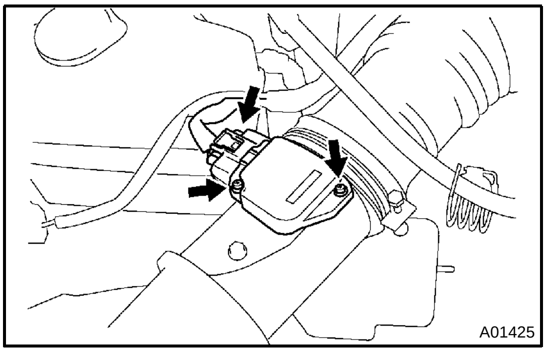
AIR FLOW METER (2RZ–FE, 3RZ–FE)

COMPONENTS

FI01H–01



FI01I-01



REMOVAL

REMOVE AIR FLOW METER

(a) Disconnect the air flow meter connecter.

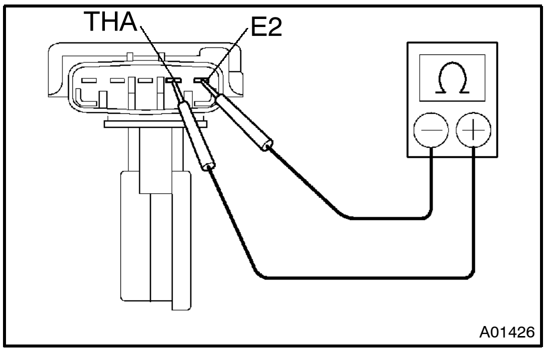
(b) Remove the 2 screws, air flow meter and gasket.

HINT:

At the time of assembly, please refer to the following items.

Install the air flow meter with the new gasket.

FI01J-01



A01426

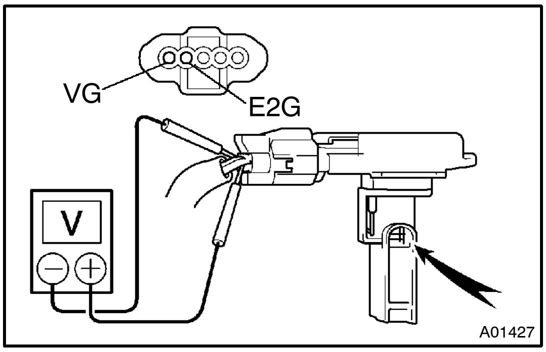
INSPECTION

1. INSPECT AIR FLOW METER RESISTANCE

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

Terminals	Resistance	Temperature
THA - E2	12.5 - 16.9 kΩ	-20°C (-4 °F)
THA - E2	2.19 - 2.67 kΩ	20°C (68 °F)
THA - E2	0.5 - 0.68 kΩ	60°C (140 °F)

If the resistance is not as specified, replace the air flow meter.



A01427

2. INSPECT AIR FLOW METER OPERATION

(a) Connect the air flow meter connector

(b) Turn the ignition switch ON.

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

(d) Blow air into the air flow meter, and check that the voltage fluctuates.

If operation is not as specified, replace the air flow meter.

(e) Turn the ignition switch OFF.

(f) Disconnect the air flow meter connector.

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3RZ-F,3RZ-FE Pages From Supplement
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FI01K-01

INSTALLATION

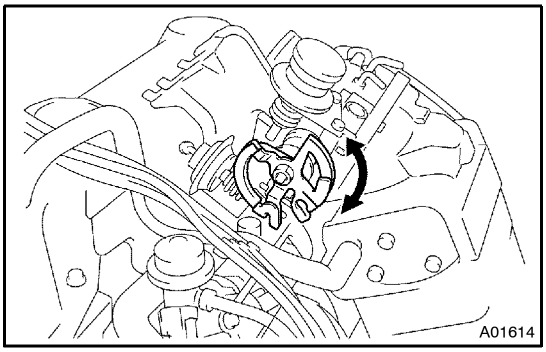
Installation is in the reverse order of removal.

(See page FI-28)

THROTTLE BODY (1RZ-E)

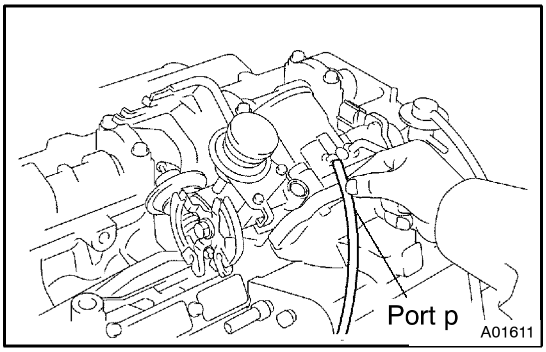
FI017-01

ON-VEHICLE INSPECTION



1. INSPECT THROTTLE BODY

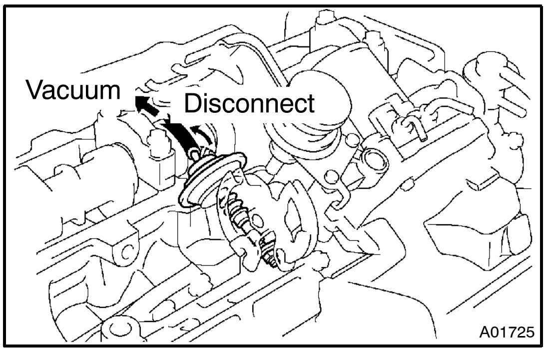
(a) Check that the throttle linkage moves smoothly.



(b) Check the vacuum at each port.

- Start the engine.
- Check the vacuum with your finger.

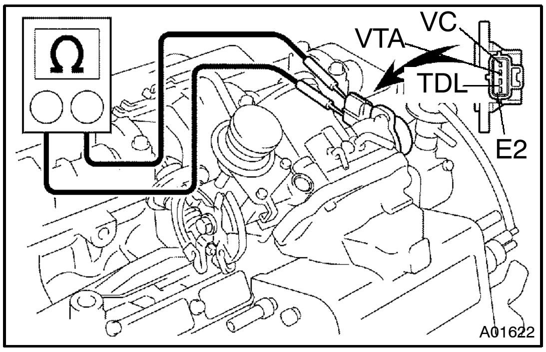
Port name	At idle	Other than idle
P	No vacuum	Vacuum



2. INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the sensor connector.

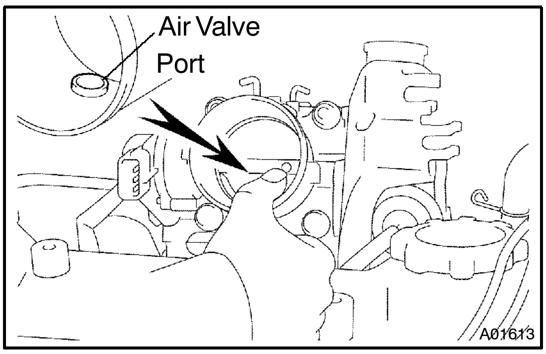
(b) Apply vacuum to the throttle opener



(c) Using an ohmmeter, check the continuity between each terminal.

Throttle valve condition	Between terminals	Resistance
Fully closed	VTA - E2	0.2 - 5.7 kΩ
Fully closed	IDL - E2	2.3 kΩ or less
Open	IDL - E2	Infinity
Fully open	VTA - E2	2.0 - 10.2 kΩ
-	VC - E2	2.5 - 5.9 kΩ

(d) Reconnect the sensor connector.



3. CHECK AIR VALVE OPERATION

Check the engine rpm by closing the air valve port on the throttle body.

- At low temperature (Coolant temperature: below 80°C (176°F)): When the air valve port is closed, the engine speed should drop.
- After warm-up:
  When the air valve port is closed, check that the engine speed does not drop more than 100 rpm.

CONTINUED

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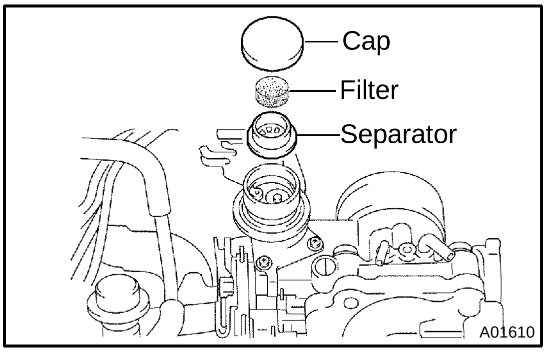
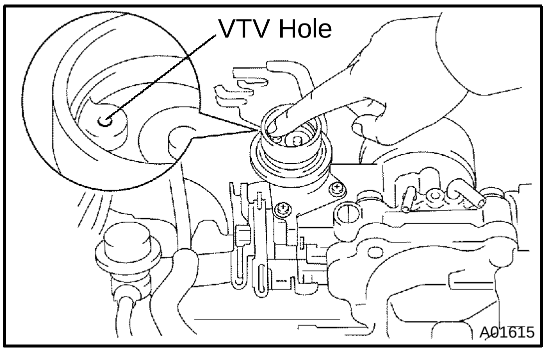
4. INSPECT AND ADJUST DASHPOT

(a) Warm up engine
Allow the engine to warm up to normal operating temperature.

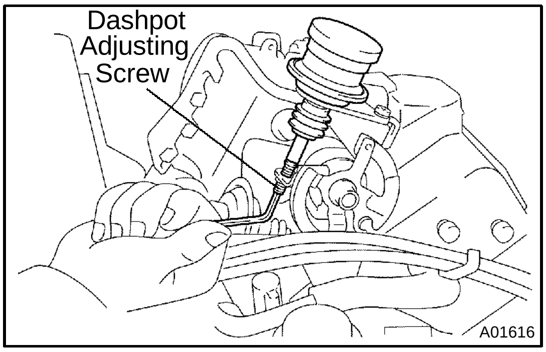
(b) Check idle speed
(See page EM–17)
Idle speed: 700 – 800 rpm



(c) Remove cap, filter and separator from dashpot.



(d) Check and adjust dashpot setting speed
(1) Maintain the engine at 4,000 rpm.
(2) Plug the VTV hole with your finger.
(3) Release the throttle valve.
(4) Check that the dashpot is set.
Dashpot setting speed: 2,000 ± 200 rpm



(5) Adjust the dashpot setting speed by turning the dashpot adjusting screw.
(6) Repeat steps from (a) to (c), and recheck the dashpot setting speed.

(e) Reinstall separator, filter and cap to dashpot.
HINT:
Install the filter with the coarser surface facing the atmospheric side (outside).

(f) Check VTV operation
(1) Maintain the engine at 2,500 rpm.
(2) Release the throttle valve, and check that the engine returns to idle in a few seconds.

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

5. INSPECT THROTTLE OPENER

(a) Warm up engine

(1) Allow the engine to warm up to normal operating temperature.

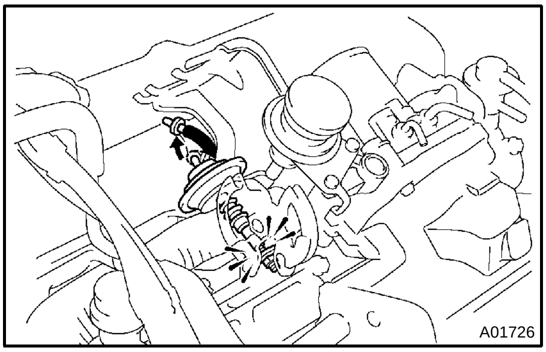
(b) Check idle speed

(See page EM–17)

Idle speed:

700 – 800 rpm

(c) Check throttle opener setting speed



A01726

(1) Disconnect the vacuum hose from the throttle opener, and plug the hose end.

(2) Check the throttle opener setting speed.

Throttle opener setting speed:

1,200 – 1,500 rpm

If the throttle opener setting is not as specified, replace the throttle body.

(3) Stop the engine.

(4) Reconnect the vacuum hose to the throttle opener.

(5) Start the engine, and check that the idle speed returns to the correct speed.

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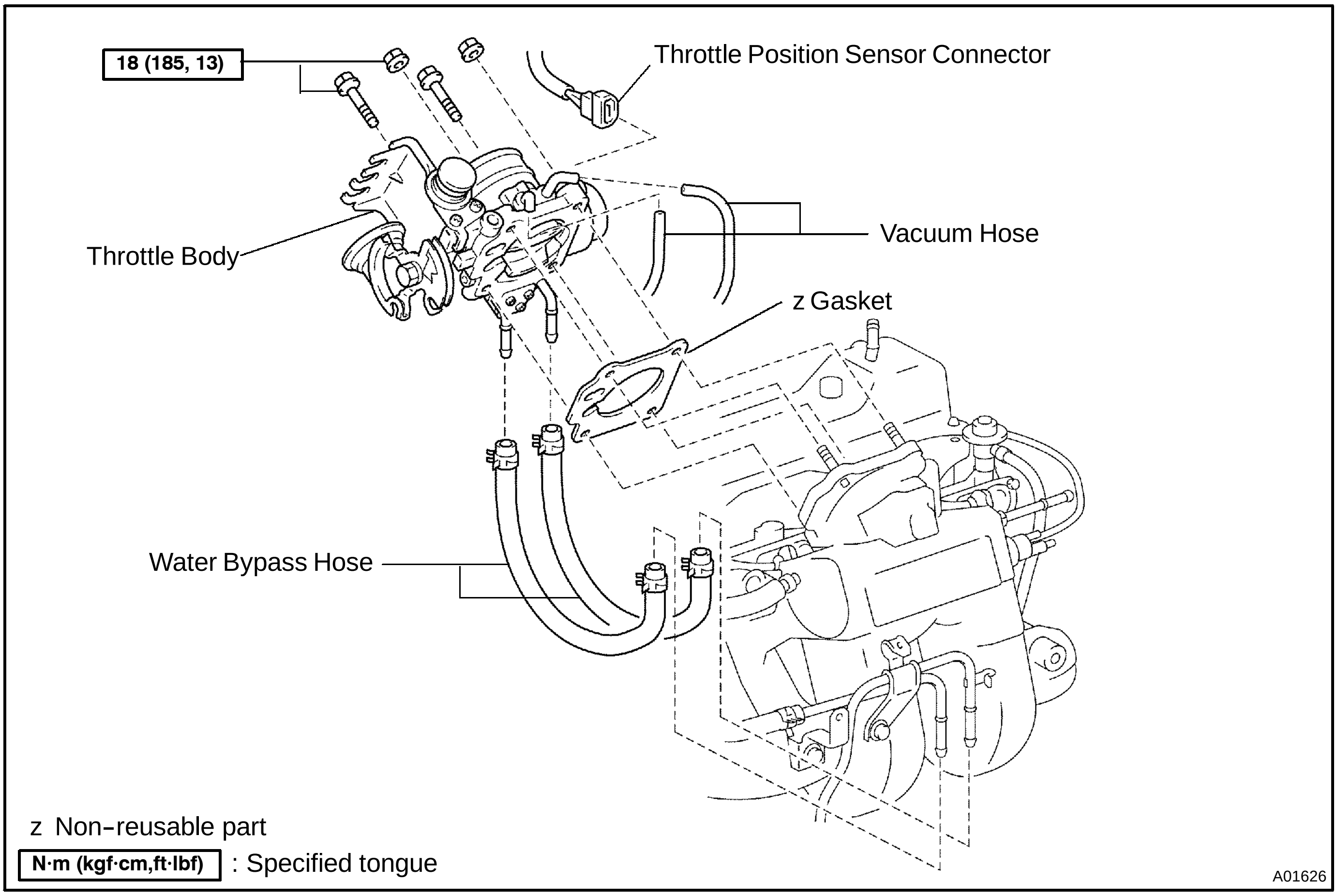
FI018–01

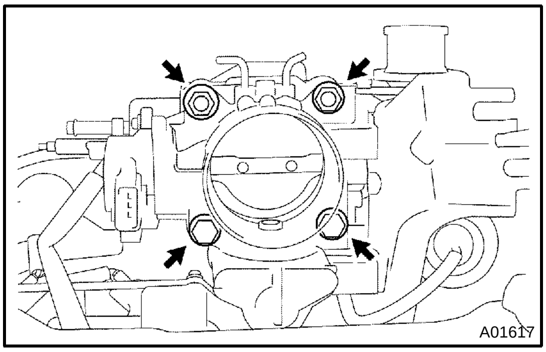
COMPONENTS



FI019–01

REMOVAL

1. **DRAIN ENGINE COOLANT**
2. **DISCONNECT THROTTLE POSITION SENSOR CONNECTOR**
3. **DISCONNECT VACUUM HOSES FROM THROTTLE BODY**
4. **DISCONNECT WATER BYPASS HOSES FROM NO.2 WATER BYPASS PIPE**


A01617

5. **REMOVE THROTTLE BODY**

(a) Remove the 2 bolts, 2 nuts, throttle body and gasket.

(b) Remove the 2 water bypass hoses from the throttle body.

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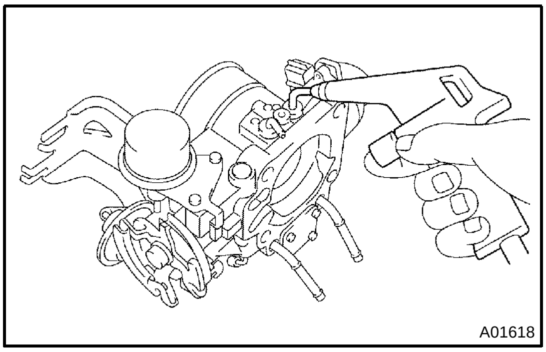
FI01A-01

INSPECTION


A01618

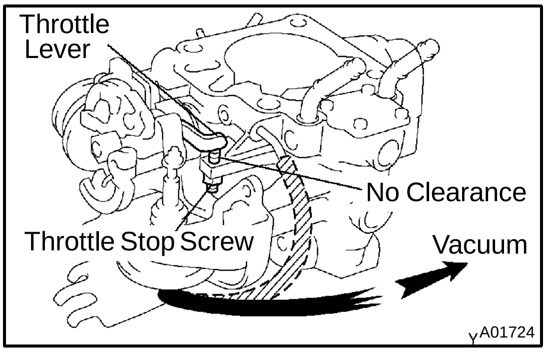
1. CLEAN THROTTLE BODY

(a) Using a soft brush and carburetor cleaner, clean the cast parts.

(b) Using compressed air, clean all the passages and apertures.

NOTICE:

To prevent deterioration, do not clean the throttle position sensor and ISC valve.

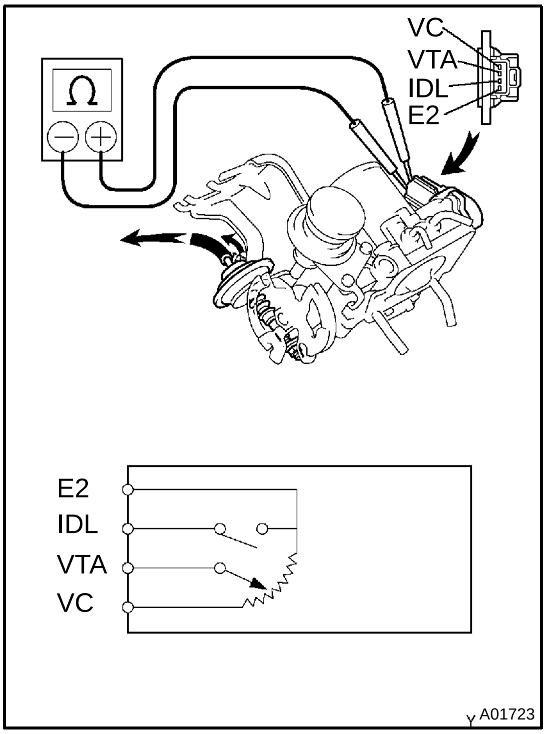


A01724

2. INSPECT THROTTLE VALVE

(a) Apply vacuum to the throttle opener.

(b) Check that there is no clearance between the throttle stop screw and throttle lever when the closed throttle position.



A01723

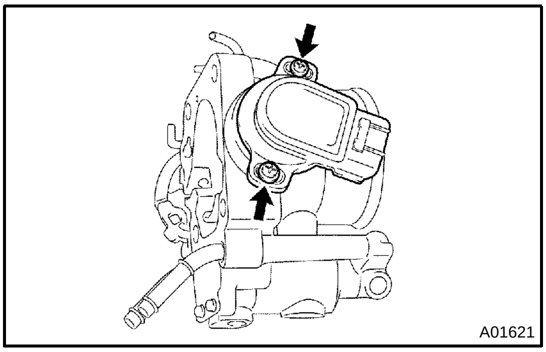
3. INSPECT THROTTLE POSITION SENSOR

(a) Apply vacuum to the throttle opener.

(b) Insert a thickness gauge between the throttle stop screw and stop lever.

(c) Using an ohmmeter, measure the resistance between each terminal.

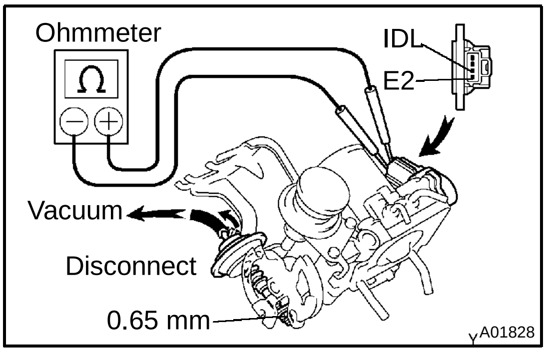
Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA - E2	0.2 - 5.7 kΩ
0.57 mm (0.022 in.)	IDL - E2	2.3 kΩ or less
0.74 mm (0.029 in.)	IDL - E2	Infinity
Throttle valve fully open	VTA - E2	2.0 - 10.2 kΩ
-	VC - E2	2.5 - 5.9 kΩ


A01621

4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

(a) Loosen the 2 set screws of the sensor

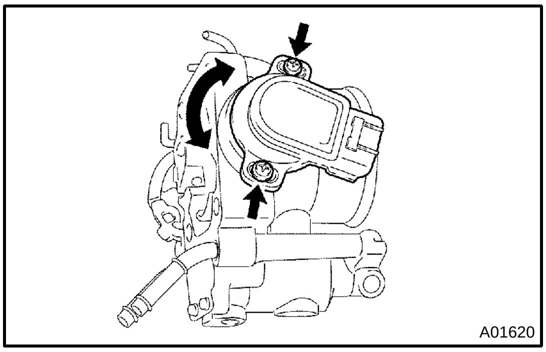
CONTINUED



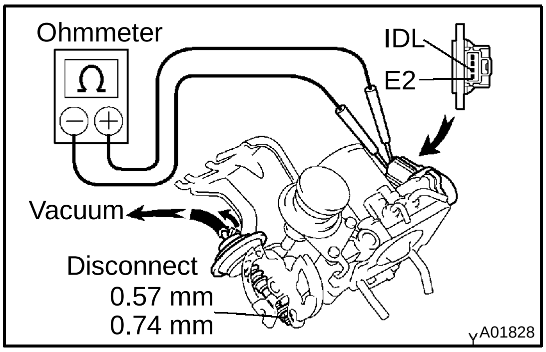
(b) Apply vacuum to the throttle opener.

(c) Insert a 0.65 mm (0.026 in.) thickness gauge between the throttle stop screw and stop lever.

(d) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.



(e) Gradually, turn the sensor clockwise until the ohmmeter deflects, and secure it with the 2 set screws



(f) Recheck the continuity between terminals IDL and E2.

Clearance between lever and stop screw	Continuity (IDL – E2)
0.57 mm (0.022 in.)	Continuity
0.74 mm (0.029 in.)	No Continuity

FI01B-01

INSTALLATION

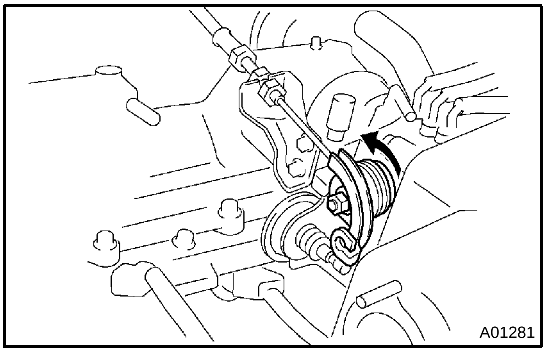
Installation is in the reverse order of removal.

(see page FI-42)

THROTTLE BODY (2RZ-FE, 3RZ-FE)

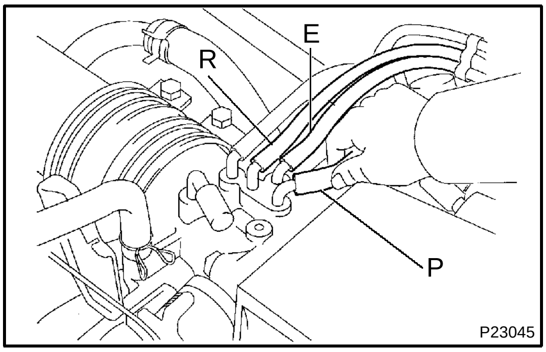
FI01C-01

ON-VEHICLE INSPECTION



1. INSPECT THROTTLE BODY

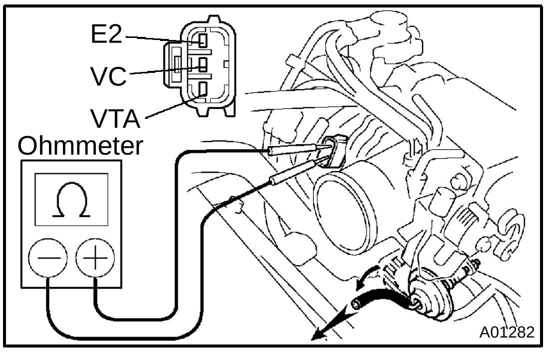
(a) Check that the throttle linkage moves smoothly.



(b) Check the vacuum at each port.
(1) Start the engine.
(2) Check the vacuum with your finger.

Port name	At idle	At 3,500 rpm
P	Vacuum	Vacuum
*E	No vacuum	Vacuum
R	No vacuum	Vacuum

*: 2RZ-FE

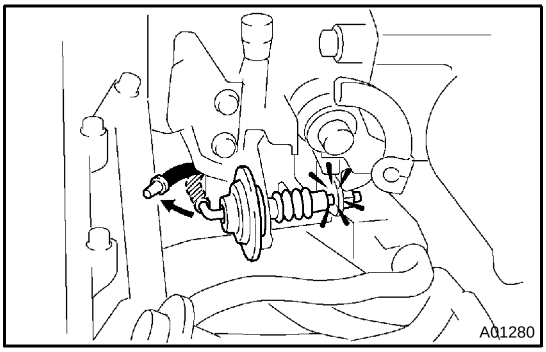


2. INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the sensor connector.
(b) Apply vacuum to the throttle opener.
(c) Using an ohmmeter, measure the resistance between each terminal.

Throttle valve condition	Between terminals	Resistance
Fully closed	VTA - E2	0.2 - 5.7 kΩ
Fully open	VTA - E2	2.0 - 10.2 kΩ
-	VC - E2	2.5 - 5.9 kΩ

(d) Connect the sensor connector.



3. INSPECT THROTTLE OPENER

(a) Warm up engine
Allow the engine to warm up to normal operating temperature.
(b) Check idle speed
Idle speed: 650 - 750 rpm
(c) Disconnect the vacuum hose from the throttle opener, and plug the hose end.

CONTINUED

(d) Check the throttle opener setting speed.

Throttle opener setting speed: 1,200 – 1,500 rpm

If the throttle opener setting is not as specified, replace the throttle body.

(e) Stop the engine.

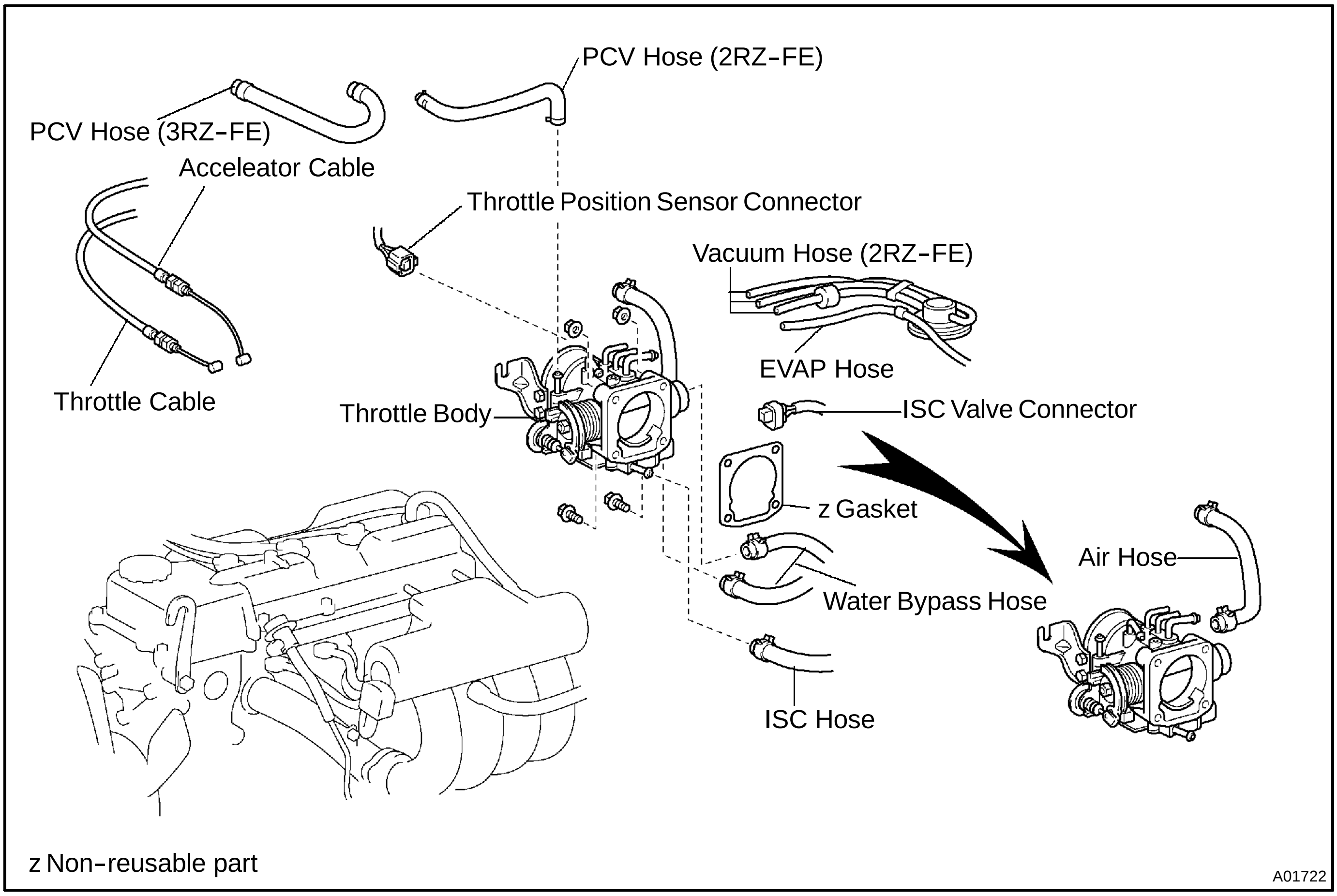
(f) Connect the vacuum hose to the throttle opener.

(g) Start the engine, and check that the idle speed returns to the correct speed.

(h) Disconnect hand–held tester or OBDII scan tool.

FI01D-01

COMPONENTS



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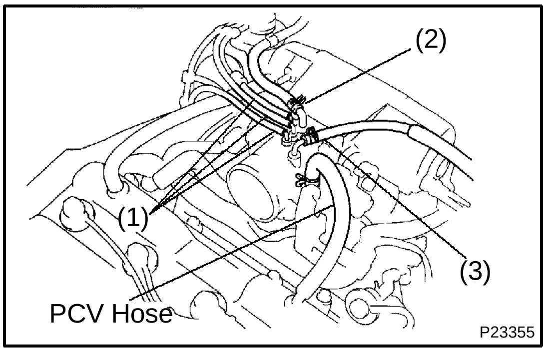
FI01E–01

REMOVAL

1. DRAIN ENGINE COOLANT

2. (M/T) DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

3. (A/T) DISCONNECT ACCELERATOR AND THROTTLE CABLES FROM THROTTLE BODY



4. REMOVE PCV HOSE

5. REMOVE THROTTLE BODY

(a) Disconnect these hoses:

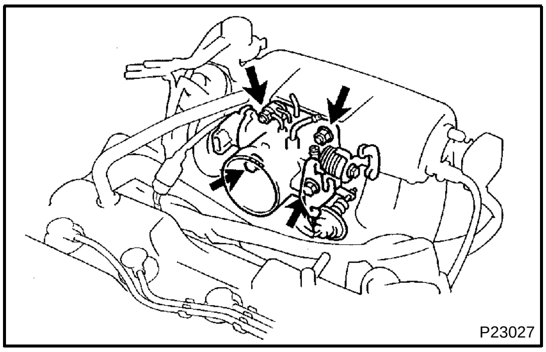
(1) 2RZ–FE:
Vacuum hose for EGR

(2) EVAP hose

(3) Air hose for PS idle–up

(b) Disconnect the throttle position sensor connector.

(c) Disconnect the ISC valve connector.



(d) Remove the 2 bolts, 2 nuts, and disconnect the throttle body form the air intake chamber.

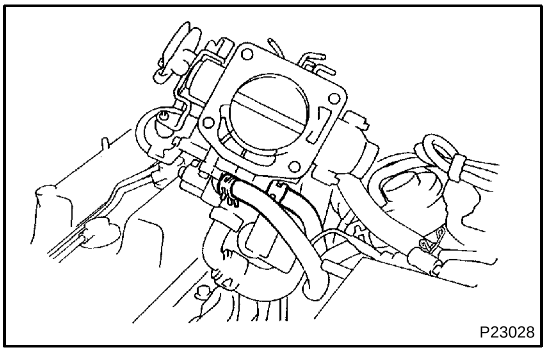
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

(e) Remove the throttle body gasket.

HINT:

At the time of assembly, please refer to the following items.

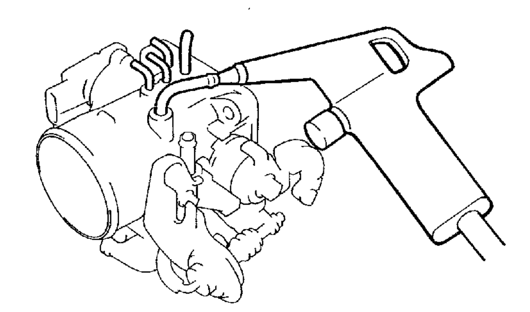
Install the throttle body with the new gasket.



(f) Disconnect the 2 water bypass hoses from the throttle body, and remove the throttle body.

6. REMOVE AIR HOSE FROM ISC VALVE

FI01F–01



P21653

INSPECTION

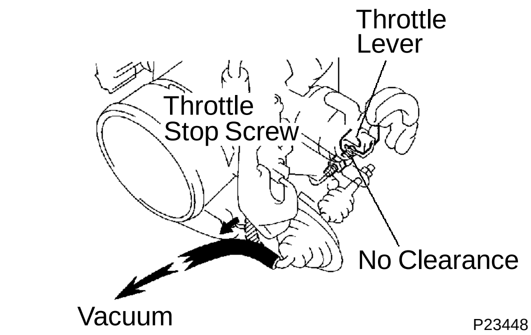
1. CLEAN THROTTLE BODY

(a) Using a soft brush and carburetor cleaner, clean the cast parts.

(b) Using compressed air, clean all the passages and apertures.

NOTICE:

To prevent deterioration, do not clean the throttle position sensor and ISC valve.

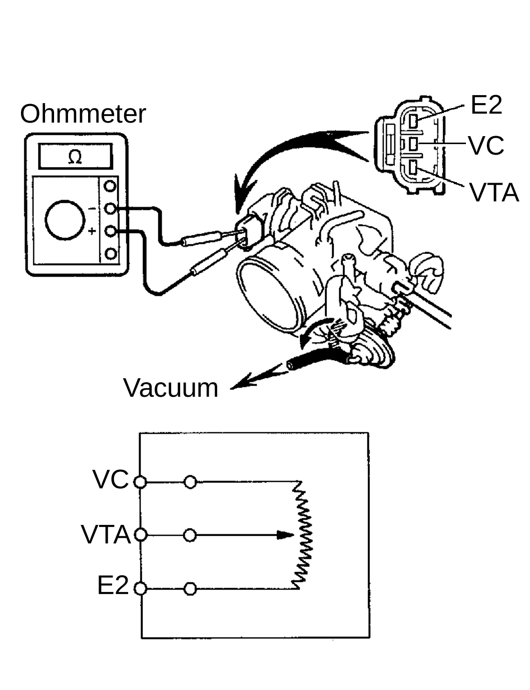


P23448

2. INSPECT THROTTLE VALVE

(a) Apply vacuum to the throttle opener.

(b) Check that there is no clearance between the throttle stop screw and throttle lever when the closed throttle position.



P25997

3. INSPECT THROTTLE POSITION SENSOR

(a) Apply vacuum to the throttle opener.

(b) Insert a thickness gauge between the throttle stop screw and stop lever.

(c) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

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FI01G–01

INSTALLATION

Installation is in the reverse order of removal.

(See page FI–42)

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IDLE SPEED CONTROL (ISC) VALVE (2RZ–FE)

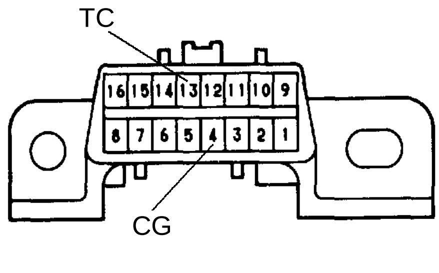
FI01L–01

ON–VEHICLE INSPECTION

1. INSPECT ISC VALVE OPERATION

(a) Initial conditions:

- Engine at normal operating temperature
- Idle speed check correctly
- Transmission in neutral position



N09214

(b) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843–18020

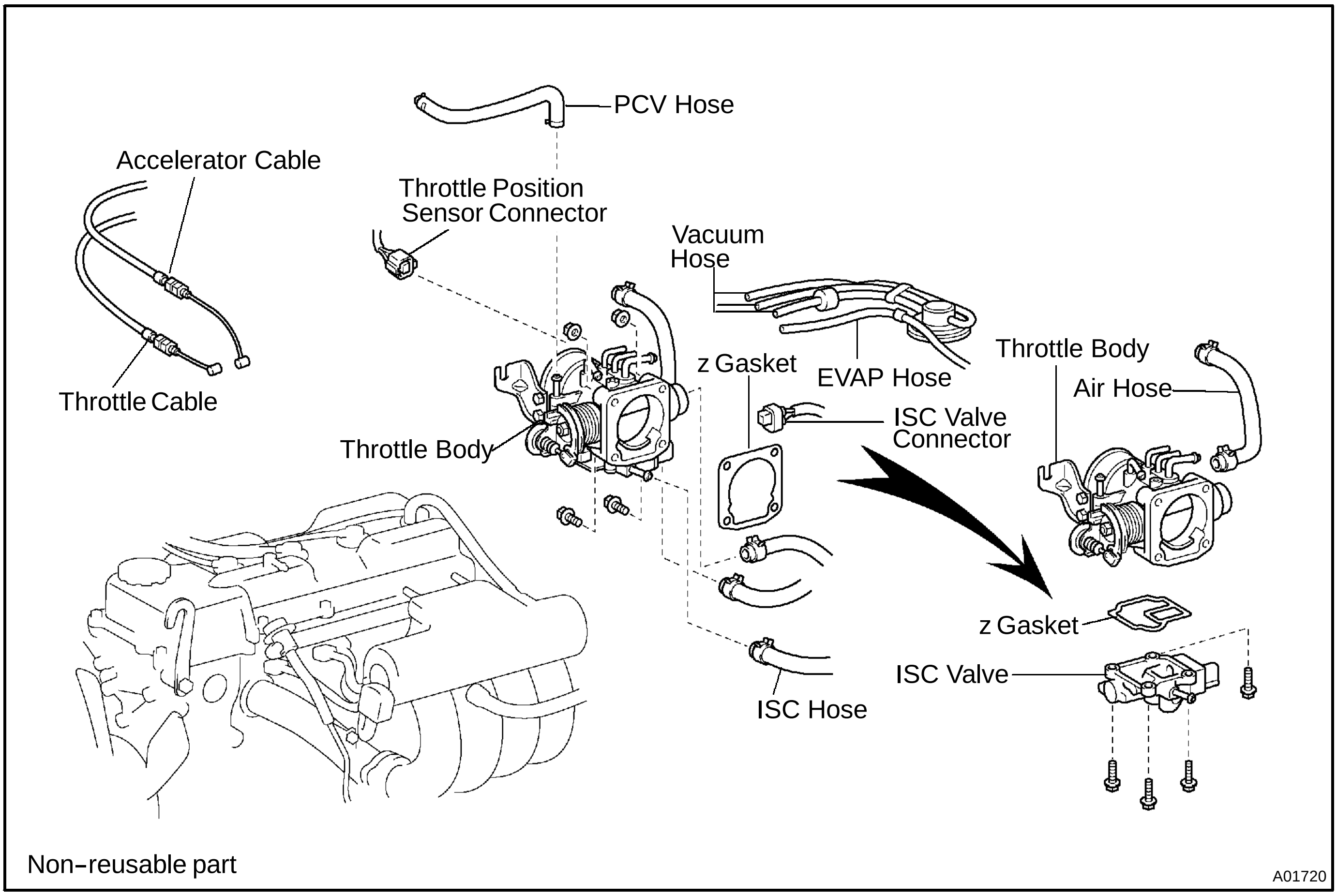
(c) After engine speed are kept at 1,000 – 1,500 rpm for 5 seconds, check that they return to idle speed.

If the engine speed operation is not as specified, check the ISC valve, wiring and ECU.

(d) Remove the SST.
SST 09843–18020

FI01M-01

COMPONENTS



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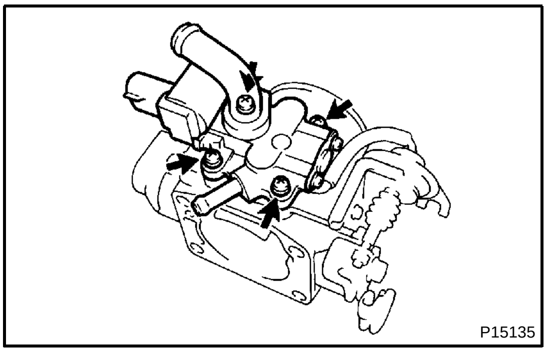
FI01N–01



P15135

REMOVAL

1. REMOVE THROTTLE BODY

(See page FI–42)

2. REMOVE ISC VALVE

Remove the 4 screws, ISC valve and gasket.

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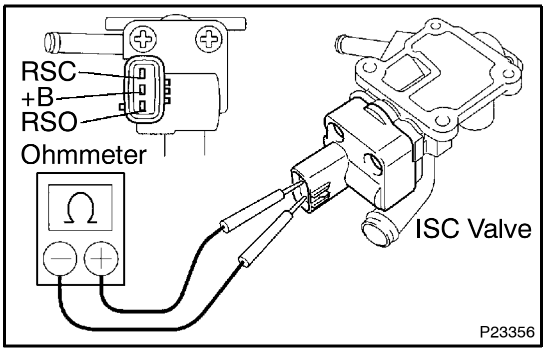


FI010-01

INSPECTION

1. INSPECT ISC VALVE RESISTANCE

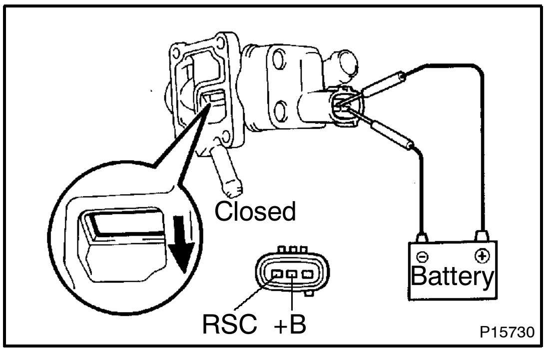
NOTICE:

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

Using an ohmmeter, measure the resistance between terminal +B and other terminals (RSC, RSO).

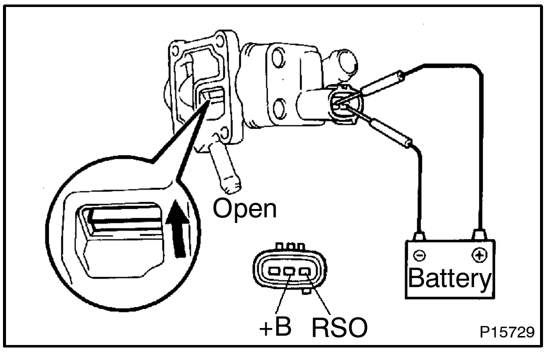
Resistance:
Cold: 17.0 - 24.5 Ω
Hot: 21.5 - 28.5 Ω

If resistance is not as specified, replace the ISC valve.



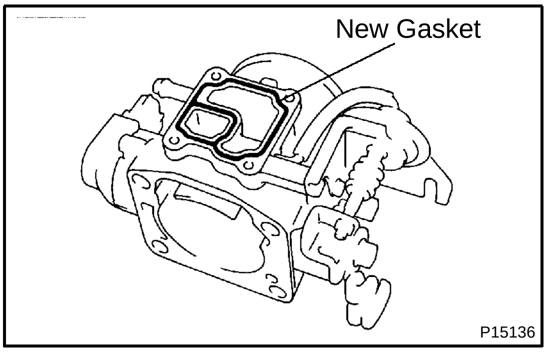
2. INSPECT ISC VALVE OPERATION

(a) Connect the positive (+) lead from the battery to terminal +B and negative (-) lead to terminal RSC, and check that the valve is closed.



(b) Connect the positive (+) lead from the battery to terminal +B and negative (-) lead to terminal RSO, and check that the valve is open.

FI01P-01



INSTALLATION

1. INSTALL ISC VALVE

(a) Place a new gasket on the throttle body.

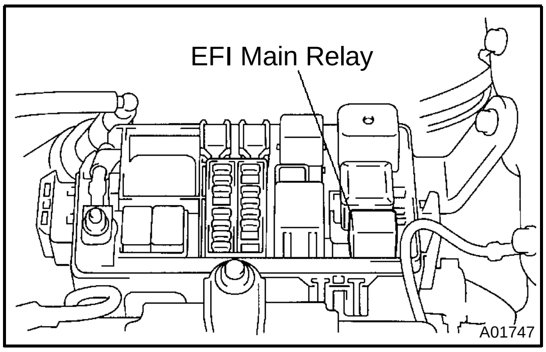
(b) Install the ISC valve with the 4 screws.

2. INSTALL THROTTLE BODY

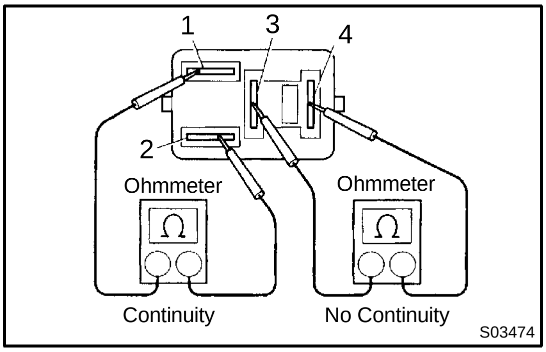
(See page FI-44)

EFI MAIN RELAY
INSPECTION

FI01Q-01



1. REMOVE EFI MAIN RELAY (Marking: EFI)



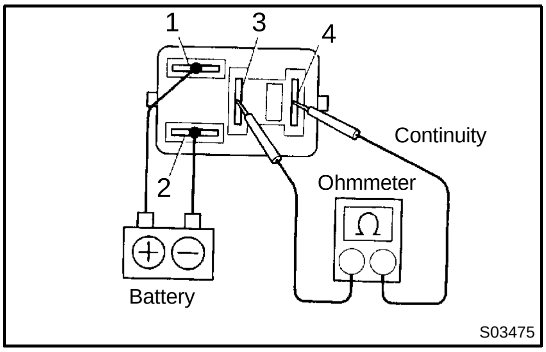
2. INSPECT EFI MAIN RELAY

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

If there is no continuity, replace the relay.

(b) Check that there is no continuity between terminals 3 and 4.

If there is continuity, replace the relay.



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

(d) Using an ohmmeter, check that there is continuity between terminals 3 and 4.

If operation is not as specified, replace the relay.

3. REINSTALL EFI MAIN RELAY

CLICK HERE TO VIEW CHAPTER INDEX

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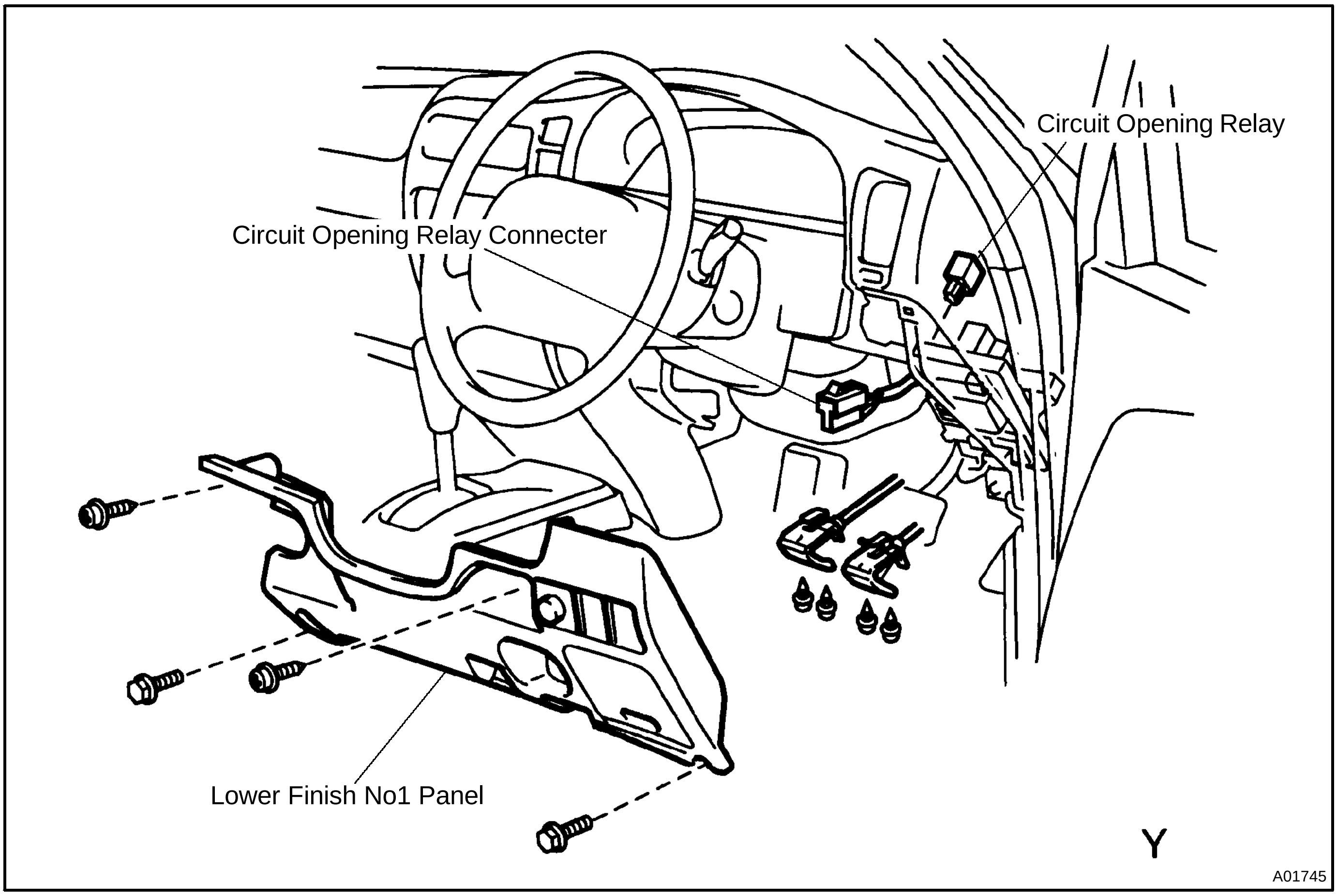
CIRCUIT OPENING RELAY

COMPONENTS

FI01R–01

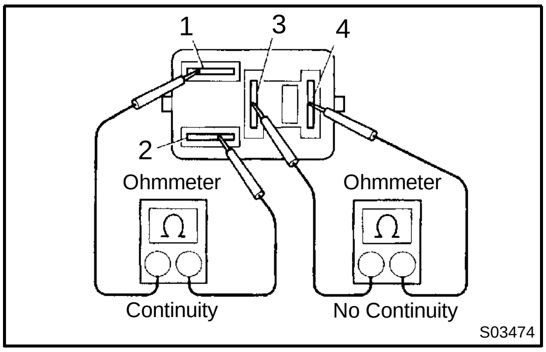


FI01S–01

INSPECTION

1. REMOVE CIRCUIT OPENING RELAY

2. INSPECT CIRCUIT OPENING RELAY CONTINUITY



S03474

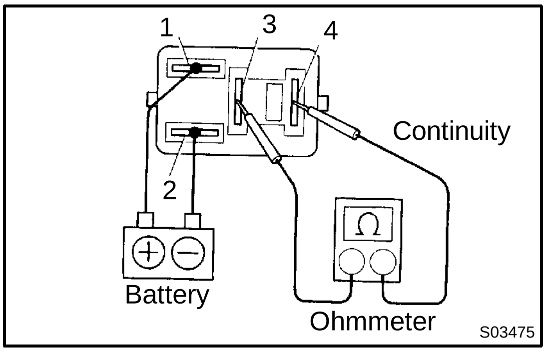
(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there no continuity, replace the relay.

(b) Check that there is no continuity between terminals 3 and 4.

If there continuity, replace the relay.

3. INSPECT CIRCUIT OPENING RELAY OPERATION



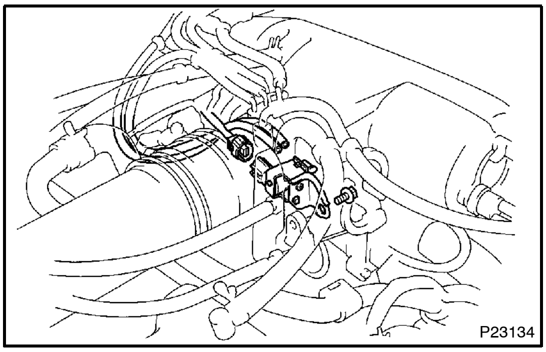
S03475

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

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 4.

If operation is not as specified, replace the relay.

4. REINSTALL CIRCUIT OPENING RELAY



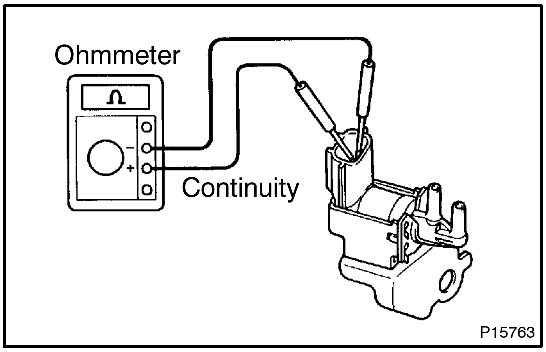
VSV FOR EXHAUST GAS RECIRCULATION (EGR) (2RZ-FE)

FI01T-01

INSPECTION

(a) Remove the bolt.

(b) Disconnect the connector and 2 vacuum hoses from the VSV.

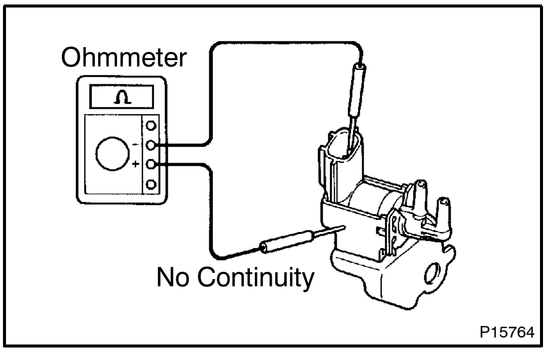


1. INSPECT VSV

(a) Using an ohmmeter, check that there is continuity between terminals.

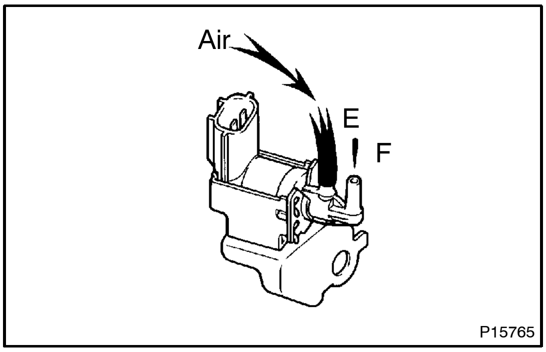
Resistance: At 20°C (68°F): 33 - 39 Ω

If there is no continuity, replace the VSV.

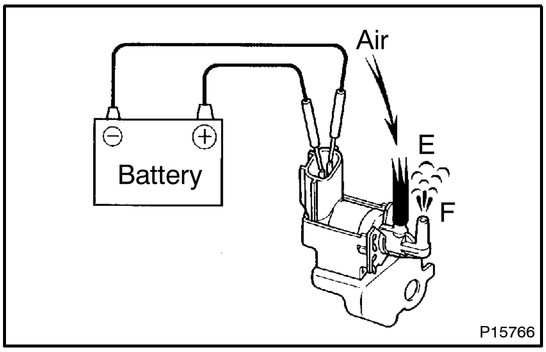


(b) Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



(c) Check that air does not flow from ports E to F.



(d) Apply battery positive voltage across the terminals.

(e) Check that air flows from ports E to F.

If operation is not as specified, replace the VSV.

2. REINSTALL VSV

CLICK HERE TO VIEW CHAPTER INDEX
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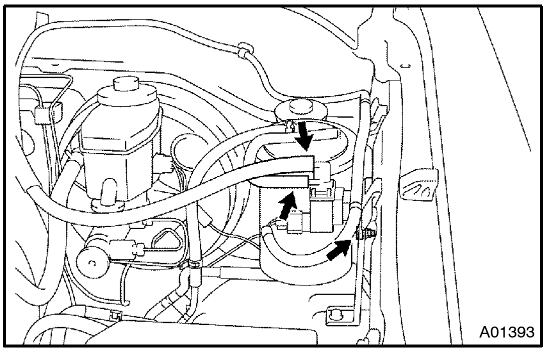
VSV FOR EVAPORATIVE EMISSION (EVAP) (2RZ-FE, 3RZ-FE)

FI01U-01

INSPECTION


A01393

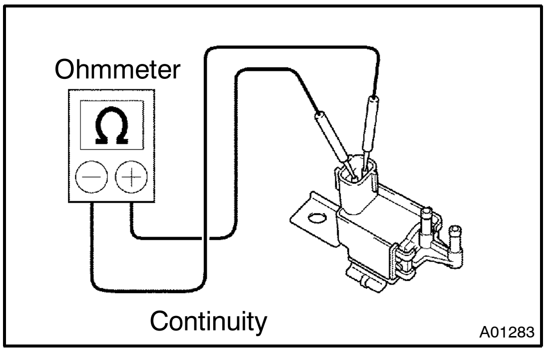
1. REMOVE VSV

(a) Disconnect the connector and 2 EVAP hoses from the VSV.

(b) Remove the 2 bolt and VSV assembly.

(c) Remove the screw and VSV.

2. INSPECT VSV

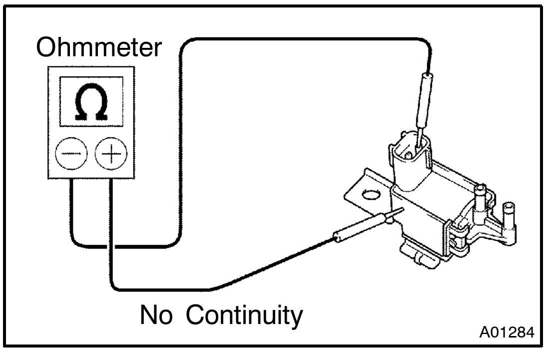


A01283

(a) Using an ohmmeter, check that there is continuity between the terminals.

Resistance: At 20°C (68°F): 30 -34 Ω

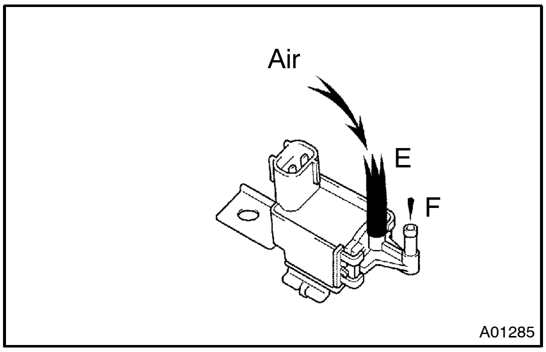
If there is no continuity, replace the VSV.



A01284

(b) Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



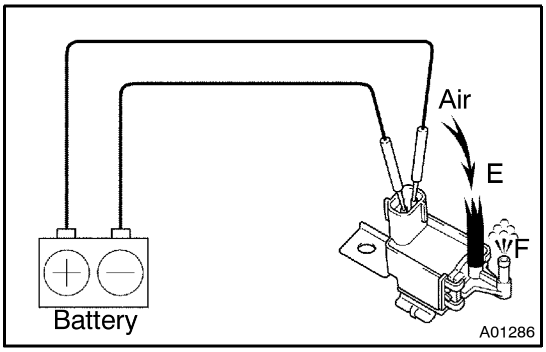
A01285

(c) Inspect VSV operation

- Check that air does not flow from ports E to F.

NOTICE:

Never apply more than 93 kPa (0.95 kgf/cm^2, 13.5 psi) of pressure compressed air to the VSV.



A01286

- Apply battery positive voltage across the terminals.
- Check that air flows from ports E to F.

If operation is not as specified, replace the VSV.

3. REINSTALL VSV

WATER TEMPERATURE SENSOR (2RZ-FE)

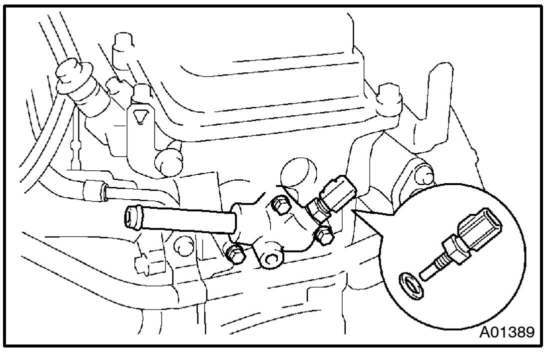
FI01V-01

INSPECTION

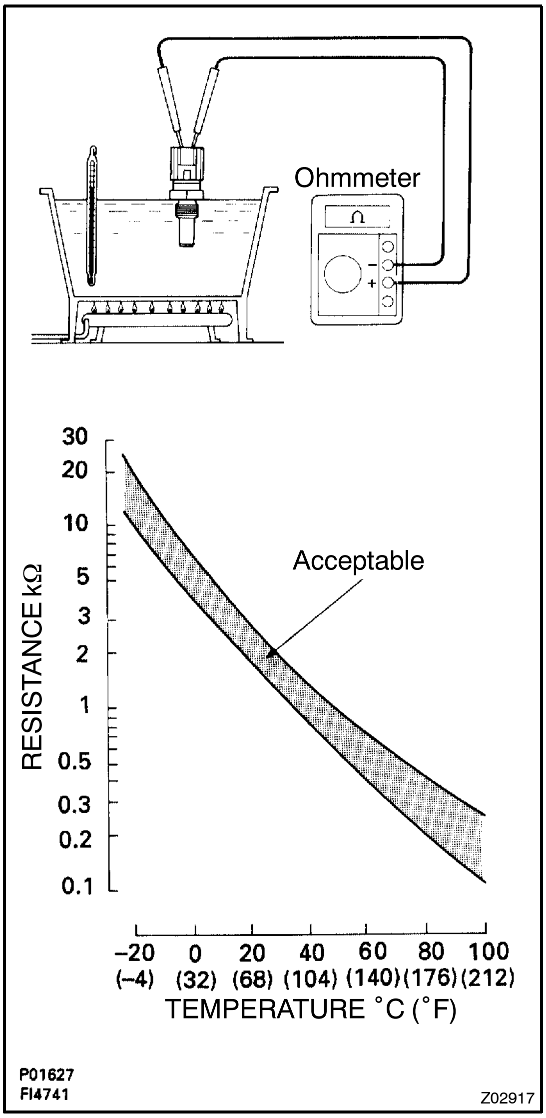
1. DRAIN ENGINE COOLANT

2. REMOVE WATER TEMPERATURE SENSOR

(a) Disconnect the water temperature sensor connector.



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



3. INSPECT WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance: Refer to the chart graph

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

4. REINSTALL WATER TEMPERATURE SENSOR

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

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

(b) Connect the water temperature sensor connector.

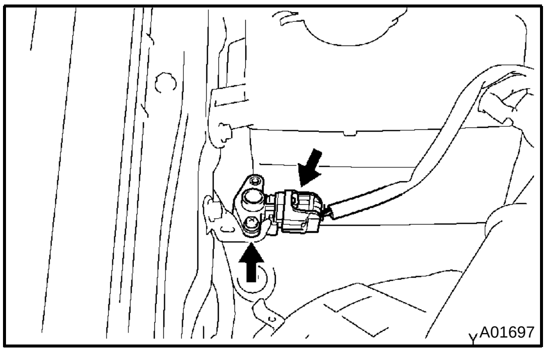
(c) Install the engine wire protector to the 3 brackets.

5. REFILL ENGINE COOLANT

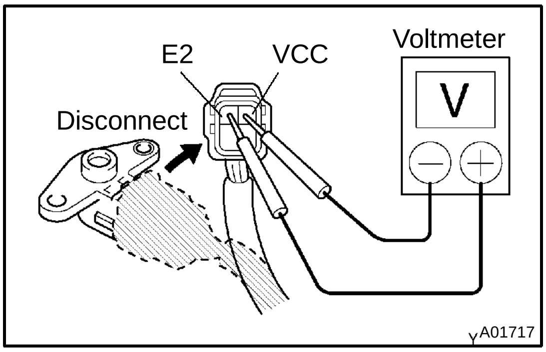
VARIABLE RESISTOR

FI01X–01

INSPECTION

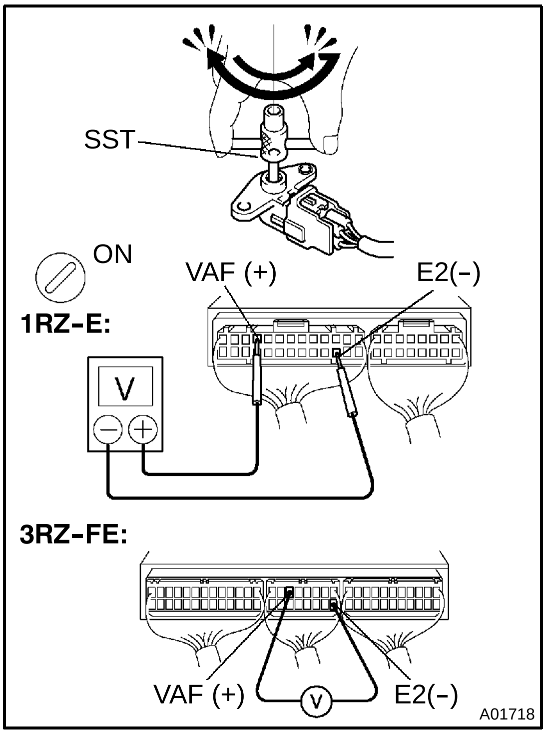


1. REMOVE VARIABLE RESISTOR



2. INSPECT POWER SOURCE VOLTAGE OF VARIABLE RESISTOR

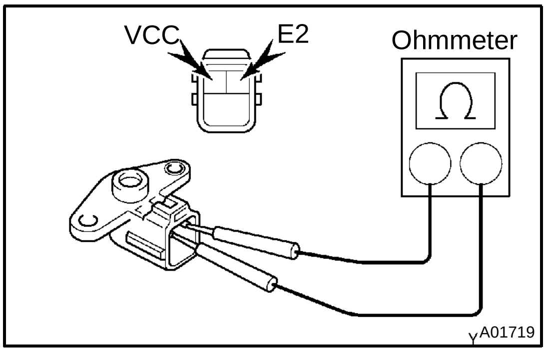
(a) Disconnect the variable resistor connector.
(b) Turn the ignition switch ON.
(c) Using a voltmeter, VCC and E2 of the wiring harness side.
Voltage: 4.5 – 5.5 V
(d) Reconnect the variable resistor connector.



3. INSPECT POWER OUTPUT OF VARIABLE RESISTOR

(a) Turn the ignition switch ON.
(b) Connect a voltmeter to terminals VAF and E2 of the ECU, and measure the voltage while slowly turning the idle mixture adjusting screw first fully counter–clockwise, and then fully clockwise using SST.
SST 09243–00020
(c) Check that voltage changes smoothly from 0 V to approx. 5 V.

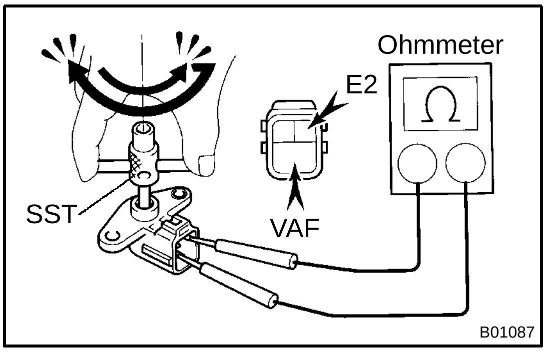
HINT:
These is no sudden jump up to 5 V or down to 0V.



4. INSPECT RESISTANCE OF VARIABLE RESISTOR

(a) Disconnect the variable resistor connector
(b) Using an ohmmeter, measure the resistance between terminals VCC and E2 of the variable resistor.
Resistance: 4 – 6 kΩ

CONTINUED



(c) Using SST, turn the idle mixture adjusting screw fully counterclockwise .
SST 09243–00020

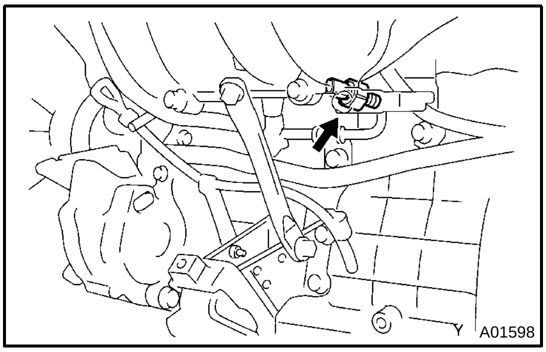
(d) Connect the ohmmeter to terminals VAF and E2 of the variable resister, and turn the idle mixture adjusting screw fully clockwise and check that the resistance value changes from approx. 5 kΩ to 0 Ω accordingly.

(e) Reconnect the variable resistor connector.

KNOCK SENSOR (2RZ-FE, 3RZ-FE)

FI01Y-01

INSPECTION



1. REMOVE KNOCK SENSER

(a) Disconnect the knock sensor connecter.

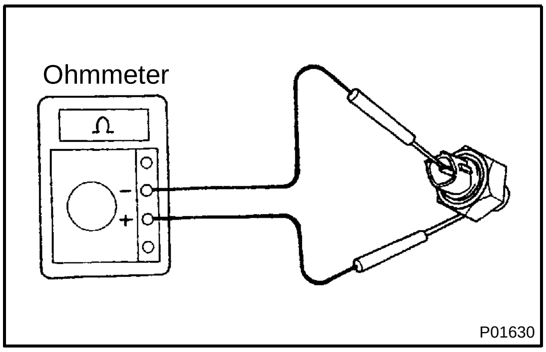
(b) Using SST, remove the knock sensor.

SST 09816-30010

2. INSPECT KNOCK SENSOR

Using an ohmmeter, check that these is no continuity between the terminal and body.

If these is continuity, replace the sensor.



3. REINSTALL KNOCK SENSOR

(a) Using SST, install the knock sensor.

SST 09816-30010

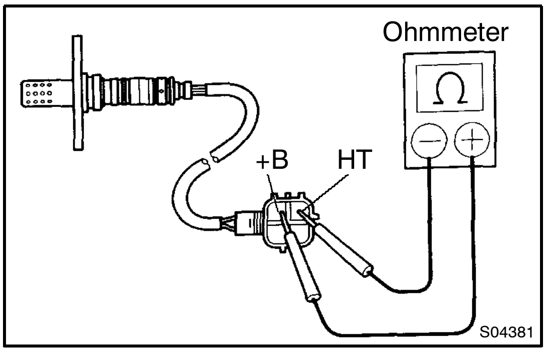
Torque: 44 N.m (450 kgf.cm, 33 ft.lbf)

(b) Connect the knock sensor connecter.

4. REINSTALL FUEL FILTER SET BOLT

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

5. REINSTALL STATER



OXYGEN SENSOR (2RZ-FE)

FI01W-01

INSPECTION

INSPECT HEATER RESISTANCE OF HEATED OXYGEN SENSORS

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

Resistance:

At 20°C (68°F): 11.7 - 14.3 kΩ

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

CLICK HERE TO VIEW CHAPTER INDEX

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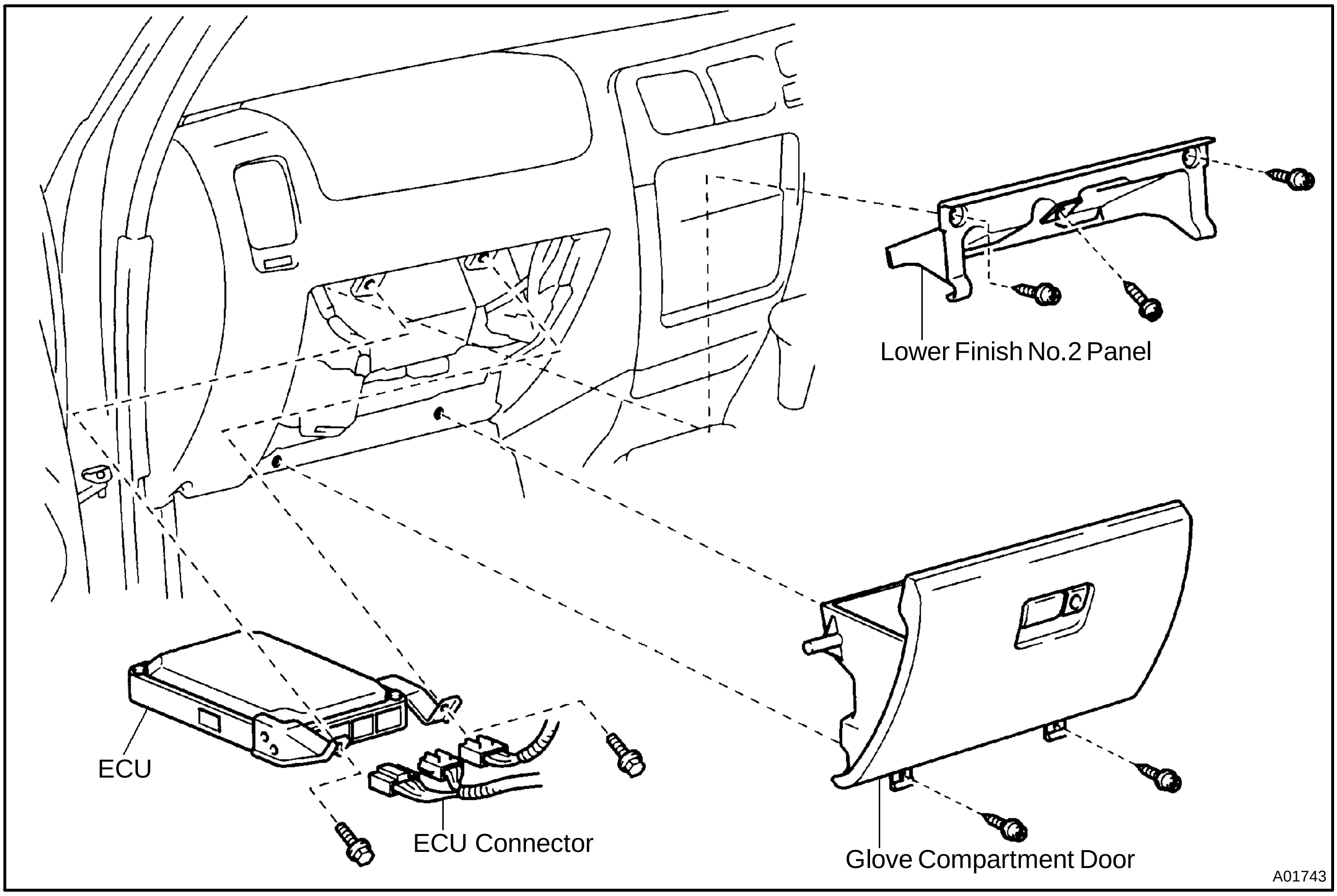
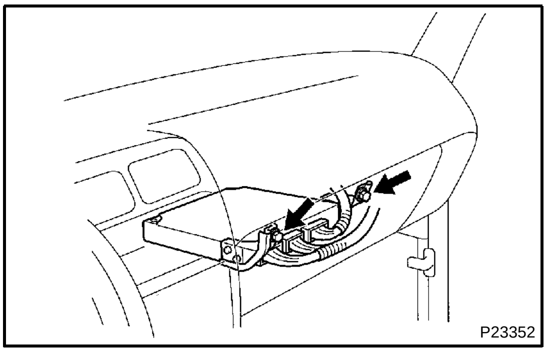
ENGINE CONTROL UNIT (ECU)

COMPONENTS

FI01Z-01



FI020–01



P23352

REMOVAL

1. REMOVE GLOVE COMPARTMENT DOOR

2. REMOVE LOWER FINISH NO.2 PANEL

3. REMOVE ECU

(a) 1RZ–E:
Disconnect the 2 ECU connecter.

(b) 2RZ–FE: 3RZ–FE:
Disconnect the 3 ECU connector.

(c) Remove the 2 bolts and ECU

CLICK HERE TO VIEW CHAPTER INDEX

FI021-01

INSPECTION

(See page DI-17 and DI-90)

FI022-01

INSTALLATION

Installation is in the reverse order of removal.

(see page FI–61)

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
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FUEL CUT RPM

FI023-01

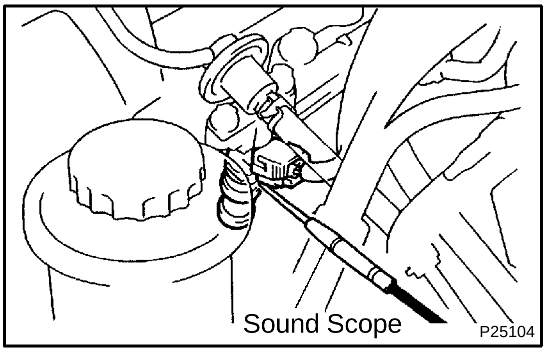
INSPECTION

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

2. CONNECT HAND-HELD TESTER OR OBDII SCAN TOOL

(See page FI-6)



3. INSPECT FUEL CUT OFF RPM

(a) Increase the engine speed to at least 3,500 rpm.
(b) Using a sound scope, check for injector operating noise.
(c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.

HINT:
Measure with the A/C OFF.

Fuel return rpm:
1RZ-E:
1,200rpm
2RZ-FE:
1,400 rpm
3RZ-FE:
M/T: 1,400 rpm
A/T: 1,500 rpm

4. DISCONNECT HAND-HELD TESTER OR OBDII SCAN TOOL

COOLING

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
1RZ, 2RZ, 2RZ–E Engine Repair Manual	RM167E
2RZ, 2RZ–E Engine Repair Manual	RM558E
3RZ–F, 3RZ–FE Engine Repair Manual	RM521E
1RZ–E Engine Repair Manual Suplement	RM467E

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

COOLANT

CO06X-01

REPLACEMENT

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

The coolant level should be between the "L" and "F" lines.

If low, check for leaks and add coolant up to the "F" line.

2. CHECK ENGINE COOLANT QUALITY

(a) Remove the radiator cap.

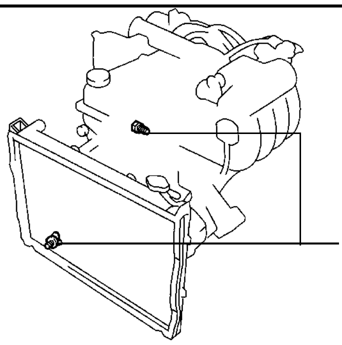
CAUTION:

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.

(b) There should not be any excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the coolant should be free from oil.

If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.



B02204

3. REPLACE ENGINE COOLANT

(a) Remove the 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.

(b) Drain the coolant from the radiator and cylinder drain plugs. (Engine coolant drain plug at the right of cylinder block.)

(c) Close the engine coolant drain plugs.

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

(d) Slowly fill the system with coolant.

- Use a good brand of ethylene-glycol base coolant and mix it according to the manufacturer's directions.
- Using coolant which includes more than 50 % ethylene-glycol

CONTINUED

NOTICE:

- **Do not use an alcohol type coolant.**
- **The coolant should be mixed with demineralized water or distilled water.**

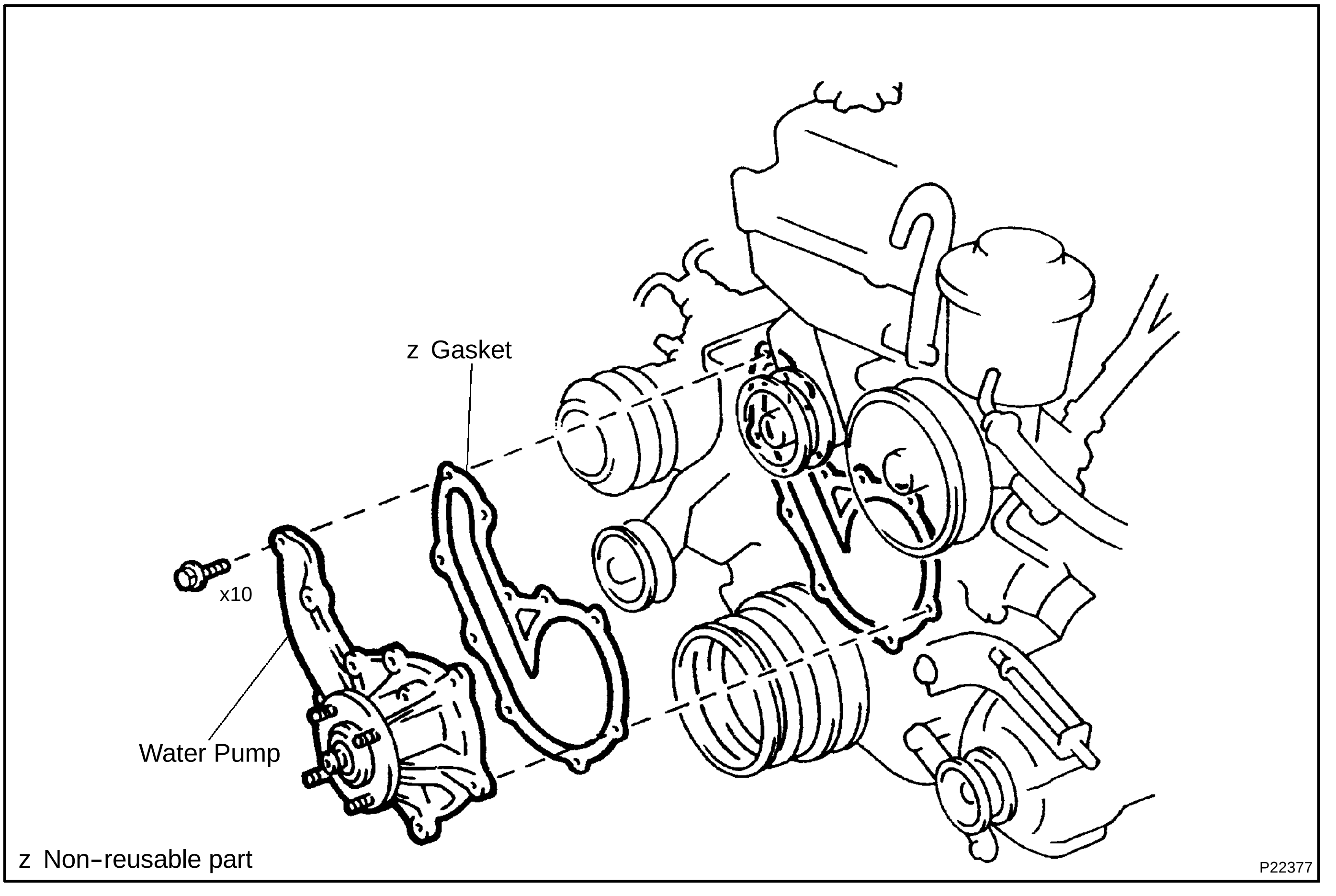
Capacity:
1RZ-E:
7.8 liters (8.2 US qts, 6.9 Imp. qts)
1RZ:
w/ Heater: 7.8 liters (8.2 US qts, 6.9 Imp. qts)
w/o Heater: 7.3 liters (7.7 US qts, 6.4 Imp. qts)
2RZ-FE:
w/ Heater: 7.4 liters (7.8 US qts, 6.5 Imp. qts)
w/o Heater: 6.9 liters (7.3 US qts, 6.1 Imp. qts)
3RZ-F:
w/ Heater: 7.7 liters (8.1 US qts, 6.8 Imp. qts)
w/o Heater: 7.2 liters (7.6 US qts, 6.3 Imp. qts)
3RZ-FE:
7.7 liters (8.1 US qts, 6.8 Imp. qts)

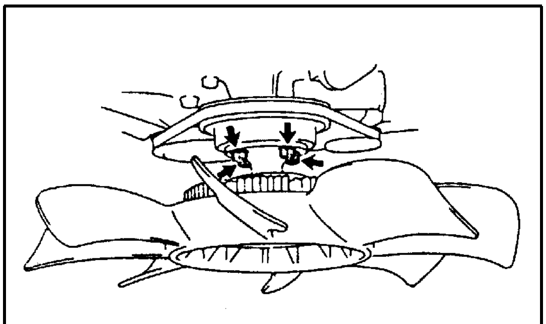
(e) Reinstall the radiator cap.
(f) Warm up the engine and check for leaks.
(g) Recheck the coolant level and refill as necessary.

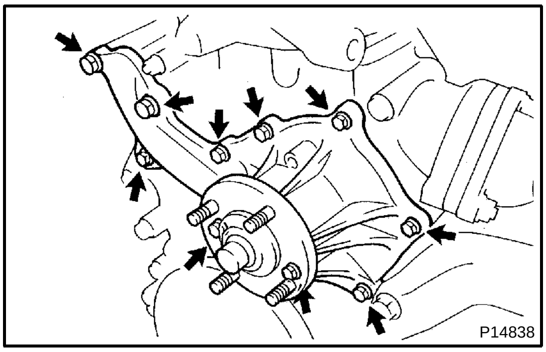
WATER PUMP

COMPONENTS

CO06Y-01




P25546


P14838

CO06Z-01

REMOVAL

1. DRAIN ENGINE COOLANT

2. REMOVE DRIVE BELT, FAN, FLUID COUPLING AND WATER PUMP PULLEY

(a) Stretch the belt and loosen the fan pulley mounting nuts.

(b) Loosen the pivot and adjusting bolts of the alternator, and remove the drive belt.

(c) Remove the 4 nuts fan with fluid coupling and pulley.

Torque: 21 N·m (210 kgf·cm, 16 ft·lbf)

(d) Remove the 4 nuts and fan from the fluid coupling.

3. REMOVE WATER PUMP

Remove the 10 bolts, water pump and gasket.

Torque:

14 mm head bolt : 24.5 N·m (250 kgf·cm, 18 ft·lbf)

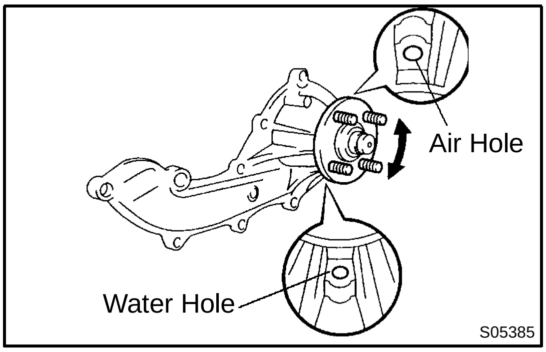
12 mm head bolt : 8.9 N·m (90 kgf·cm, 78 in.·lbf)

HINT:

At the time of assembly, please refer to the following items.

Install the water pump with the new gasket.

CO070-01



INSPECTION

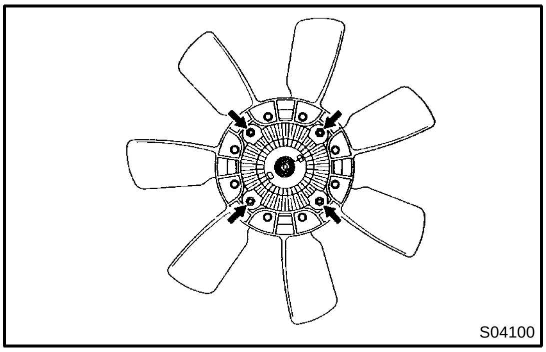
1. INSPECT WATER PUMP

(a) Visually check the air hole and water hole for coolant leakage.

If leakage is found, replace the water pump.

(b) Turn the pulley, and check that the water pump bearing moves smoothly and quietly.

If necessary, replace the water pump.



2. INSPECT FLUID COUPLING

(a) Remove the 4 nuts and fan from the fluid coupling.

(b) Check the fluid coupling for damage and silicon oil leakage.

If necessary, replace the fluid coupling.

(c) Install the fan and fluid coupling with the 4 nuts.

Torque: 5.5 N·m (55 kgf·cm, 49 in.·lbf)

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CO071-01

INSTALLATION

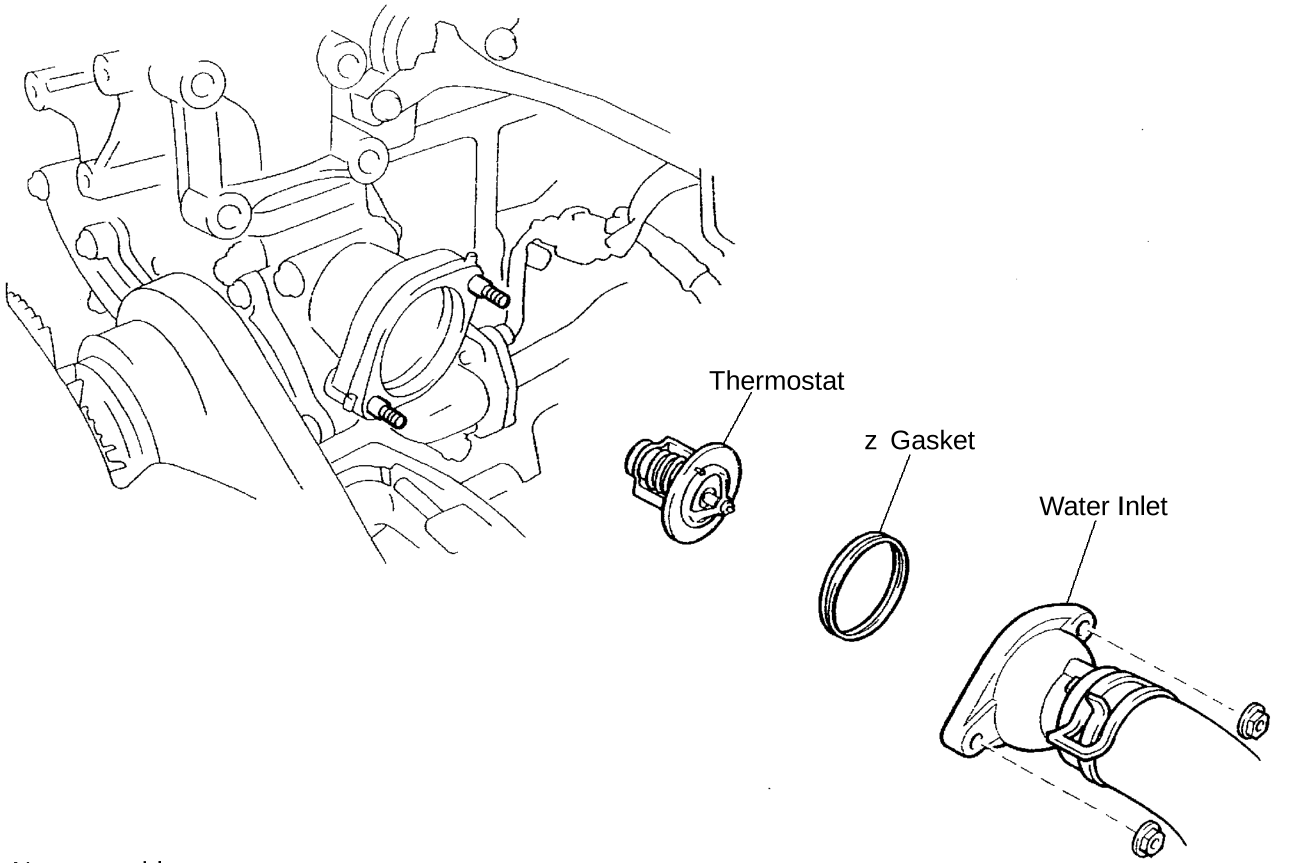
Installation is in the reverse order of removal.

(See page CO–4)

THERMOSTAT

COMPONENTS

CO072-01



z Non-reusable part

P23587

CO073-01

REMOVAL

HINT:

Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. DRAIN ENGINE COOLANT

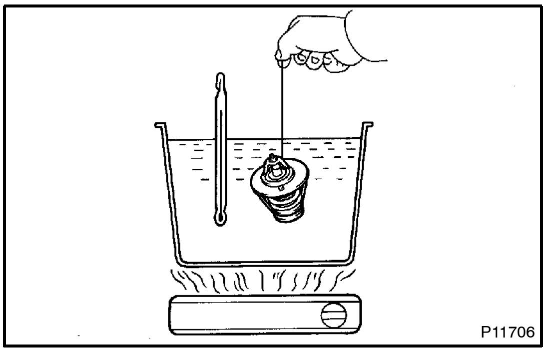
2. DISCONNECT WATER INLET WITH LOWER RADIATOR HOSE, AND REMOVE THERMOSTAT

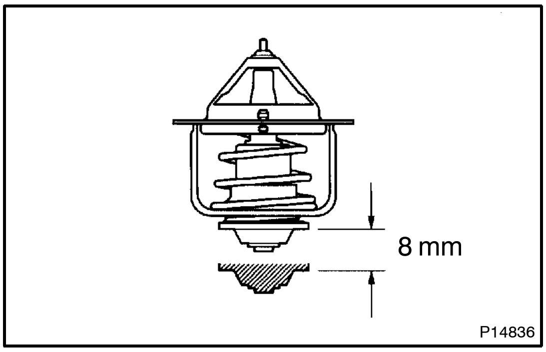
(a) Remove the 2 nuts holding the water inlet to the inlet housing, and disconnect the water inlet from the inlet housing.

(b) Remove the thermostat.

(c) Remove the gasket from the thermostat.

CO074-01


P11706



P14836

INSPECTION

INSPECT THERMOSTAT

HINT:
The thermostat is numbered with the valve opening temperature.

(a) Immerse the thermostat in water and gradually heat the water.

(b) Check the valve opening temperature.
Valve opening temperature:
80 – 84°C (176 – 183°F)

If the valve opening temperature is not as specified, replace the thermostat.

(c) Check the valve lift
Valve lift:
At 95°C (203°F): 8 mm (0.31 in.) or more

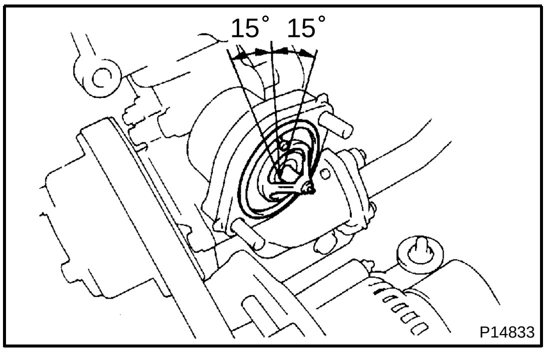
If the valve lift is not as specified, replace the thermostat.

(d) Check that the valve is fully closed when the thermostat is at low temperatures (below 40°C (104°F)).

If not closed, replace the thermostat.

CO075-01

INSTALLATION



P14833

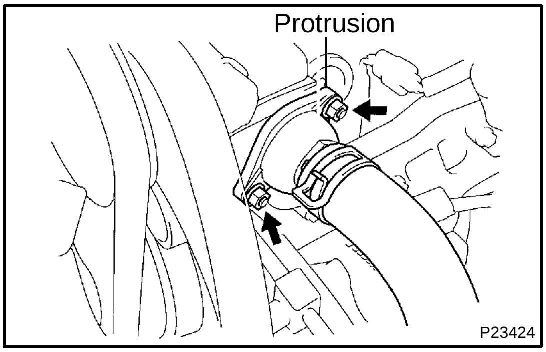
1. PLACE THERMOSTAT IN WATER INLET HOUSING

(a) Install a new gasket to the thermostat.

(b) Align the jiggle valve of the thermostat with the protrusion of the water inlet housing, and insert the thermostat in the water inlet housing.

HINT:

The jiggle valve may be set within 15° of either side of the prescribed position.



P23424

2. CONNECT WATER INLET WITH LOWER RADIATOR HOSE

Install the water inlet with the 2 nuts.

HINT:

Facing the top mark (protrusion) upward.

Torque:20 N·m (200 kgf·cm, 15 ft·lbf)

3. FILL WITH ENGINE COOLANT

4. START ENGINE AND CHECK FOR LEAKS

RADIATOR

CO076-02

ON-VEHICLE CLEANING

Using water or a steam cleaner, remove any mud or dirt from the radiator core.

NOTICE:

If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. (i.e. Maintain a distance between the cleaner nozzle radiator core)

CO077-01

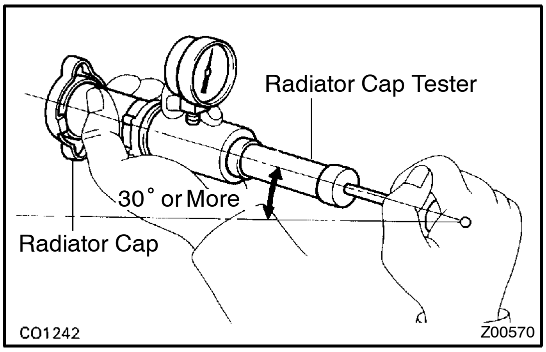
ON–VEHICLE INSPECTION

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

(a) Using a radiator cap tester, slowly pump the tester and check that air is coming from 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 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.

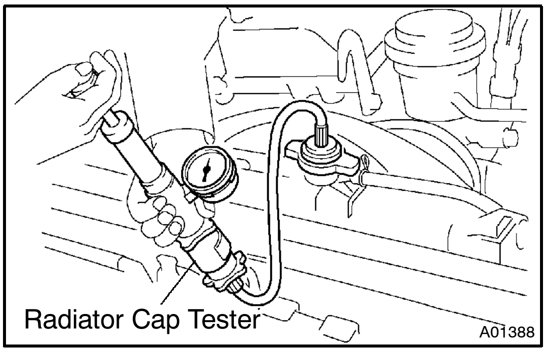
Standard opening pressure:
93 – 123 kPa (0.95 – 1.25 kgf/cm^2, 13.1 – 18.2 psi)
Minimum opening pressure:
59 kPa (0.6 kgf/cm^2, 8.5 psi)

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



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

(b) Warm up the engine.

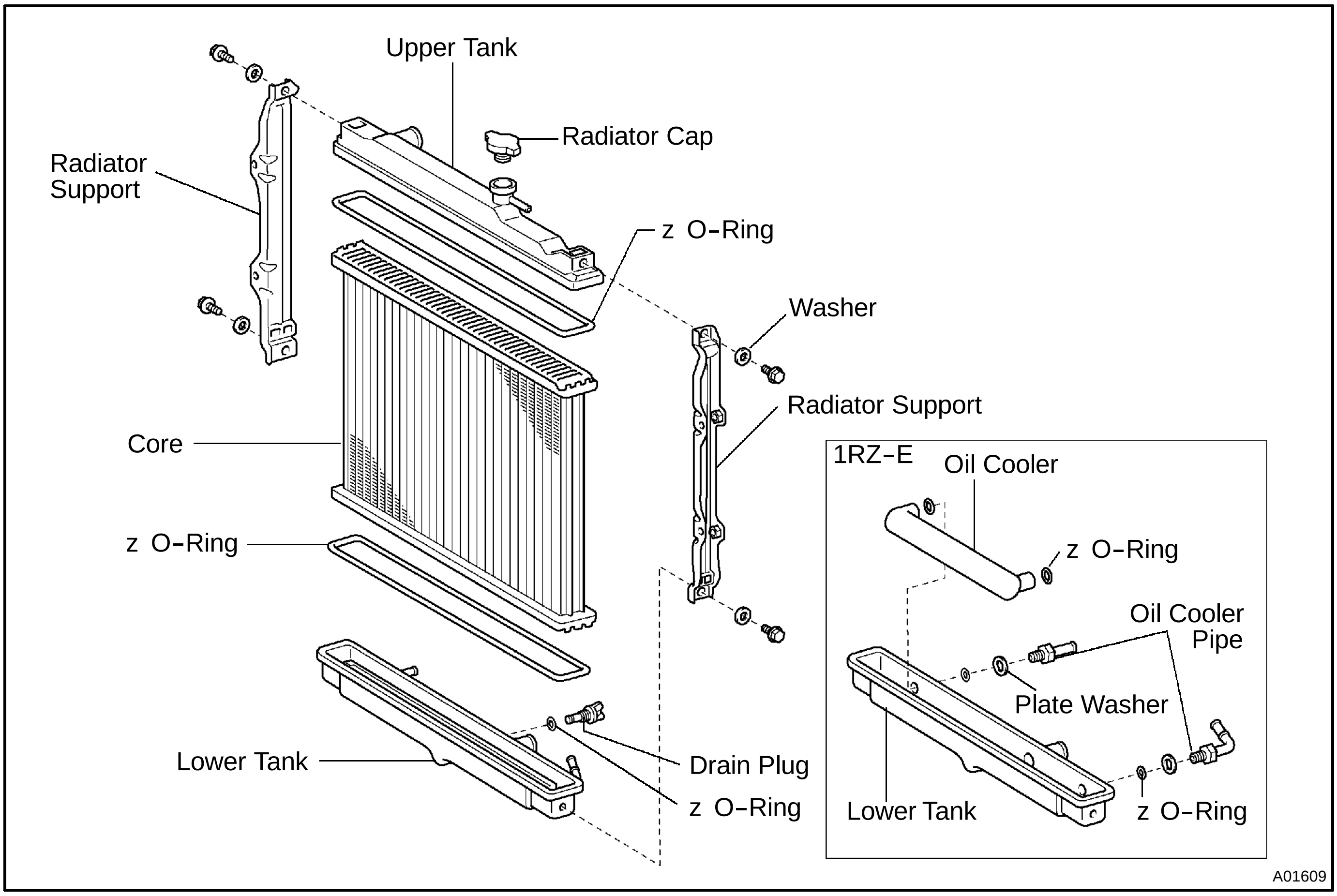
(c) Pump it to 118 kPa (1.2 kgf/cm^2, 17.1 psi), and check that the pressure does not drop.

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.

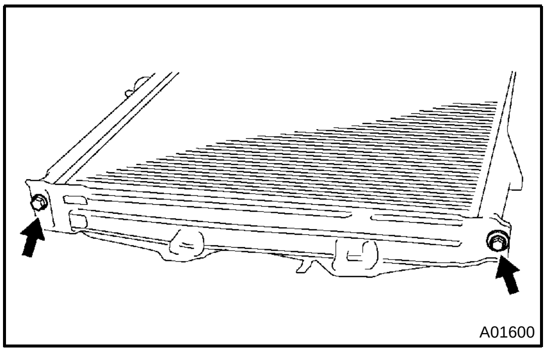
4. REINSTALL RADIATOR CAP

CO078-01

COMPONENTS



CO079-01

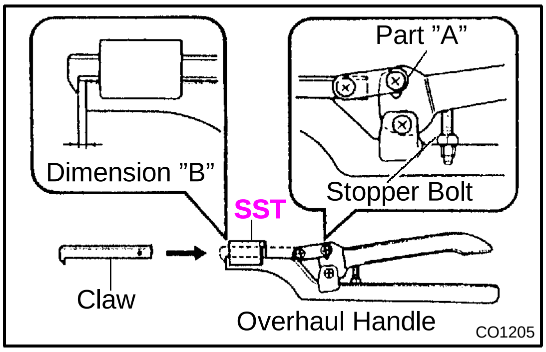


DISASSEMBLY

1. REMOVE RADIATOR SUPPORTS

(a) Remove the 4 bolts and 2 radiator supports.

2. REMOVE DRAIN PLUG



3. ASSEMBLE SST

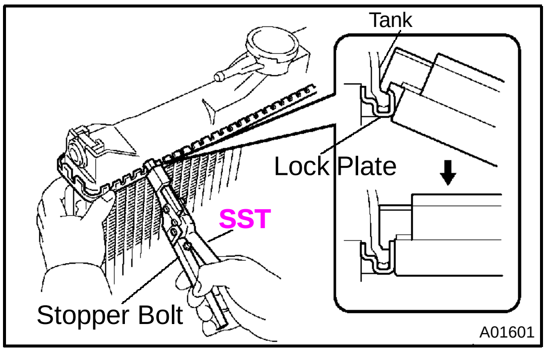
SST 09230 – 01010

(a) Install the claw to the overhaul handle, inserting it in the hole in part ”A” as shown in the diagram.

(b) While gripping the handle, adjust the stopper bolt so that dimension ”B” shown in the diagram is 0.2 – 0.3 mm (0.008 – 0.012 in.).

NOTICE:

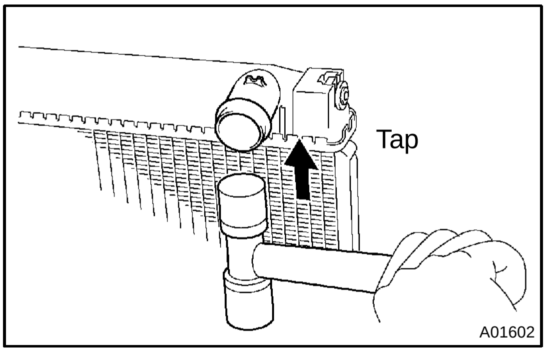
If this adjustment is not done, the claw may be damaged.



4. UNCAULK LOCK PLATES

Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.

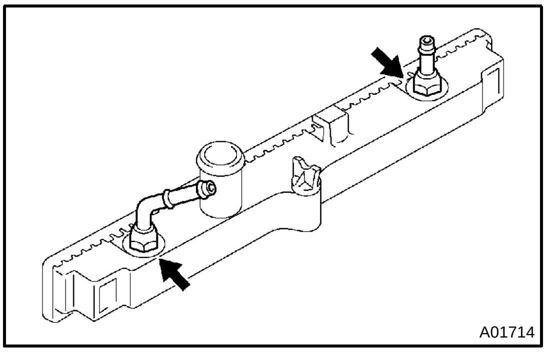
SST 09230 – 01010



5. REMOVE TANKS AND O–RINGS

(a) Lightly tap the radiator port (inlet or outlet) with a soft–faced hammer, and remove the tank.

(b) Remove the O–ring.



6. 1RZ–E:
REMOVE OIL COOLER FROM LOWER TANK

(a) Remove the pipes.

HINT:

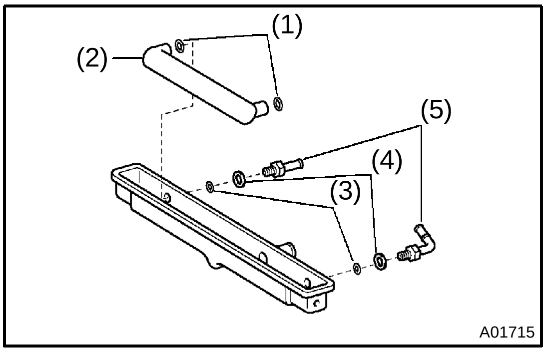
Make a note of the direction to face the pipes.

(b) Remove the nuts and plate washers.

(c) Remove the oil cooler and O–rings.

CO07A–01

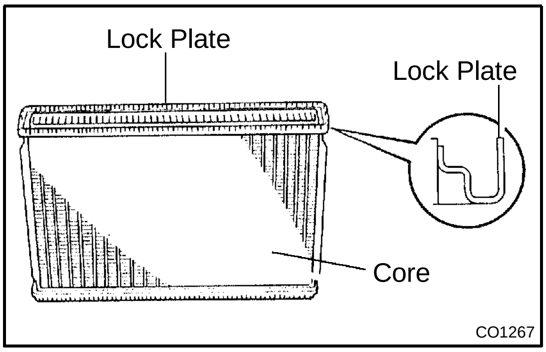
REASSEMBLY



1. 1RZ–E: INSTALL OIL COOLER TO LOWER TANK

(a) Clean the O–ring contact surface of the lower tank and oil cooler.
(b) Install new O–rings (1) to the oil cooler (2).
(c) Install the oil cooler with the O–rings to the lower tank (3).
(d) Install the plate washers (4)
Torque:8.3 N·m (85 kgf·cm, 74 in.·lbf)
(e) Install the pipes (5).
Torque:22 N·m (220 kgf·cm, 16 ft·lbf)

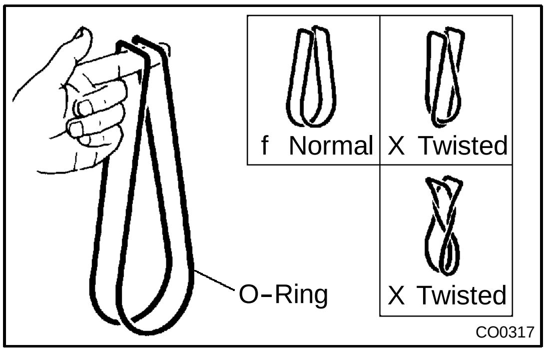
HINT:
Face the pipes in the same direction as before disassembly.



2. INSPECT LOCK PLATE

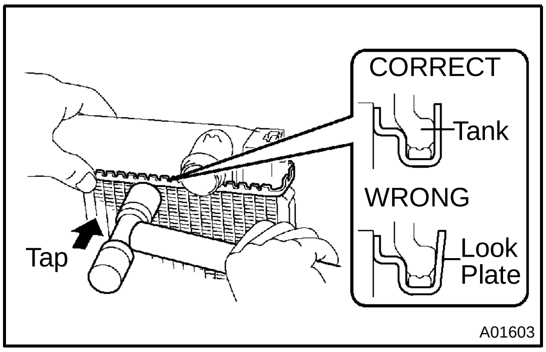
Inspect the lock plate for damage.
HINT:
- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or similar object. Water leakage will result if the bottom of the lock plate groove is damaged or dented. Therefore, repair or replace if necessary.

NOTICE:
The radiator can only be recaulked 2 times.
After the 2nd time, the radiator core must be replaced.

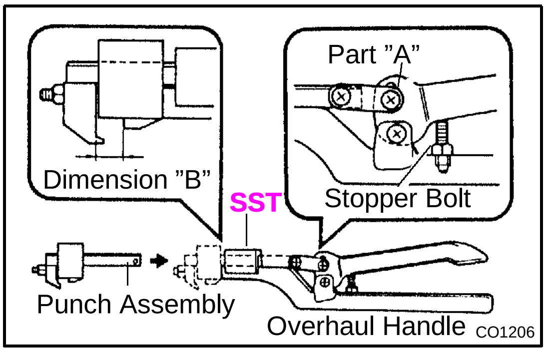


3. INSTALL NEW O–RINGS AND TANKS

(a) After checking that there are no foreign objects in the lock plate groove, install the new O–ring without twisting it.
HINT:
When cleaning the lock plate groove, lightly rub it with sand paper without scratching it.
(b) Install the tank without damaging the O–ring.



(c) Tap the lock plate with a soft–faced hammer so that there is no gap between it and the tank.



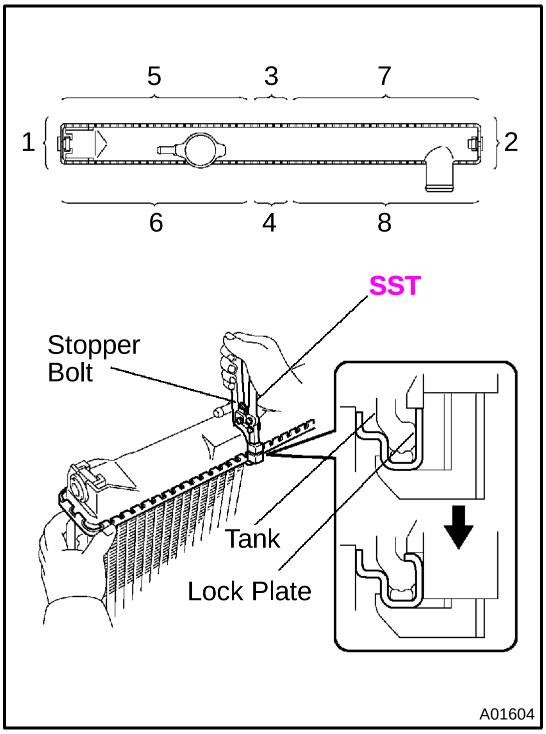
4. ASSEMBLE SST

SST 09230 – 01010, 09231 – 14010

(a) Install the punch assembly to the overhaul handle, inserting it in the hole in part "A" as shown in the illustration.

(b) While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram.

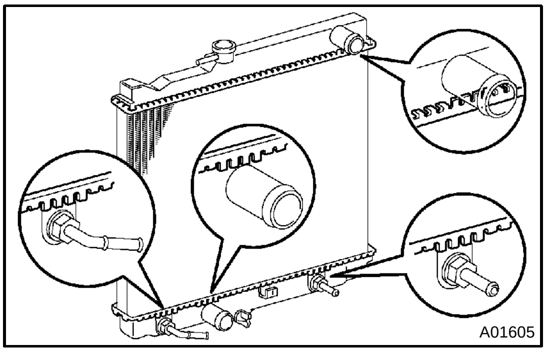
Dimension "B": 8.4 mm (0.34 in.)



5. CAULK LOCK PLATE

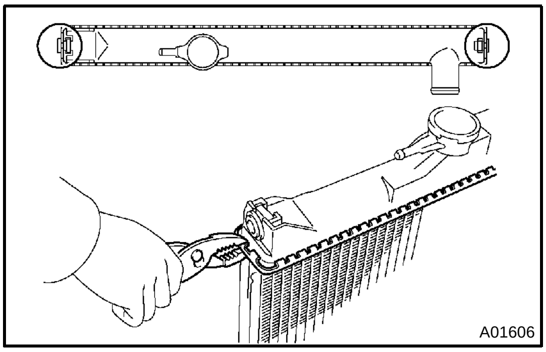
(a) Lightly press SST against the lock plate in the order shown in the illustration. After repeating this a few times, fully caulk the lock plate by squeezing the handle until stopped by the stopper bolt.

SST 09230 – 01010



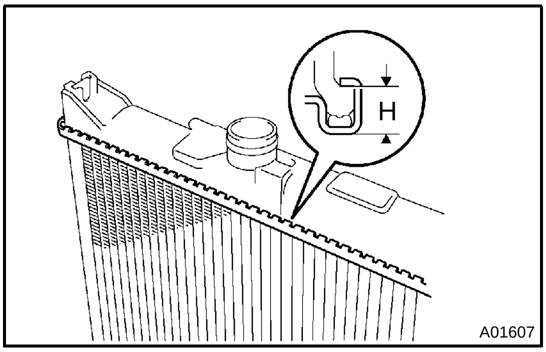
HINT:

- Do not stake the areas protruding around the ports.



- The points shown in the rib sides near here cannot be staked with SST. Use pliers or similar object and be careful not to damage the core plates.

CONTINUED



(b) Check the lock plate height (H) after completing the caulking.

Plate height (H):
7.4 – 7.8 mm (0.2959 – 0.3119 in.)

If not within the specified height, adjust the stopper bolt of the handle again and caulk again.

6. PAINT LOCK PLATES

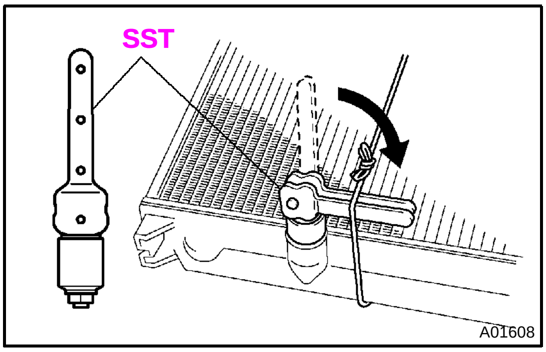
7. INSTALL DRAIN PLUG

(a) Install a new O–ring to the drain plug.
(b) Apply soapy water to the O–ring.
(c) Install the drain plug.

8. INSTALL RADIATOR SUPPORTS

Install the 4 bolt and 2 radiator supports

Torque:13 N·m (130 kgf·cm, 9.6 ft·lbf)



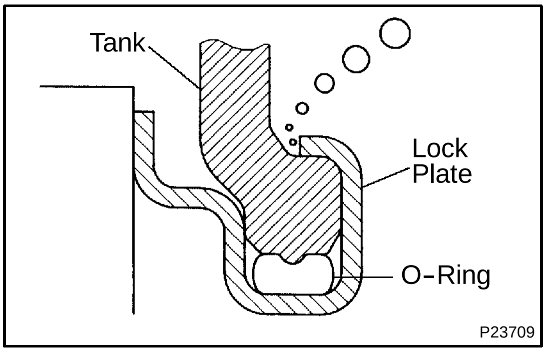
9. CHECK FOR WATER LEAKS

(a) Using SST, plug the inlet and outlet pipes of the radiator.

SST 09230 – 01010

(b) Using a radiator cap tester, apply pressure to the radiator.

Test pressure:
147 kPa (1.5 kgf/cm^2, 21 psi)



(c) Check for water leaks.

HINT:
On radiators with resin tanks, there is a clearance between the core plate and tank plate where a minute amount of air will remain, giving the appearance of an air leak when the radiator is submerged in water. Therefore, before performing the water leak test, first swirl the radiator around in the water until all air bubbles disappear.

LUBRICATION

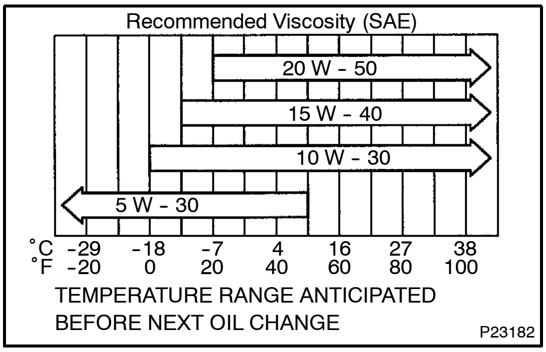
REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
1RZ, 2RZ, 2RZ–E Engine Repair Manual	RM167E
2RZ, 2RZ–E Engine Repair Manual	RM558E
3RZ–F, 3RZ–FE Engine Repair Manual	RM521E
1RZ–E Engine Repair Manual Suplement	RM467E

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

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX



OIL AND FILTER

LU03V-01

INSPECTION

1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is visibly poor, replace the oil.

Oil grade:

API grade SH Energy-Conserving II or SJ Energy-Conserving or ILSAC multigrade engine oil. Recommended viscosity is as shown in the illustration.

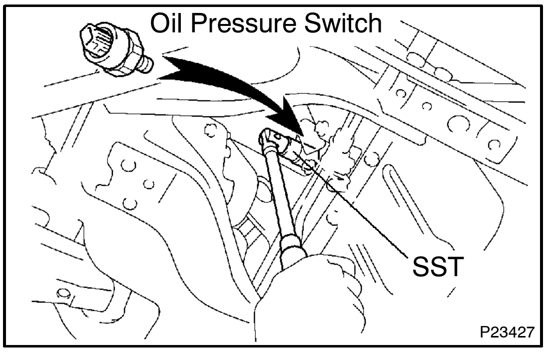
2. CHECK ENGINE OIL LEVEL

After warning up the engine and then 5 mnutes after the engine stop, oil level should be between ”L” and ”F” of the dipstick.

If low, check for leakage and add oil up to ”F” mark.

NOTICE:

- **Do not fill with engine oil above the ”F” mark.**
- **When inserting the dipstick, insert the curved tip of the dipstick facing the same direction as the curve of the guide.**
- **If the dipstick gets caught while inserting it, do not force it in. Reconfirm the direction of the dipstick.**



3. REMOVE OIL PRESSURE SWITCH

Using SST, remove the oil pressure switch.

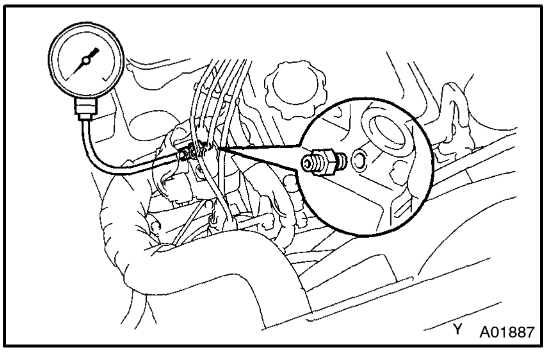
SST 09816-30010

4. INSTALL OIL PRESSURE GAUGE

Install an oil pressure gauge to an adaptor.

5. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.



6. INSPECT OIL PRESSURE

Oil pressure:

At idle

29 kPa (0.3 kgf/cm^2, 4.3 psi) or more

At 3,000 rpm

245 – 490 kPa (2.5 – 5.0 kgf/cm^2, 36 – 71 psi)

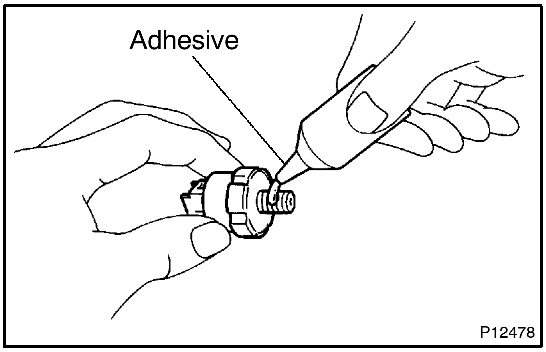
7. REMOVE OIL PRESSURE GAUGE

8. REINSTALL OIL PRESSURE SWITCH

CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX



(a) Apply adhesive to 2 or 3 threads of the oil pressure switch.
Adhesive:
Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent

(b) Using SST, install the oil pressure switch.
SST 09816-30010

9. START ENGINE AND CHECK FOR LEAKS

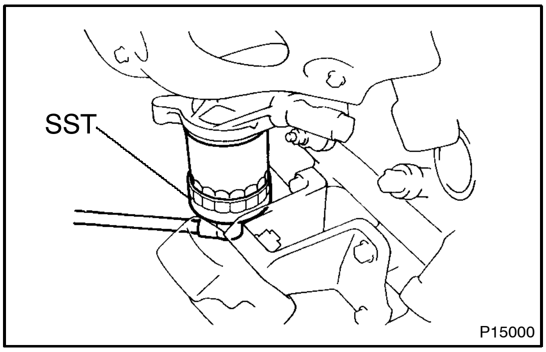
10. OIL AND FILTER REPLACEMENT

CAUTION:

- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.**
- **Care should be taken, therefore, when changing engine, oil to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves that cannot be penetrated by oil should be worn. The skin should be thoroughly washed with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.**
- **In order to preserve the environment, used oil and used oil filters must be disposed of only at designated disposal sites.**

11. DRAIN ENGINE OIL

(a) Remove the oil filler cap.
(b) Remove the oil drain plug, and drain the oil into a container.



12. REPLACE OIL FILTER

(a) Using SST, remove the oil filter.
SST 09228-07501
(b) Check and clean the oil filter installation surface.
(c) Apply clean engine oil to the gasket of a new oil filter.
(d) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
(e) Using SST, tighten it an additional 3/4 turn.
SST 09228-07501

13. REFILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket.
Torque:37 N·m (375 kgf·cm, 27 ft·lbf)

CONTINUED

(b) Fill with fresh engine oil.

Oil capacity
2WD:
Dry fill
5.1 liters (5.4 US qts, 4.5 Imp. qts)
Drain and refill
w/ Oil filter change
4.7 liters (5.0 US qts, 4.1 Imp. qts)
w/o Oil filter change
4.0 liters (4.2 US qts, 3.5 Imp. qts)
4WD:
Dry fill
6.3 liters (6.7 US qts, 5.5 Imp. qts)
Drain and refill
w/ Oil filter change
6.0 liters (6.3 US qts, 5.3 Imp. qts)
w/o Oil filter change
5.3 liters (5.6 US qts, 4.7 Imp. qts)

(c) Reinstall the oil filler cap.

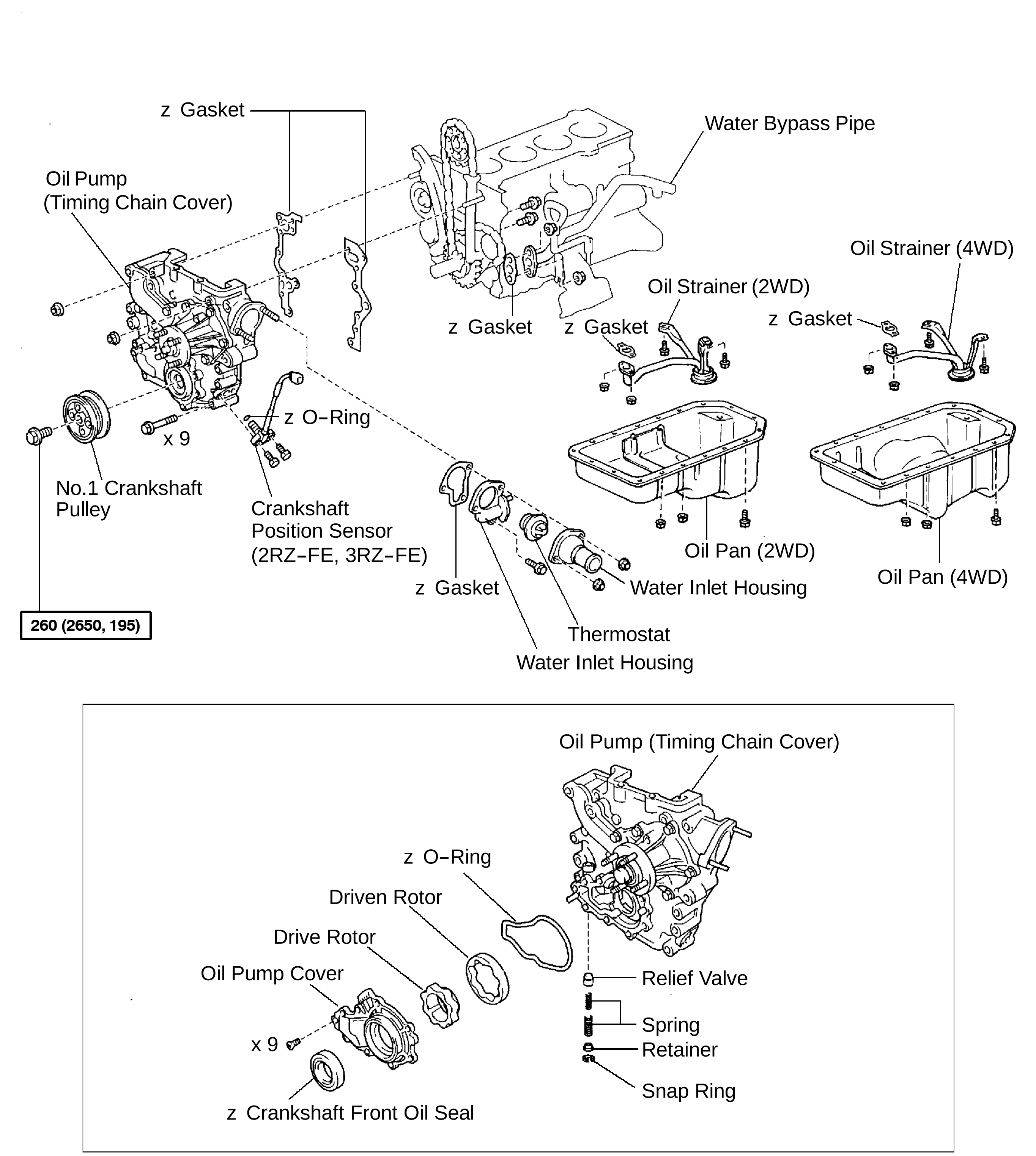
14. START ENGINE AND CHECK FOR LEAKS

15. RECHECK ENGINE OIL LEVEL

OIL PUMP

COMPONENTS

LU03W–01



z Non–reusable part

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

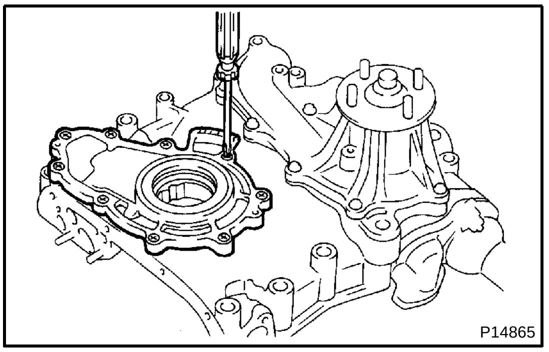
A01716

LU03X-01

REMOVAL

1. REMOVE CYLINDER HEAD ASSEMBLY
(See page EM-40)
2. REMOVE OIL PAN
3. REMOVE WATER INLET AND WATER INLET HOUSING
(a) Remove the 2 nut, water inlet and thermostat.
(b) Remove the bolt and water inlet housing and gasket.
4. REMOVE TIMING CHAIN COVER
(See page EM-22)

LU03Y-01



P14865

DISASSEMBLY

1. REMOVE DRIVE AND DRIVEN ROTORS

Remove the 9 screws, pump cover, drive rotor, driven rotor and O-ring.

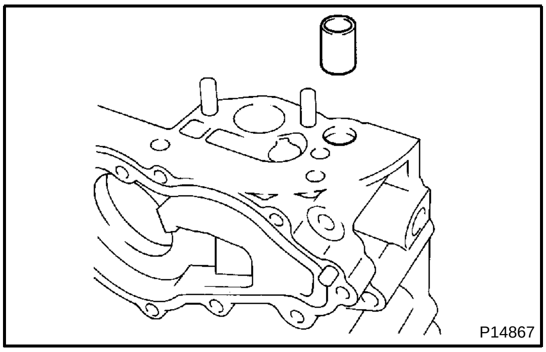
2. REMOVE RELIEF VALVE

(a) Using snap ring pliers, remove the snap ring.

(b) Remove the retainer, spring(s) and relief valve.

LU03Z-01

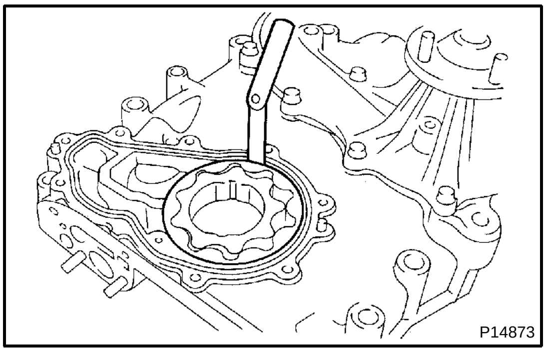
INSPECTION


P14867

1. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If it does not, replace the relief valve. If necessary, replace the oil pump assembly.

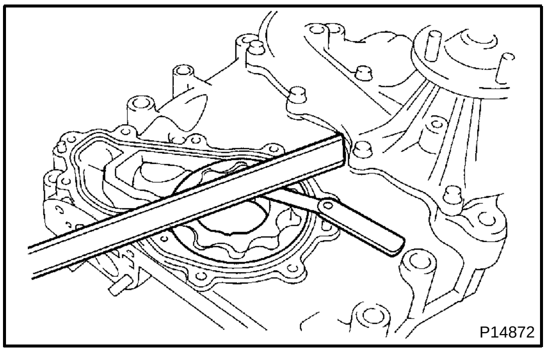

P14873

2. INSPECT ROTOR BODY CLEARANCE

Using a thickness gauge, measure the clearance between the driven rotor and body.

Standard body clearance:
0.100 – 0.175 mm (0.0039 – 0.0069 in.)
Maximum body clearance:
0.30 mm (0.0118 in.)

If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.

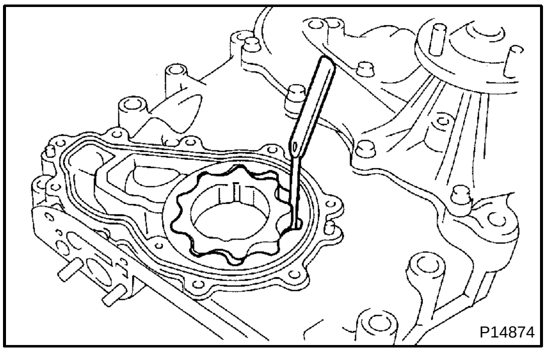

P14872

3. INSPECT ROTOR SIDE CLEARANCE

Using a thickness gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

Standard side clearance:
0.030 – 0.090 mm (0.0012 – 0.0035 in.)
Maximum side clearance: 0.15 mm (0.0059 in.)

If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.


P14874

4. INSPECT ROTOR TIP CLEARANCE

Using a thickness gauge, measure the clearance between the drive and driven rotor tips.

Standard tip clearance:
0.110 – 0.240 mm (0.0043 – 0.0094 in.)
Maximum tip clearance:
0.25 mm (0.0098 in.)

If the tip clearance is greater than maximum, replace the rotors as a set.

CLICK HERE TO VIEW CHAPTER INDEX
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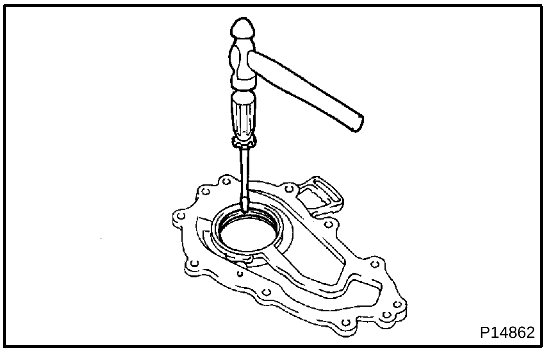
LU040-01

REPLACEMENT

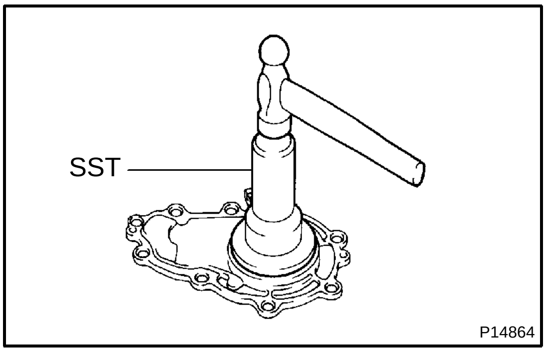


HINT:

There are 2 methods (A and B) to replace the oil seal which are as follows:

1. IF OIL PUMP IS REMOVED FROM CYLINDER BLOCK

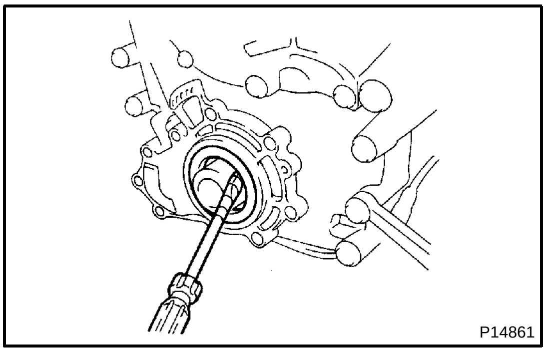
(a) Using a screwdriver and a hammer, tap out the oil seal.



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.

SST 09223–50010

(c) Apply MP grease to the oil seal lip.

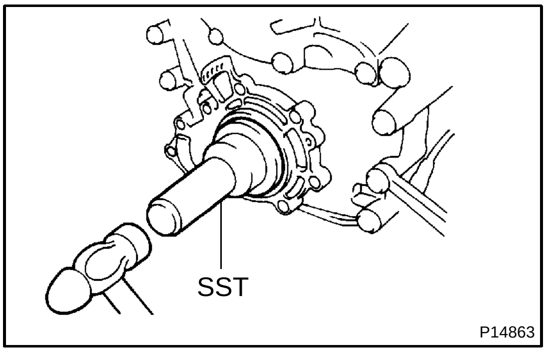


2. IF OIL PUMP IS INSTALLED TO CYLINDER BLOCK

(a) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the crankshaft. Tape the screwdriver tip.

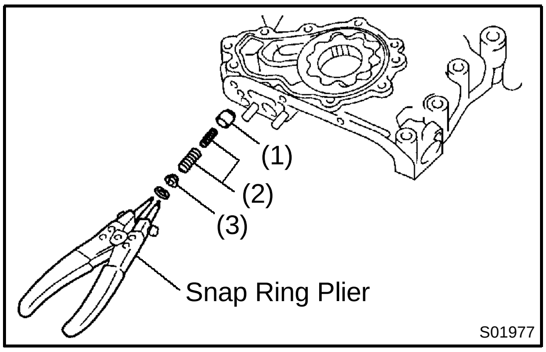


(b) Apply MP grease to a new oil seal lip.

(c) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.

SST 09223–50010

LU041-01



REASSEMBLY

1. INSTALL RELIEF VALVE

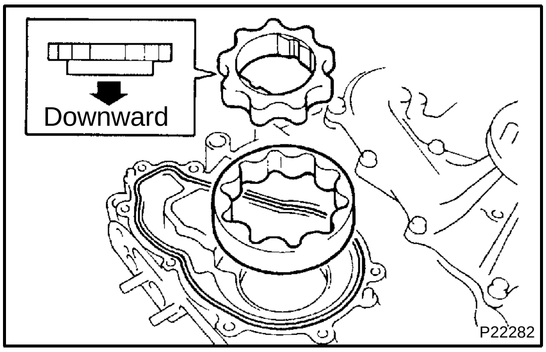
(a) Install these parts:

(1) Relief valve

(2) Spring(s)

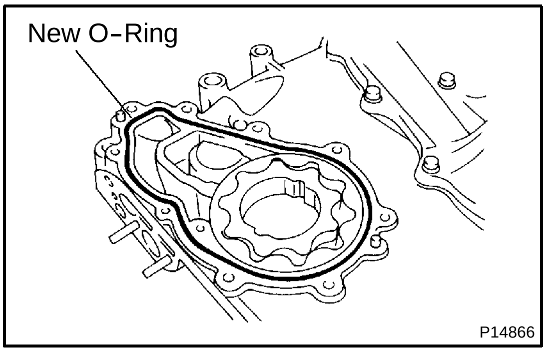
(3) Retainer

(b) Using snap ring pliers, install the snap ring.



2. INSTALL DRIVE AND DRIVEN ROTORS

(a) Place the drive and driven rotors into the pump body.



(b) Place a new O–ring to the pump body.

(c) Install the pump cover with the 9 screws.

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LU042-01

INSTALLATION

1. INSTALL TIMING CHAIN COVER.
(See page EM-26)
2. INSTALL WATER INLET AND WATER INLET HOUSING
3. INSTALL OIL PAN
4. INSTALL CYLINDER HEAD ASSEMBLY.
(See page EM-54)

IGNITION

REFER TO FOLLOWING REPAIR MANUALS:

Manual Name	Pub. No.
1RZ, 2RZ, 2RZ–E Engine Repair Manual	RM167E
2RZ, 2RZ–E Engine Repair Manual	RM558E
3RZ–F, 3RZ–FE Engine Repair Manual	RM521E
1RZ–E Engine Repair Manual Suplement	RM467E

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

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IGNITION SYSTEM (2RZ-FE, 3RZ-FE)

IG04B-01

ON-VEHICLE INSPECTION

NOTICE:

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

1. INSPECT IGNITOR AND SPARK TEST

Check that the spark occurs.

(1) Disconnect the high-tension cords from the spark plugs.

(2) Remove the spark plugs.

(3) Install the spark plugs to each high-tension cord.

(4) Ground the spark plug.

(5) Check if spark occurs while engine is being cranked.

NOTICE:

To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 1 - 2 seconds at a time.

If the spark does not occur, perform the test as follows:

Check	Result	Action
SPARK TEST	NO → next	
CHECK CONNECTION OF IGNITION COIL AND IGNITER	BAD	Connect securely.
OK ↓		
CHECK RESISTANCE OF HIGH-TENSION CORD (See step 2.) **Maximum resistance; 25 kΩ per cord**	BAD	Replace the cord(s).
OK ↓		
CHECK POWER SUPPLY TO IGNITION COIL AND IGNITER 1. Turn ignition switch to ON. 2. Check that there is battery voltage at ignition coil positive (+) terminal.	BAD	Check wiring between ignition switch to ignition coil and igniter.
OK ↓		
CHECK RESISTANCE OF IGNITION COIL (See step 4.) **Resistance: Cold / Hot** **Secondary 9.7 - 16.7 kΩ / 12.4 - 19.6 kΩ**	BAD	Replace the ignition coil.
OK ↓		
CHECK RESISTANCE OF CAMSHAFT POSITION SENSOR (See step 5.) **Resistance: Cold / Hot** **G⊕ and G⊖ 835 - 1,400 kΩ / 1,060 - 1,645 kΩ**	BAD	Replace the camshaft position sensor.
OK ↓		
CHECK RESISTANCE OF CRANKSHAFT POSITION SENSOR (See page IG-12) **Resistance: Cold / Hot** **NE⊕ and NE⊖ 1,630 - 2,740 kΩ / 2,065 - 3,225 kΩ**	BAD	Replace the crankshaft position sensor.
OK ↓		
CHECK IGT SIGNAL FROM ECM (See page DI-157)	BAD	Check wiring between ECM, ignition coil with igniter, and then try another ECM.
↓		
TRY ANOTHER IGNITER		

CONTINUED

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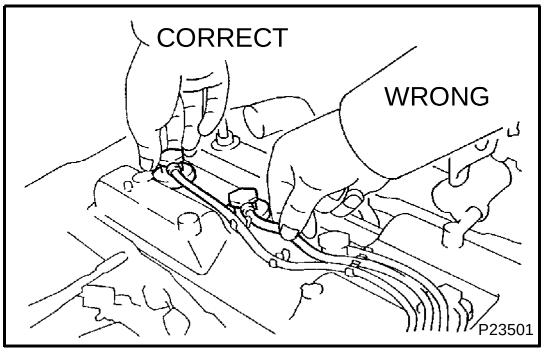


2. INSPECT HIGH-TENSION CORDS

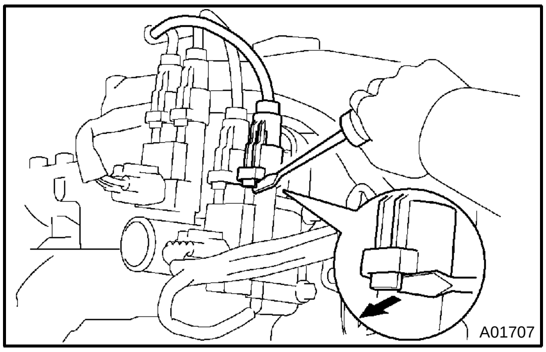
(a) Remove the air cleaner cap and MAF meter assembly.

(b) Remove the intake air connector.

(c) Disconnect the high-tension cords from the spark plugs.

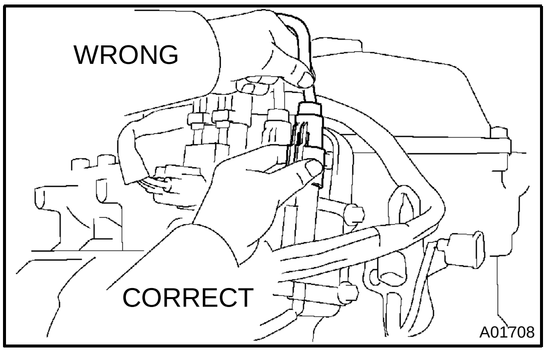
NOTICE:

Pulling on or bending the cords may damage the conductor inside.



(d) Disconnect the high-tension cords from the ignition coils.

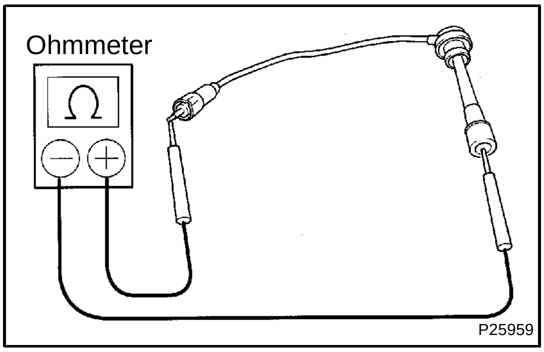
(1) Using a screwdriver, lift up the lock claw and disconnect the holder from the ignition coils.



(2) Disconnect the high-tension cord at the grommet.

NOTICE:

- **Pulling on or bending the cords may damage the conductor inside.**
- **Do not wipe any of the oil from the grommet after the high-tension cord is disconnected.**

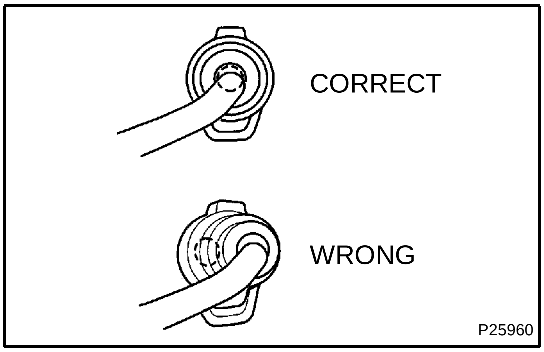


(e) Using an ohmmeter, measure the resistance.

Maximum resistance: 25 kΩ per cord

If the resistance is greater than the maximum, check the terminals.

If necessary, replace the high-tension cord.



(f) Connect the high-tension cords to the ignition coils.

(1) Assemble the holder and grommet.

(2) Align the spline of the ignition coil with the spline of the holder, and push in the cord.

NOTICE:

Check that the holder is correctly installed to the grommet and ignition coil as shown in the illustration.

(3) Check that the lock claw of the holder is engaged by lightly pulling the holder.

CONTINUED

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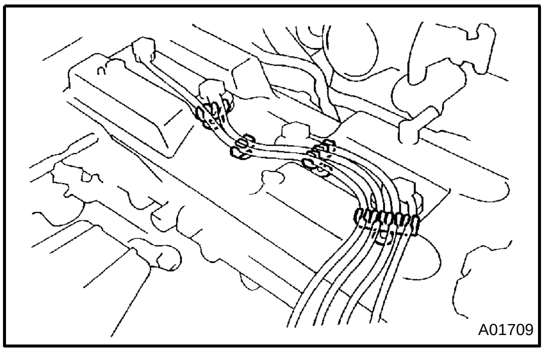
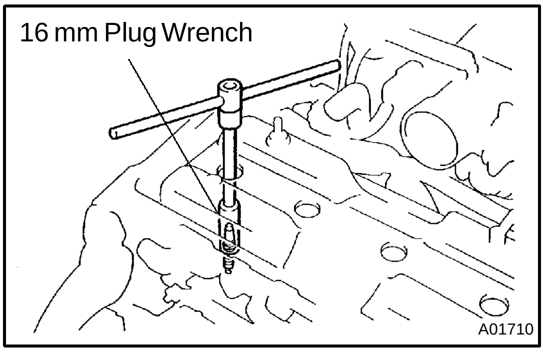
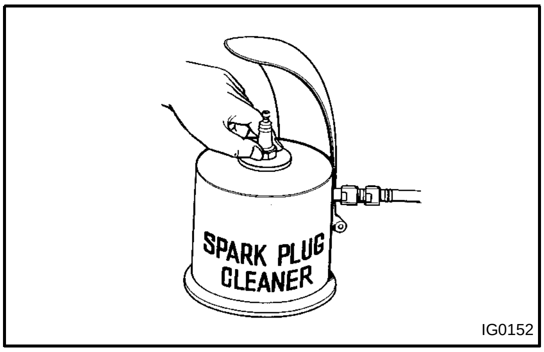


(g) Connect the high-tension cords to the spark plugs. Secure the high-tension cords with the clamps as shown in the illustration.
(h) Install the intake air connector.
(i) Install the air cleaner cap and MAF meter assembly.



3. INSPECT SPARK PLUGS

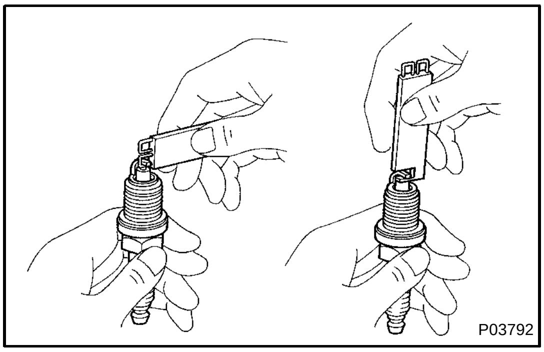
(a) Disconnect the high-tension cords from the spark plugs.
(b) Using a 16 mm plug wrench, remove the spark plug.



(c) Using a spark plug cleaner or wire brush, clean the spark plug.
(d) Check the spark plug for electrode wear, threads damage and insulator damage.

If abnormal, replace the plugs.

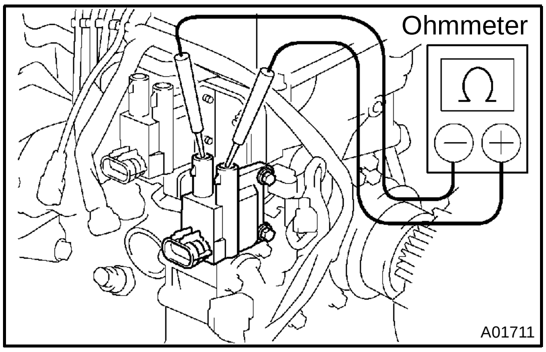
Recommended spark plugs:
ND: K16R-U
NGK: BKR5EYA



(e) Carefully bend the outer electrode to obtain the correct electrode gap.
Correct electrode gap: 0.8 mm (0.031 in.)
(f) Using a 16 mm plug wrench, install the spark plug.
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)
(g) Connect the high-tension cords to the spark plugs.

4. INSPECT IGNITION COIL

(a) Disconnect the high-tension cords from the ignition coil.
(b) Disconnect the ignition coil connectors.



(c) Using an ohmmeter, measure the secondary coil resistance between the positive (+) and high-tension terminals.
Secondary coil resistance:
Cold: 9.7 - 16.7 kΩ
Hot: 12.4 - 19.6 kΩ

If the resistance is not as specified, replace the ignition coil.

(d) Connect ignition coil connectors.
(e) Connect the high-tension cords from the ignition coils.

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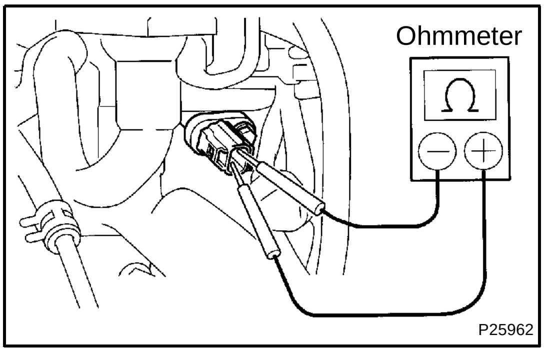


5. INSPECTION CAMSHAFT POSITION SENSOR

(a) Disconnect the camshaft position sensor connector.

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

Resistance:

Cold: 835 - 1,400 Ω

Hot: 1,060 - 1,645 Ω

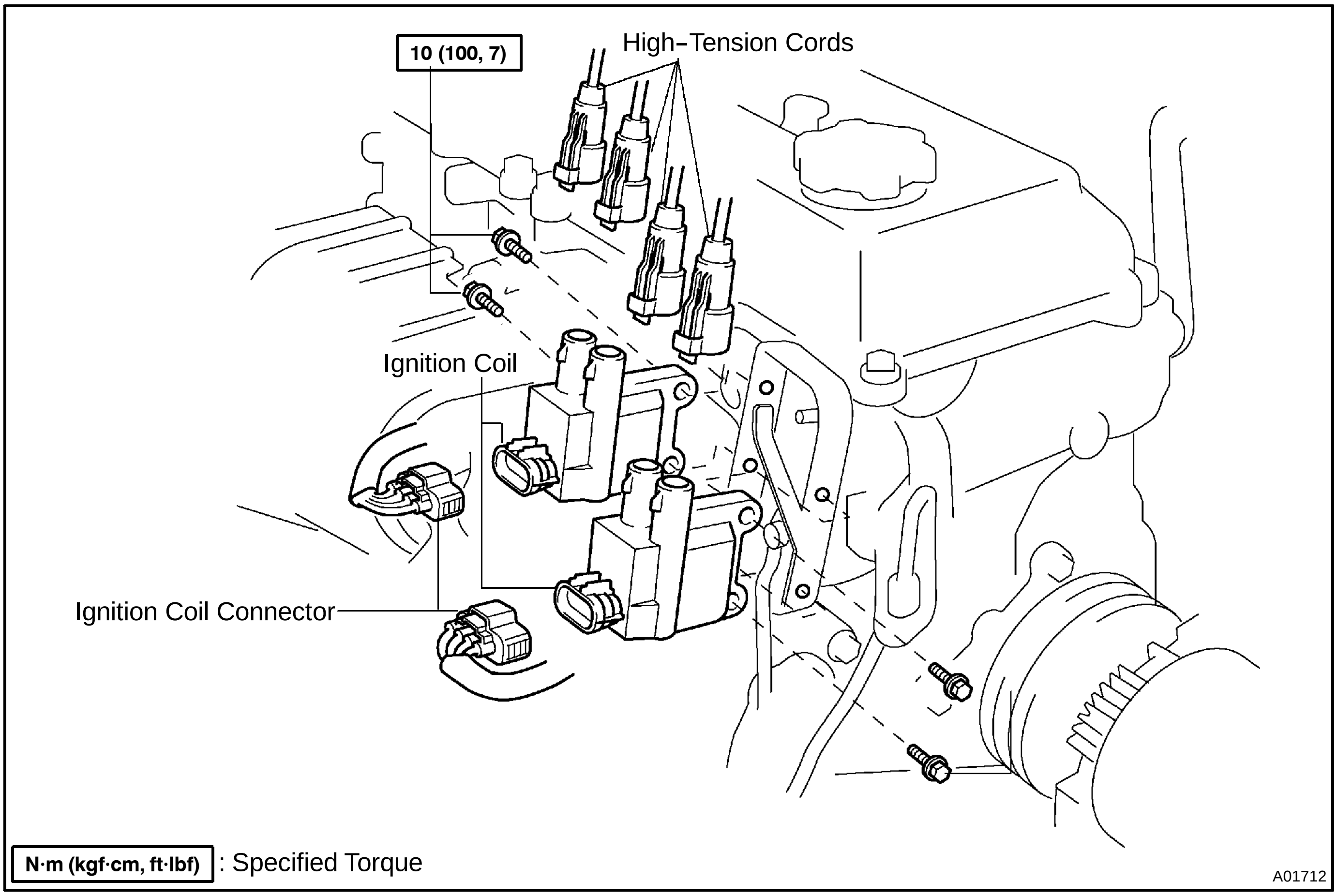
If the resistance is not as specified, replace the camshaft position sensor.

(c) Connect the camshaft position sensor connector.

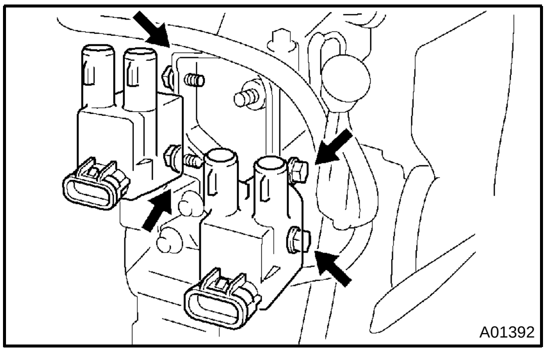
IGNITION COIL (2RZ–FE, 3RZ–FE)

COMPONENTS

IG04C–01



IG04D-01


A01392

REMOVAL

1. DISCONNECT HIGH-TENSION CORDS FROM IGNITION COILS

(See page IG-1)

2. REMOVE IGNITION COILS

(a) Disconnect the 2 connectors from the ignition coils.

(b) Remove the 4 bolts and 2 ignition coils from the bracket.

Torque: 10 N·m (100 kgf·cm, 7 ft·lbf)

HINT:

Arrange the ignition coils in correct order.

IG04E-01

INSTALLATION

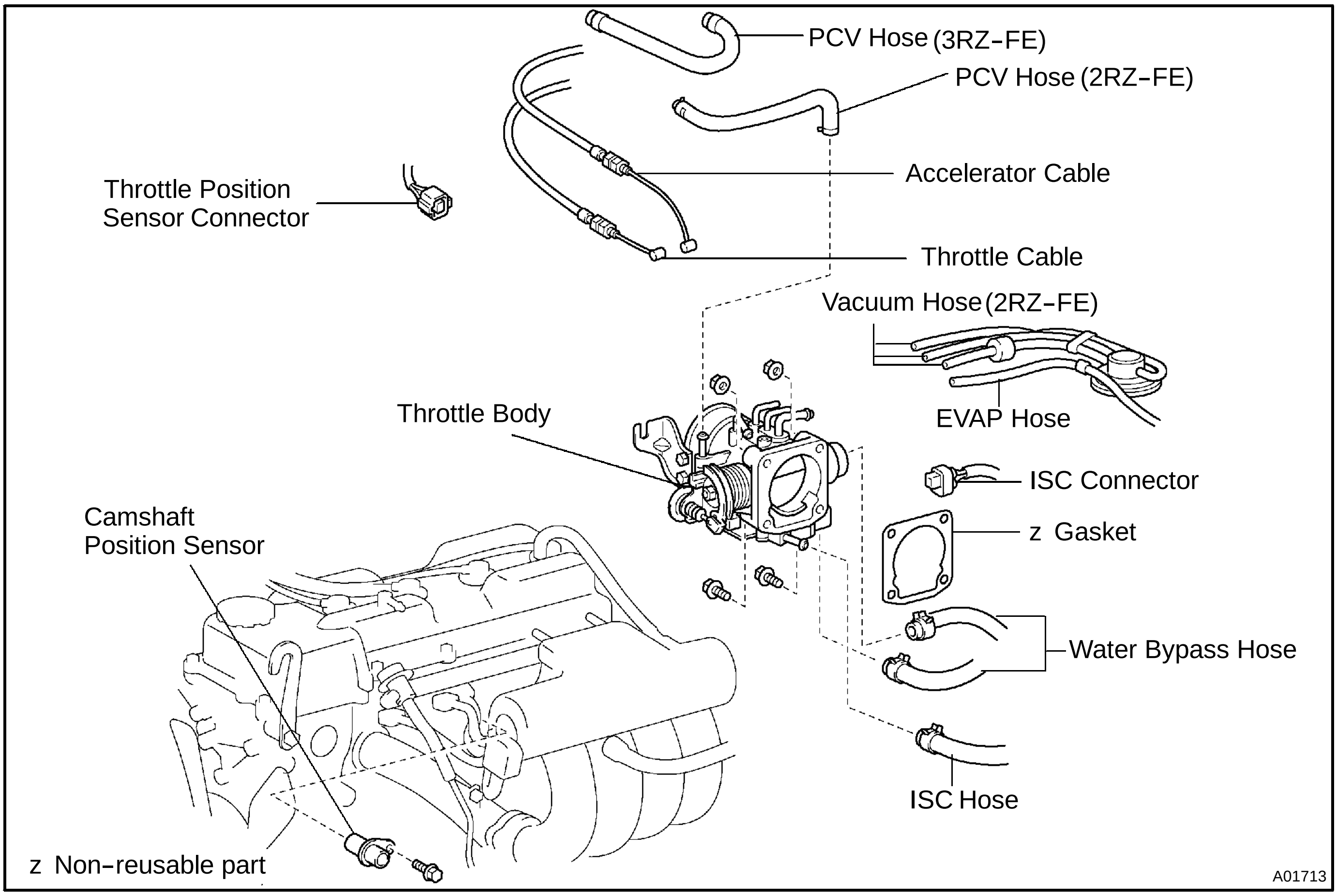
Installation is in the reverse order of removal.

(See page IG-6)

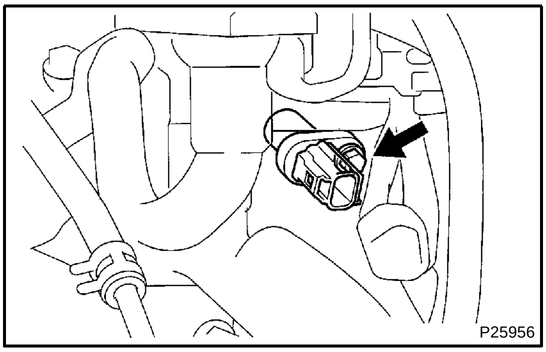
CAMSHAFT POSITION SENSOR (2RZ-FE, 3RZ-FE)

IG04F-01

COMPONENTS



IG04G-02


P25956

REMOVAL

1. REMOVE THROTTLE BODY

(See page FI-42)

2. REMOVE CAMSHAFT POSITION SENSOR

(a) Disconnect the camshaft position sensor connector.

(b) Remove the bolts and camshaft position sensor.

Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)

IG04H-01

INSTALLATION

Installation is in the reverse order of removal.

(See page IG-11)

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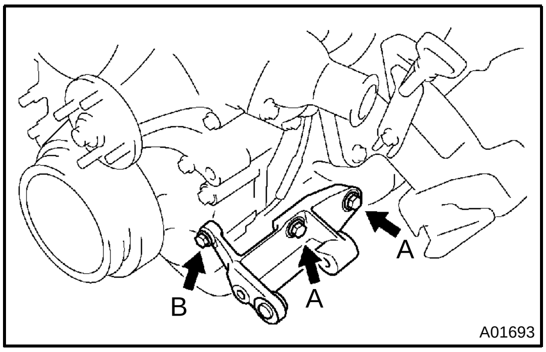


CRANKSHAFT POSITION SENSOR (2RZ–FE, 3RZ–FE)

IG04I–01

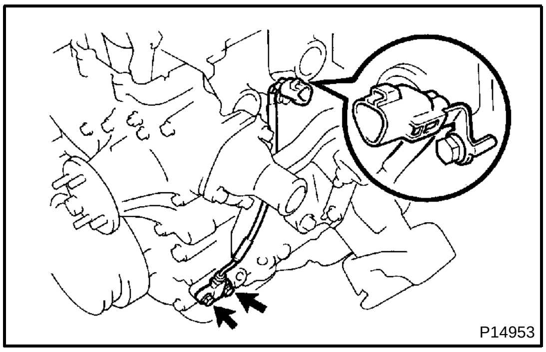
REMOVAL

1. **REMOVE ENGINE UNDER COVER**
2. **REMOVE GENERATOR**
   (See page CH–7)
3. **REMOVE GENERATOR BRACKET**

Remove the 3 bolts and bracket.

Torque:
Bolt A: 74.5 N·m (760 kgf·cm, 55 ft·lbf)
Bolt B: 18 N·m (180 kgf·cm, 13 ft·lbf)

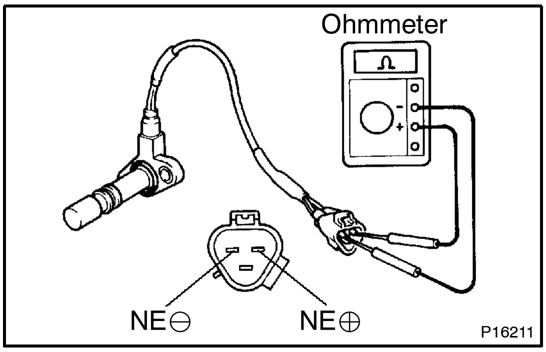
4. **DISCONNECT CRANKSHAFT POSITION SENSOR CONNECTOR**



5. **REMOVE CRANKSHAFT POSITION SENSOR**

(a) Remove the 2 bolts and crankshaft position sensor.
Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)
(b) Remove the O–ring.

HINT:
- At the time of assembly, please refer to the following items.
- Apply a light coat of engine oil on the O–ring.
- Install the crankshaft position sensor with the new O–ring.



IG04J-01

INSPECTION

NOTICE:

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

INSPECT CRANKSHAFT POSITION SENSOR RESISTANCE

Using an ohmmeter, measure the resistance between terminals.

Resistance (NE⊕ and NE⊖):
Cold: 1,630 – 2,740 Ω
Hot: 2,065 – 3,225 Ω

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

IG04K-01

INSTALLATION

Installation is in the reverse order of removal.

(See page IG-11)

STARTING

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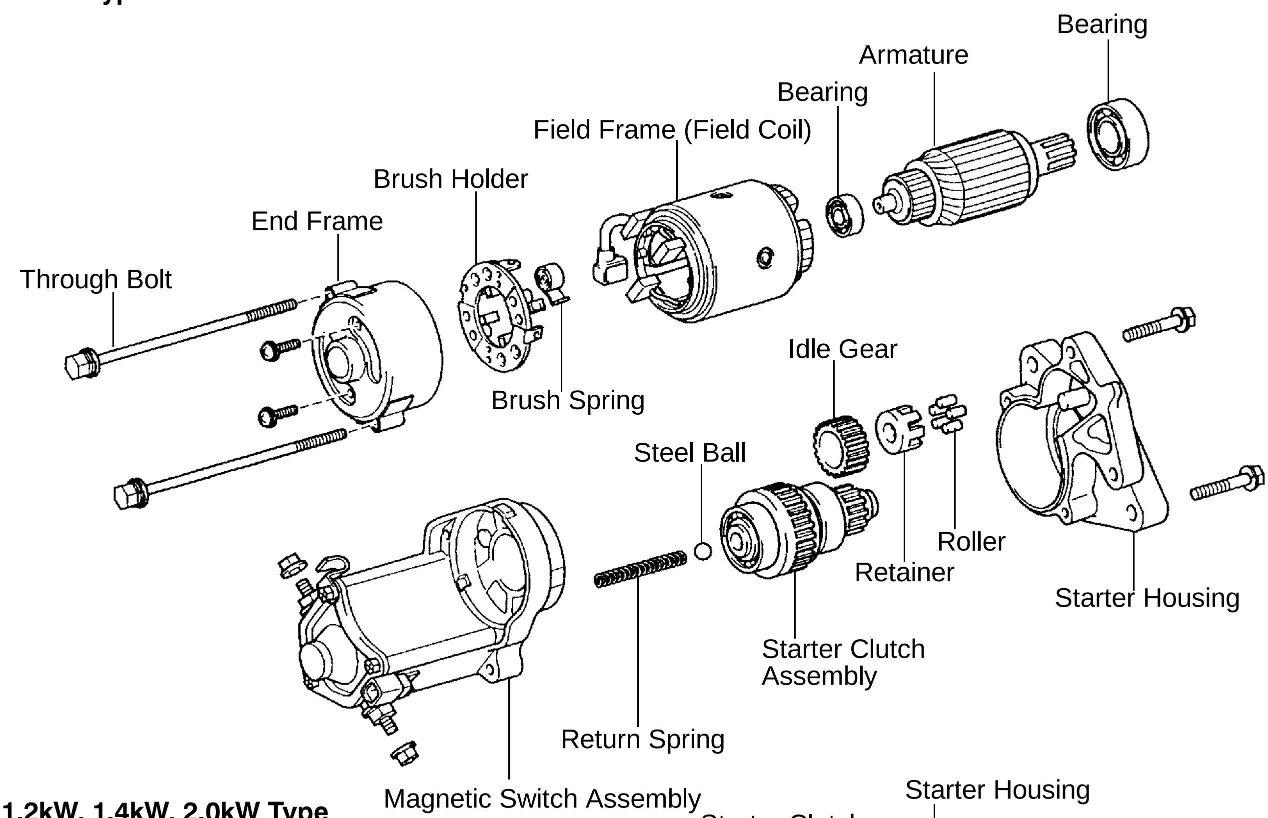
STARTING – STARTER

STARTER

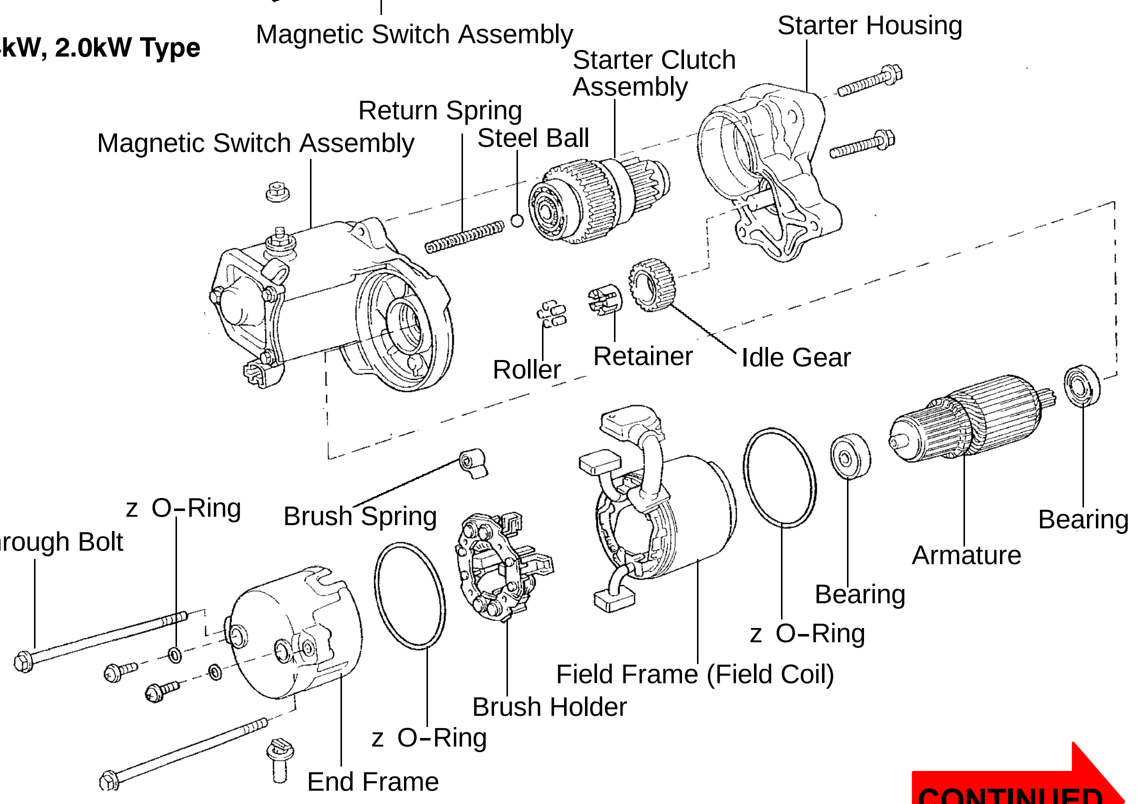
COMPONENTS

ST03S-01

1.0kW Type



1.2kW, 1.4kW, 2.0kW Type



P22914
P25575

z Non-reusable part

A01885

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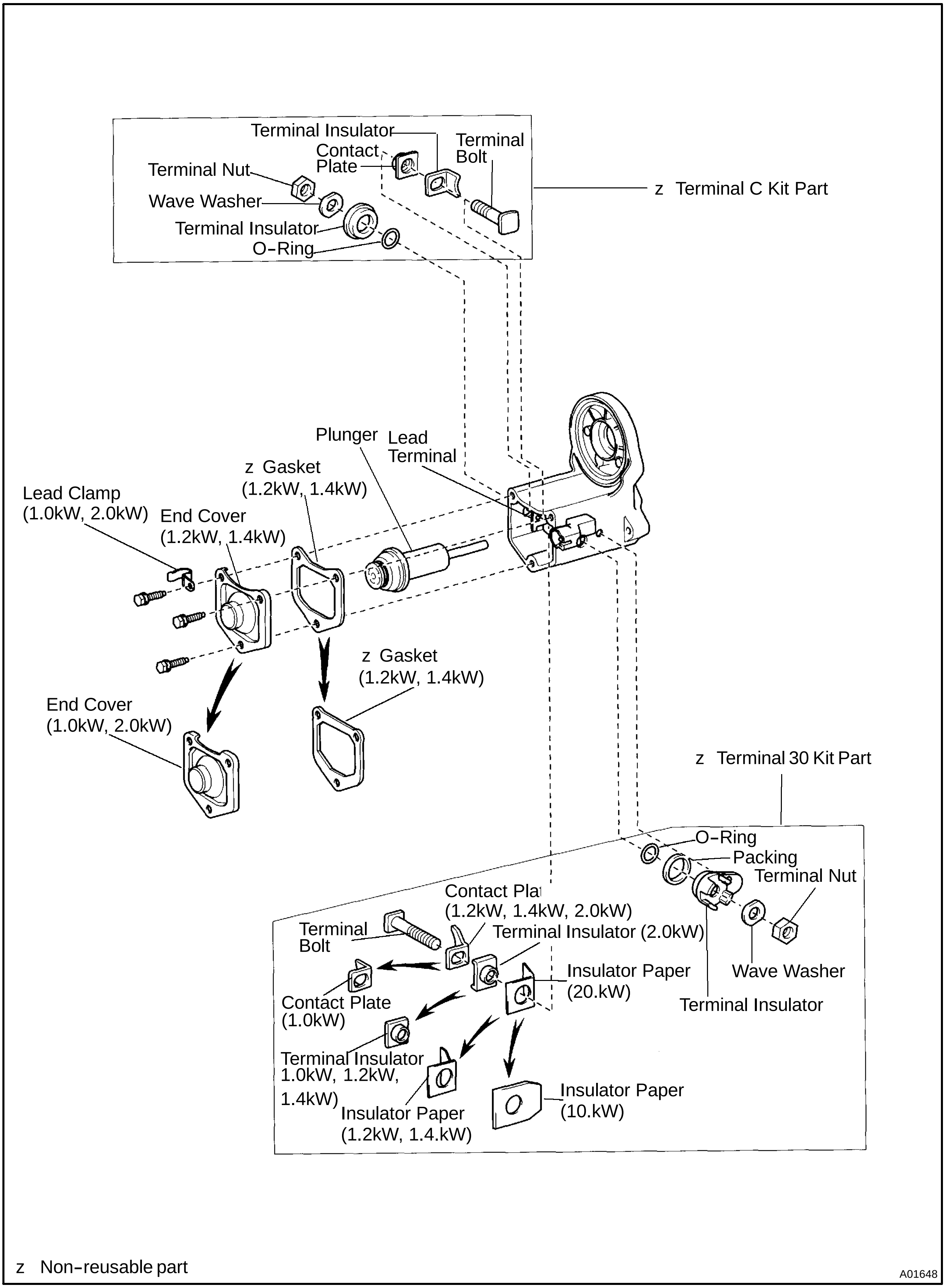
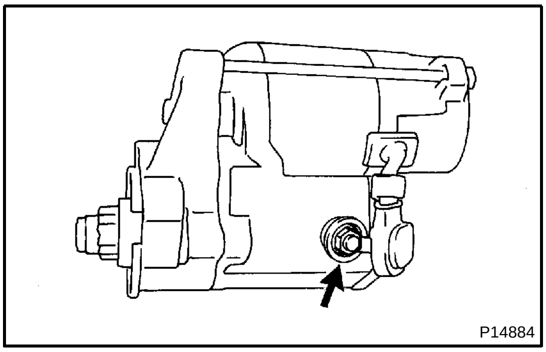

Terminal Insulator
Contact Plate
Terminal Bolt
Terminal Nut
Wave Washer
Terminal Insulator
O-Ring
z Terminal C Kit Part
Plunger
Lead Terminal
z Gasket (1.2kW, 1.4kW)
Lead Clamp (1.0kW, 2.0kW)
End Cover (1.2kW, 1.4kW)
z Gasket (1.2kW, 1.4kW)
End Cover (1.0kW, 2.0kW)
z Terminal 30 Kit Part
O-Ring
Packing
Terminal Nut
Contact Plat
(1.2kW, 1.4kW, 2.0kW)
Terminal Bolt
Terminal Insulator (2.0kW)
Insulator Paper (20.kW)
Wave Washer
Contact Plate (1.0kW)
Terminal Insulator
Terminal Insulator 1.0kW, 1.2kW, 1.4kW)
Insulator Paper (1.2kW, 1.4.kW)
Insulator Paper (10.kW)
z Non-reusable part
A01648

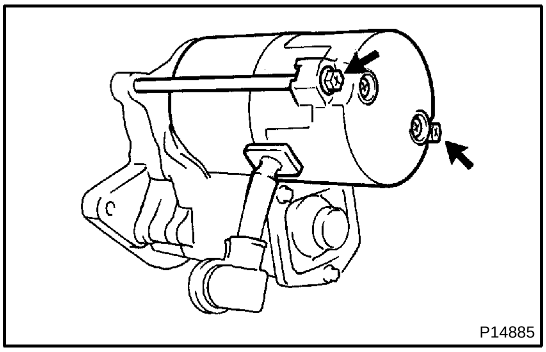
ST03T-01

DISASSEMBLY

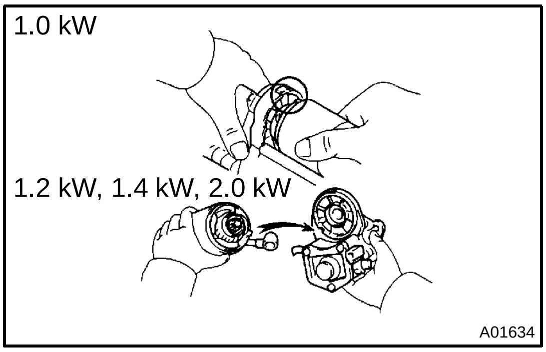


1. REMOVE FIELD FRAME AND ARMATURE

(a) Remove the nut and disconnect the lead wire from the magnetic switch terminal.
Torque:5.9 N·m (60 kgf·cm, 52 in.·lbf)

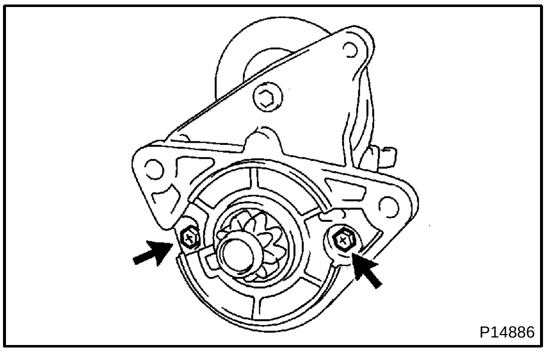


(b) Remove the 2 through bolts.
Torque:
1.2 kW, 1.4 kW type:
5.9 N·m (60 kgf·cm, 52 in.·lbf)
1.0 kW, 2.0 kW type:
9.3 N·m (93 kgf·cm, 82 in.·lbf)



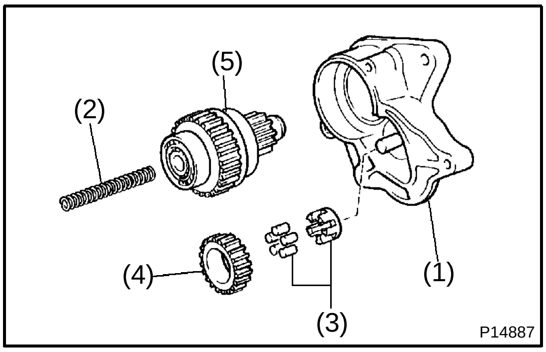
(c) Pull out the field frame with the armature from the magnetic switch assembly.
(d) 1.2kW, 1.4kW, 2.0kW
Remove the O–ring.

HINT:
- At the assembly, please refer to the following items.
- Assembly the field frame with the new O–ring.
- Align the protrusion of the field frame with the cutout of the magnetic switch.



2. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR

(a) Remove the 2 screws.
Torque:
1.2 kW, 1.4 kW type:
5.9 N·m (60 kgf·cm, 52 in.·lbf)
1.0 kW, 2.0 kW type:
9.3 N·m (93 kgf·cm, 82 in.·lbf)



(b) Remove these parts from the magnetic switch assembly:
(1) Starter housing
(2) Return spring
(3) Bearing
(4) Idler gear
(5) Clutch assembly

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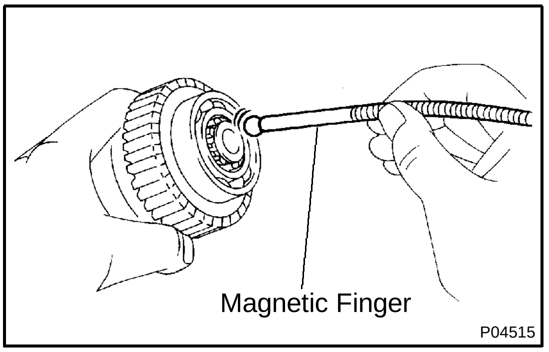
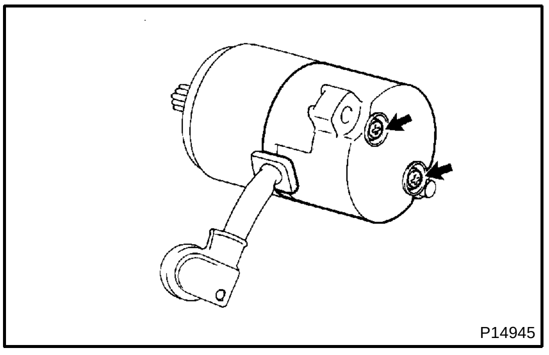


P04515

3. REMOVE STEEL BALL

Using a magnetic finger, remove the steel ball from the clutch shaft hole.


P14945

4. REMOVE BRUSH HOLDER

(a) Remove the 2 screws and end cover from the field frame.

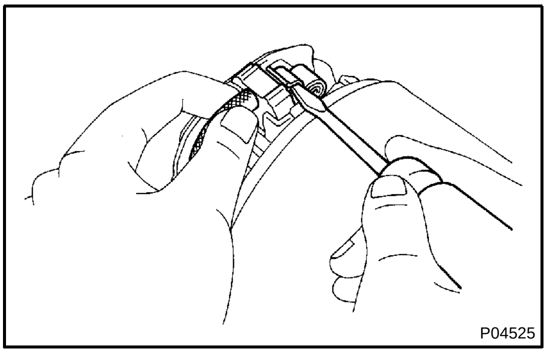
Torque:
1.0kW, 1.2 kW, 1.4kW type:
1.5 N·m (15 kgf·cm, 13 in.·lbf)
2.0 kW type:
3.8 N·m (39 kgf·cm, 34 in.·lbf)

(b) 1.2kW, 1.4kW, 2.0,kW
Remove the O-ring from the field frame.

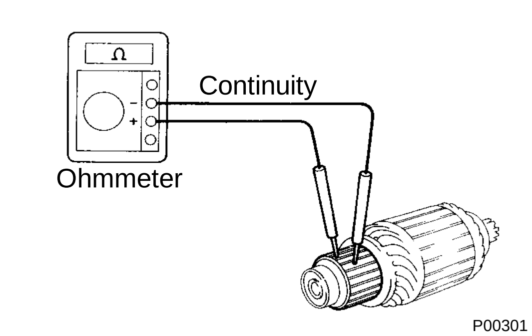
HINT:

S At the assembly, please refer to the following items.
Assembly the brush holder with the new O-ring.

(c) Using a screwdriver, hold the spring back and disconnect the brush from the brush holder. Disconnect the 4 brushes and remove the brush holder.


P04525

5. REMOVE ARMATURE FROM FIELD FRAME



P00301

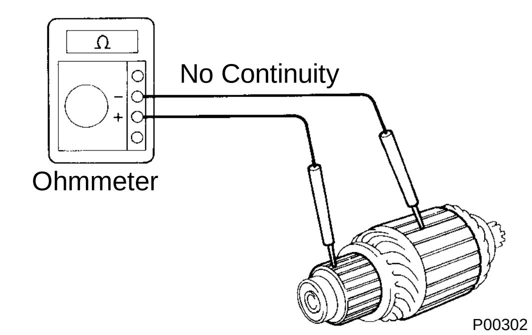
ST03U-01

INSPECTION

1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

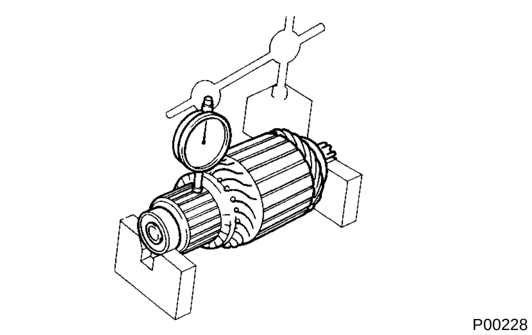


P00302

2. INSPECT COMMUTATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.


P00228

3. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

If the surface is dirty or burnt, correct it with sandpaper (No. 400) or on a lathe.

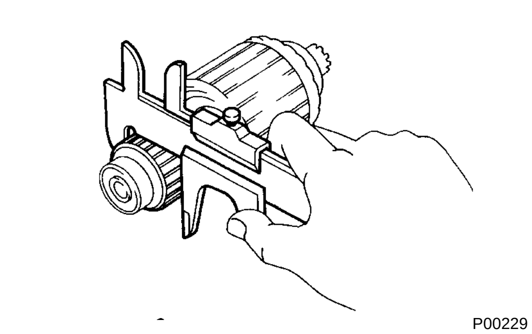
4. INSPECT COMMUTATOR CIRCLE RUNOUT

(a) Place the commutator on V-blocks.

(b) Using a dial indicator, measure the circle runout.

Maximum circle runout: 0.05 mm (0.0020 in.)

If the circle runout is greater than the maximum, correct it on a lathe.

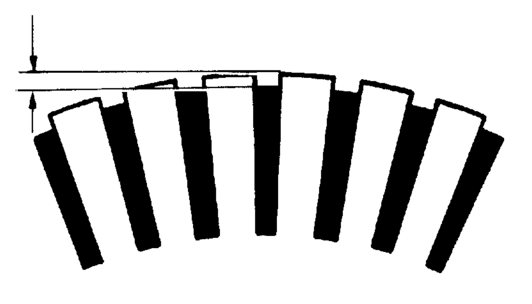

P00229

5. INSPECT COMMUTATOR DIAMETER

Using vernier calipers, measure the commutator diameter.

Standard diameter:
1.0kW, 1.2 kW, 1.4kW type:
30 mm (1.18 in.)
2.0 kW type:
35 mm (1.378 in.)
Minimum diameter:
1.0kW, 1.2 kW, 1.4kW type:
29 mm (1.14 in.)
2.0 kW type:
34 mm (1.339 in.)

If the diameter is less than the minimum, replace the armature.


ST0040

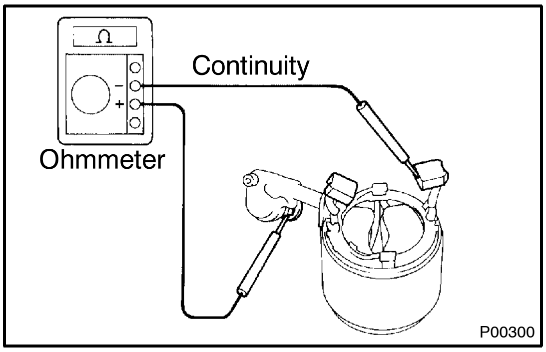
6. INSPECT UNDERCUT DEPTH

Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

CONTINUED

Standard undercut depth:
1.0kW, 1.2 kW, 1.4kW type:
0.6 mm (0.024 in.)
2.0 kW type:
0.7 mm (0.028 in.)
Minimum undercut depth:
0.2 mm (0.008 in.)

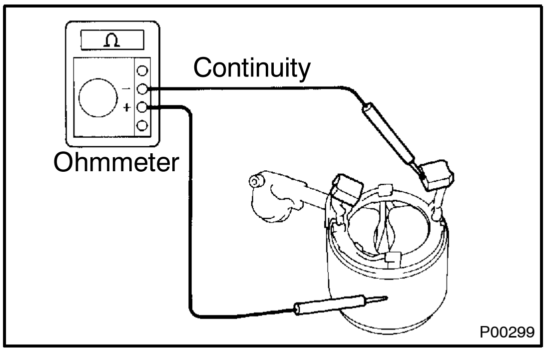
If the undercut depth is less than the minimum, correct it with a hacksaw blade.



7. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

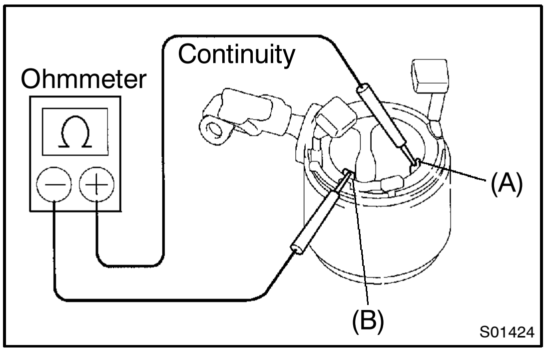
If there is no continuity, replace the field frame.



8. INSPECT FIELD COIL FOR GROUND

Using an ohmmeter, check that there is no continuity between the field coil end and field frame.

If there is continuity, repair or replace the field frame.

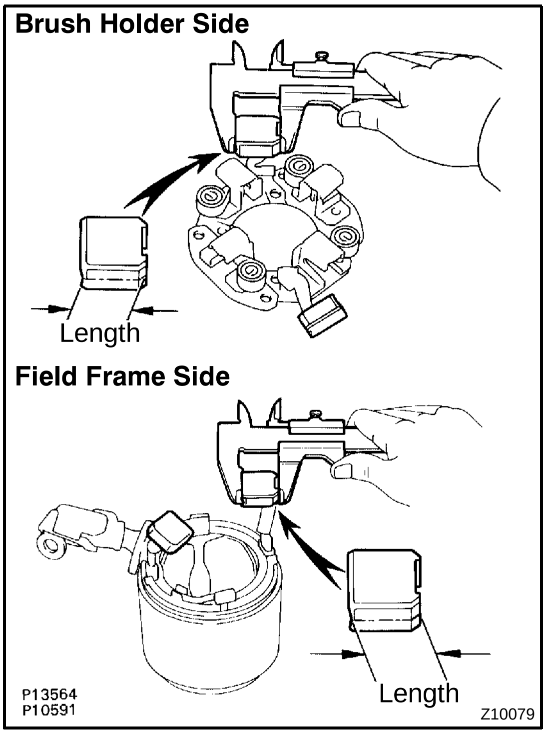


9. 2.0 kW type: INSPECT SHUNT COIL FOR RESISTANCE

Using an ohmmeter, check that the resistance between the shunt terminal (A) and shunt terminal (B).

Standard Resistance: At 20°C (68°F): 1.5 – 1.9 Ω

CONTINUED

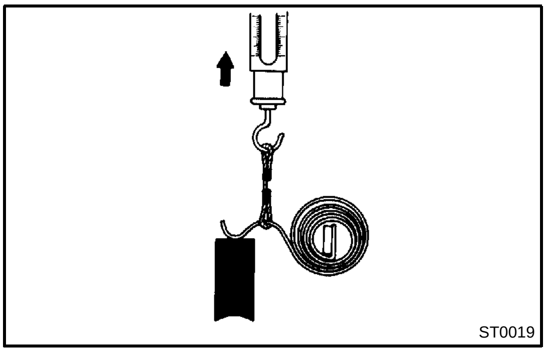


10. INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

Standard length:
1.0 kW type: 13.5 mm (0.531 in.)
1.2 kW, 1.4 kW type: 15.5 mm (0.610 in.)
2.0 kW type: 15.0 mm (0.596 in.)
Minimum length:
1.0 kW type:
8.5 mm (0.335 in.)
1.2 kW, 1.4 kW type:
10.0 mm (0.394 in.)
2.0 kW type:
9.0 mm (0.355 in.)

If the length is less than the minimum, replace the brush holder and field frame.

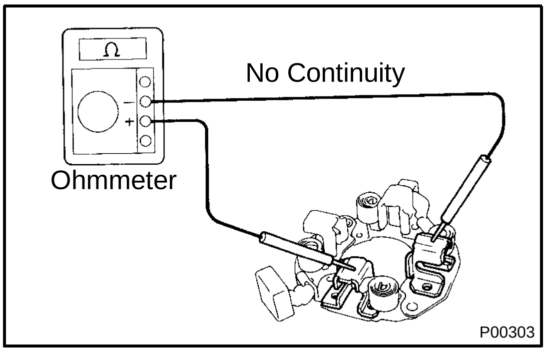


11. INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Spring installed load:
1.2 kW type:
13.7 – 19.6 N (1.40 – 2.00 kgf, 3.1 – 4.4 lbf)
1.0kW, 1.4 kW type:
17.6 – 23.5 N (1.80 – 2.40 kgf, 4.0 – 5.3 lbf)
2.0 kW type:
21.5 – 27.5 N (2.20 – 2.80 kgf, 4.9 – 6.2 lbf)
Minimum spring installed load:
1.2 kW type:
9.8 N (1.0 kgf, 2.2 lbf)
1.0k w, 1.4 kW type:
11.8 N (1.2 kgf, 2.6 lbf)
2.0 kW type:
12.7 N (1.30 kgf, 2.7 lbf)

If the installed load is not within specification, replace the brush springs.



12. INSPECT BRUSH HOLDER INSULATION

Using an ohmmeter, check that there is no continuity between the positive (+) and negative (–) brush holders.

If there is continuity, repair or replace the brush holder.

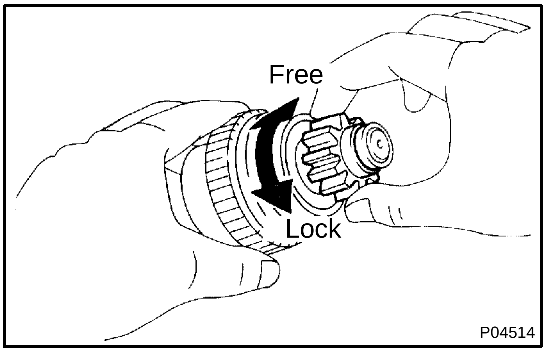
CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

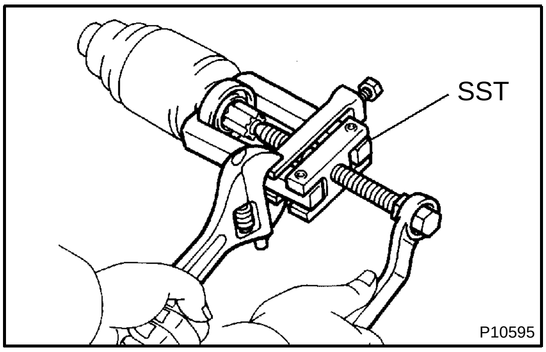
13. INSPECT GEAR TEETH

Check the gear teeth on the pinion gear, idle gear and clutch assembly for wear or damage.
If damaged, replace the gear or clutch assembly.
If damaged, also check the fly wheel ring gear for wear or damage.



14. INSPECT CLUTCH PINION GEAR

Hold the starter clutch and rotate the pinion gear clockwise, and check that it turns freely. Try to rotate the pinion gear counterclockwise and check that it locks.
If necessary, replace the clutch assembly.

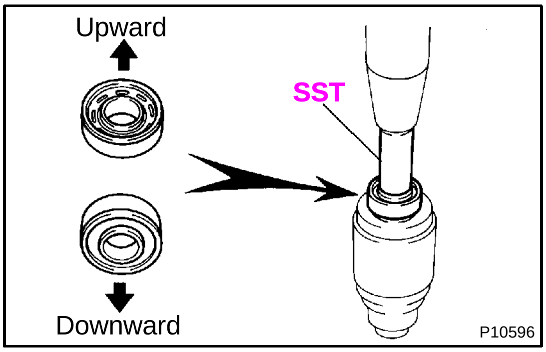


15. INSPECT FRONT BEARING

Turn the bearing by hand while applying inward force.
If resistance is felt or the bearing sticks, replace the bearing.

16. IF NECESSARY, REPLACE FRONT BEARING

(a) Using SST, remove the bearing.
SST 09286-46011

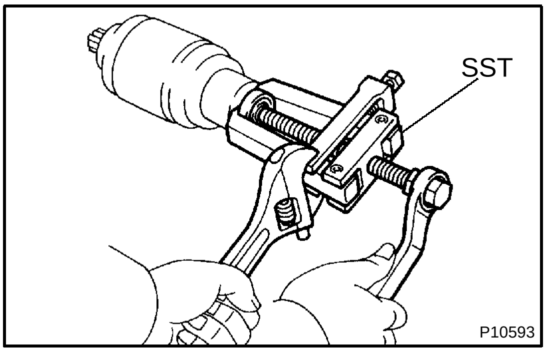


(b) Using a press, press in a new rear bearing.

NOTICE:

Be careful of the bearing installation direction.

SST 09201 – 41020



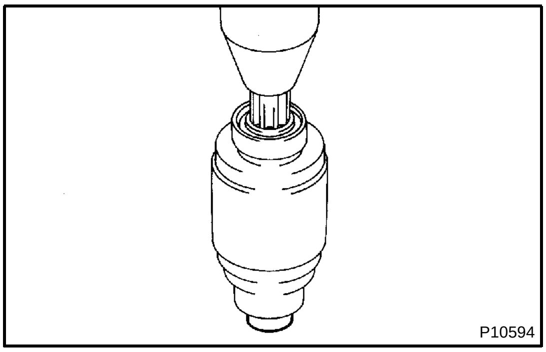
17. INSPECT REAR BEARING

Turn the bearing by hand while applying inward force.
If resistance is felt or the bearing sticks, replace the bearing.

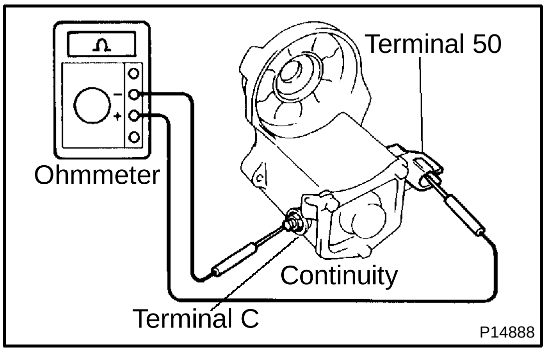
18. IF NECESSARY, REPLACE REAR BEARING

(a) Using SST, remove the bearing.
SST 09286-46011

CONTINUED


P10594

(b) Using a press, press in a new rear bearing.

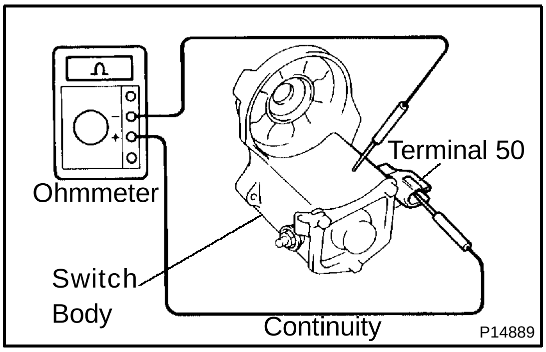


P14888

19. DO PULL-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminals 50 and C.

If there is no continuity, check and replace the magnetic switch.



P14889

20. DO HOLD-IN COIL OPEN CIRCUIT TEST

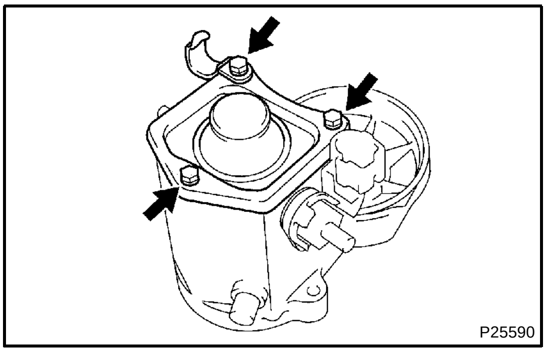
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch.

CLICK HERE TO VIEW CHAPTER INDEX
3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

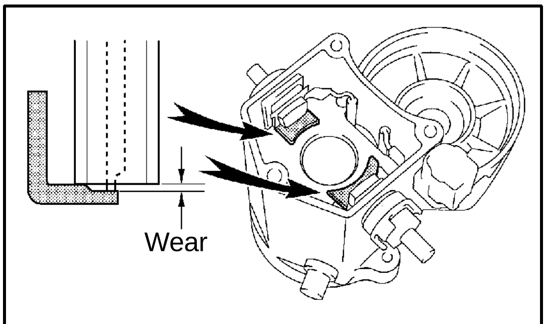
ST03V–01

REPLACEMENT


P25590

1. REMOVE MAGNETIC SWITCH END COVER

Remove the 3 bolts, lead clamp(1.0 kW, 2.0 kW type:), end cover, gasket and plunger.



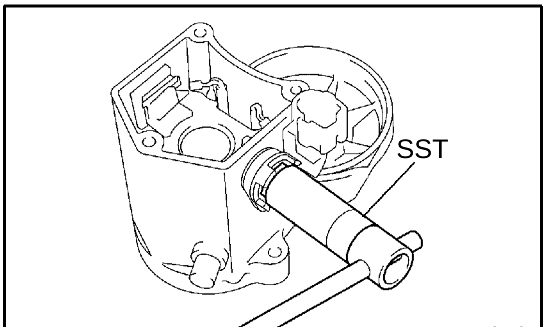
P25594

2. INSPECT CONTACT PLATE FOR WEAR

Using vernier calipers, measure the contact plate for depth of wear.

Maximum wear: 0.9 mm (0.035 in.)

If the depth of wear is greater than the maximum, replace the contact plate.



P25595

3. REMOVE TERMINAL KIT PARTS

(a) Using SST, loosen the terminal nuts.

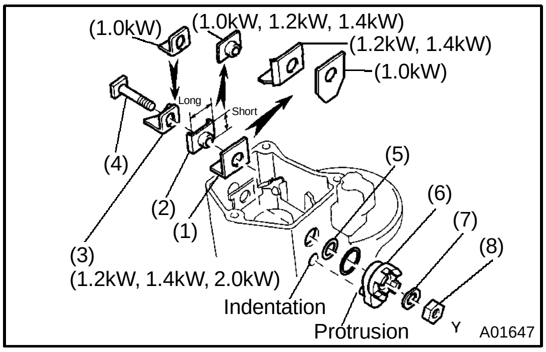
SST 09810–38140

(b) Terminal C:

Remove the terminal nut, wave washer, terminal insulator (outside), O–ring, terminal bolt, contact plate and terminal insulator (inside).

(c) Terminal 30:

Remove the terminal nut, wave washer, terminal insulator (outside), packing, O–ring, terminal bolt, contact plate, terminal insulator (inside) and insulation paper.



A01647

4. REINSTALL TERMINAL KIT PARTS

(a) Install these new parts:

Terminal 30:

(1) Insulation paper

(2) Terminal insulator (inside)

NOTICE:

Be careful to install the terminal insulator in the correct direction.

(3) Contact plate

(4) Terminal bolt

(5) O–ring

(6) Packing and terminal insulator (outside)

Install the packing to the terminal insulator, and install them.

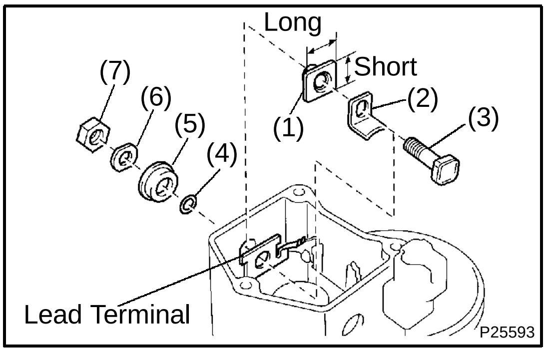
HINT:

Match the protrusion of the insulator with the indentation of the housing.

(7) Wave washer

(8) Terminal nut

CONTINUED

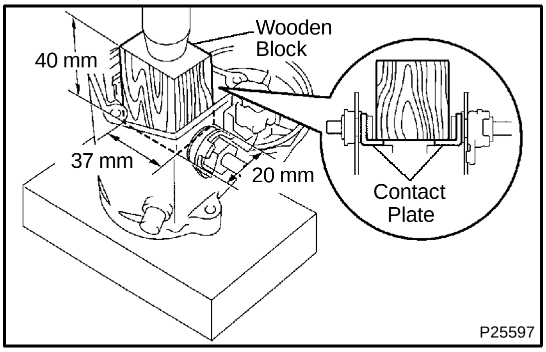


(b) Install these new parts:
Terminal C:
(1) Terminal insulator (inside)

NOTICE:
Be careful to install the terminal insulator in the correct direction.

(2) Contact plate
(3) Terminal bolt
(4) O–ring
(5) Terminal insulator (outside)
(6) Wave washer
(7) Terminal nut

(c) Temporarily tighten the terminal nuts.



5. TIGHTEN TERMINAL NUT

(a) Put a wooden block on the contact plate and press it down with a hand press.
Dimensions of wooden block:
20 x 37 x 40 mm (0.79 x 1.46 x 1.57 in.)
Press force: 981 N (100 kgf, 221 lbf)

NOTICE:
- **Check the diameter of the hand press ram. Then calculate the gauge pressure of the press when 981 N (100 kgf, 221 lbf) of force is applied.**
Gauge pressure:

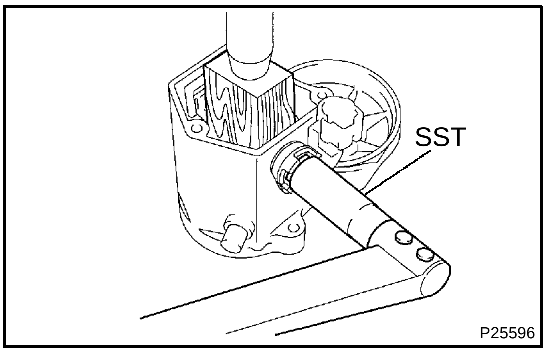
$$(\text{kgf/cm}^2) = \frac{100\ \text{kgf}}{\left(\frac{\text{Ram diameter (cm)}}{2}\right)^2 \times 3.14\ (\pi)}$$

$$(\text{psi}) = \frac{221\ \text{lbf}}{\left(\frac{\text{Ram diameter (in.)}}{2}\right)^2 \times 3.14\ (\pi)}$$

$$(\text{kPa}) = (\text{kgf/cm}^2) \times 98.1$$

$$(\text{kPa}) = (\text{psi}) \times 6.9$$

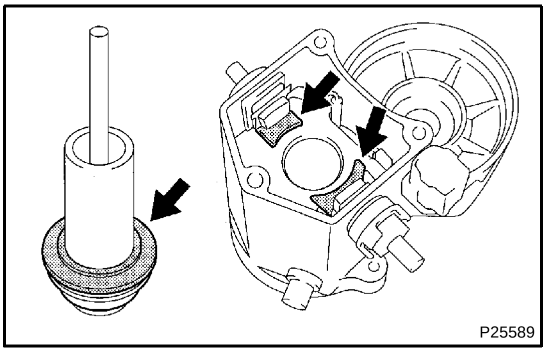
- **If the contact plate is not pressed down with the specified pressure, the contact plate may tilt due to coil deformation or the tightening of the nut.**



(b) Using SST, tighten the nuts to the specified torque.
SST 09810–38140
Torque:17 N·m (170 kgf·cm, 12 ft·lbf)

NOTICE:
If the nut is over tightened, it may cause cracks on the inside of the insulator.

CONTINUED



6. CLEAN CONTACT SURFACES OF CONTACT PLATE AND PLUNGER

Clean the contact surfaces of the remaining contact plate and plunger with a dry shop rag.

7. REINSTALL MAGNETIC SWITCH END COVER

Install the plunger, new gasket, end cover and lead clamp (1.0 kW, 2.0 kW type:) with the 3 bolts.

Torque:

1.2 kW, 1.4 kW type: 2.5 N·m (26 kgf·cm, 23 in.·lbf)

1.0 kW, 2.0 kW type: 3.6 N·m (37 kgf·cm, 32 in.·lbf)

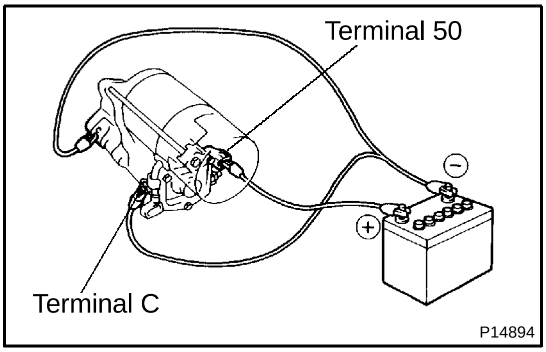
ST03W–01

REASSEMBLY

Assembly is in the reverse order of disassembly.

(See page ST–3)

ST03X-01

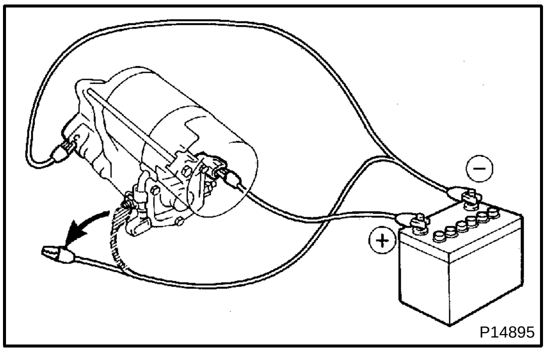


TEST

NOTICE:
These tests must be done within 3 to 5 seconds to avoid burning out the coil.

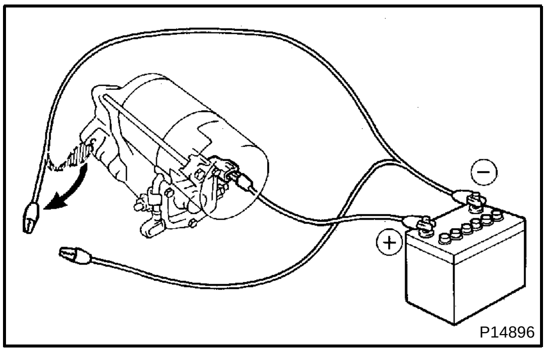
1. DO PULL-IN TEST

(a) Disconnect the field coil lead wire from terminal C.
(b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.



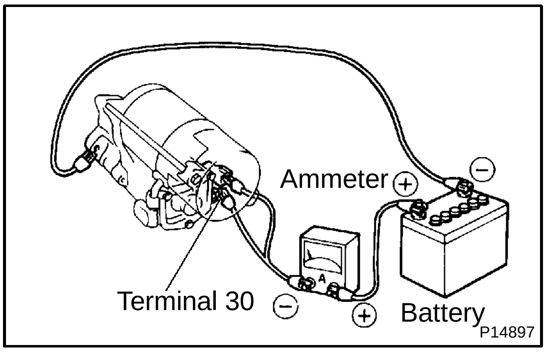
2. DO HOLD-IN TEST

With battery connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out.



3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body.Check that the clutch pinion gear returns inward.



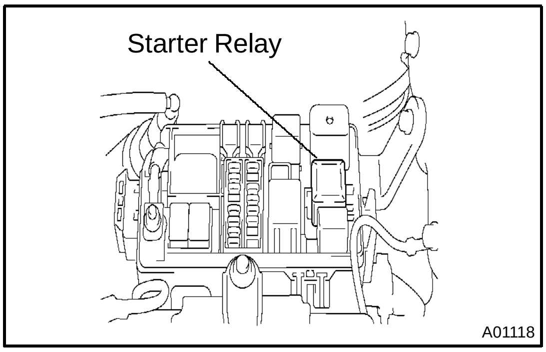
4. DO NO-LOAD PERFORMANCE TEST

(a) Connect the battery and ammeter to the starter as shown.
(b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter shows the specified current.
Specified current:
1.0 kW, 1.2kW, 1.4kW type:
At 11.5 V: 90 A or less
2.0 kW type:
At 11.5 V: 100 A or less

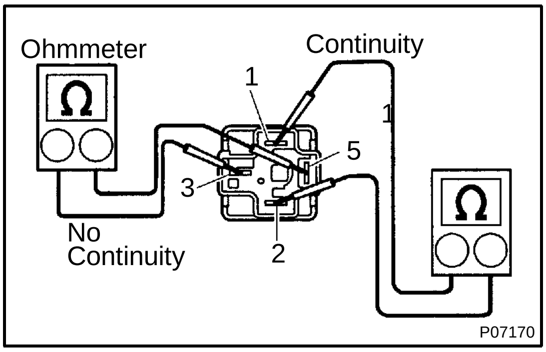
STARTER RELAY

INSPECTION

ST03Y-01



1. REMOVE STARTER RELAY (Marking: "ST")



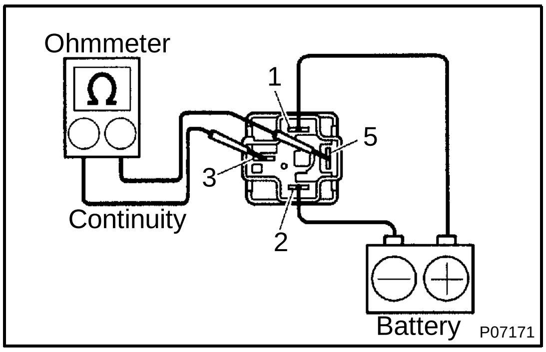
2. INSPECTION RELAY CONTINUITY

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

If there is no continuity, replace the relay.

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

If there is continuity, replace the relay.



3. INSPECT RELAY OPERATION

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

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

If operation is not as specified, replace the relay.

4. REINSTALL STARTER RELAY

CHARGING

CHARGING SYSTEM

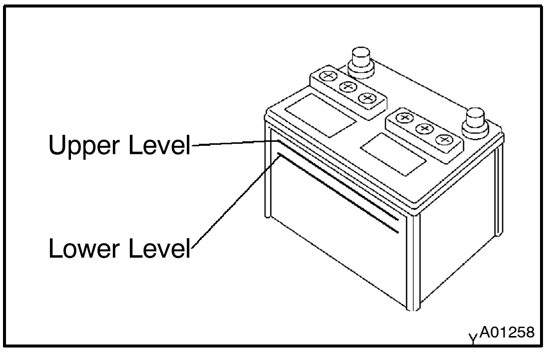
CH033-01

PRECAUTION

1. Check that the battery cables are connected to the correct terminals.
2. Disconnect the battery cables when the battery is given a quick charge.
3. Do not perform tests with a high voltage insulation resistance tester.
4. Never disconnect the battery while the engine is running.
5. Check that the battery cables are connected to the correct terminals.
6. Disconnect the battery cables when the battery is given a quick charge.
7. Do not perform tests with a high voltage insulation resistance tester.
8. Never disconnect the battery while the engine is running.

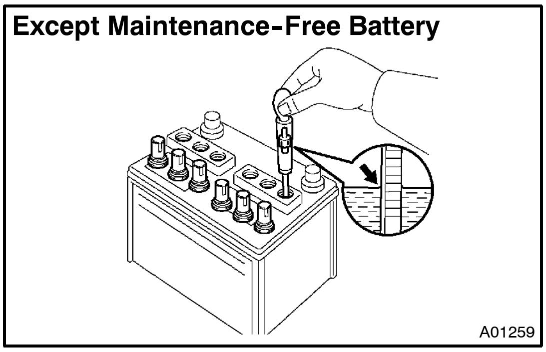
CH034-01

ON-VEHICLE INSPECTION



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). Check the charging system.
Except Maintenance-Free Battery:
If under the lower level, add distilled water.

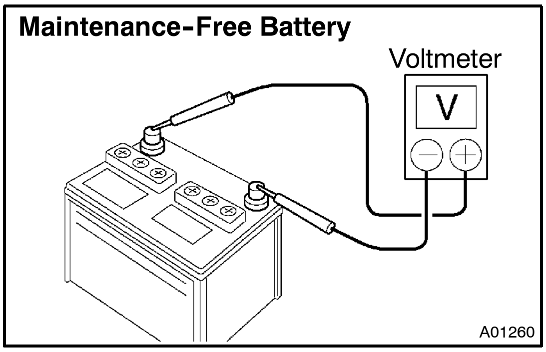


2. Except Maintenance-Free Battery: CHECK BATTERY SPECIFIC GRAVITY

Check the specific gravity of each cell.

Standard specific gravity:
1.25 - 1.29 at 20°C (68°F)

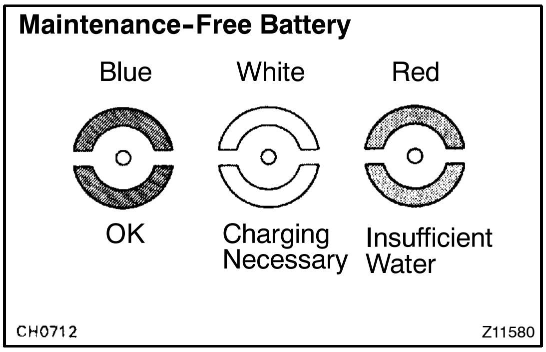
If the specific gravity is less than specification, charge the battery.



3. Maintenance-Free Battery: CHECK BATTERY VOLTAGE

(a) After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.

(b) Turn the ignition switch OFF and turn off the electrical systems.



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

Standard voltage:
12.5 - 12.9 V at 20°C (68°F)

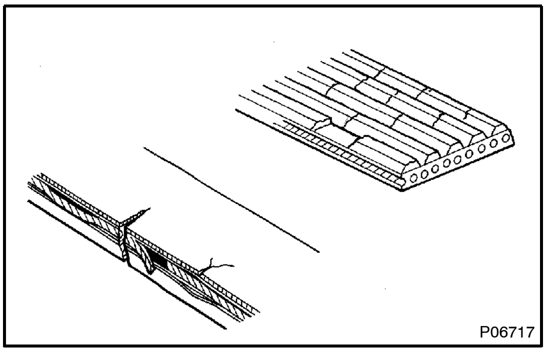
If the voltage is less than specification, charge the battery.
HINT:
Check the indicator as shown in the illustration.

4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

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

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

CONTINUED



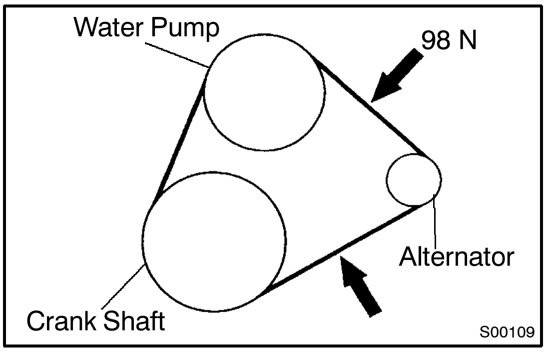
5. INSPECT DRIVE BELT

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

If any defect has been found, replace the drive belt.

HINT:

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



(b) Check the drive belt deflection by pressing on the belt at the points indicated in the illustration with 98 N (10 kgf, 22 lbf) of pressure.

Drive belt deflection:

New belt 5 - 7 mm (0.20 - 0.28 in.)

Used belt 7 - 8 mm (0.28 - 0.31 in)

If necessary, adjust the drive belt deflection.

Reference

(c) Using a belt tension gauge, measure the belt tension.

Belt tension gauge:

Denso BTG-20 (95506-00020)

Borroughs No. BT-33-73F

Drive belt tension:

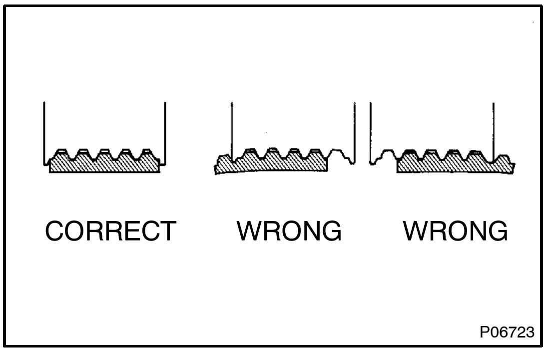
New belt 520 - 750 N (53 - 77 kgf)

Used belt 295 - 392 N (30 - 40 kgf)

If the belt tension is not as specified, adjust it.

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 a 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 pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.



6. VISUALLY CHECK ALTERNATOR 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 alternator while the engine is running.

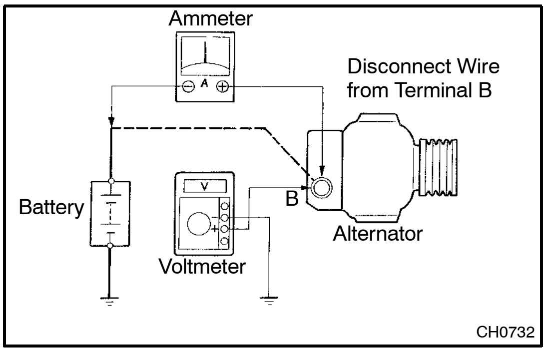
7. INSPECT DISCHARGE WARNING LIGHT CIRCUIT

(a) Turn the ignition switch "ON". Check that the discharge warning light comes on.

(b) Start the engine. Check that the light goes off.

If the light does not operate as specified, troubleshoot the discharge warning light circuit.

CONTINUED



CH0732

8. INSPECT CHARGING CIRCUIT WITHOUT LOAD

HINT:

If a battery/alternator tester is available, connect the tester to the charging circuit as per manufacturer'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 alternator and connect it to the negative (–) lead of the ammeter.
- Connect the positive (+) lead of the ammeter to terminal B of the generator.
- Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
- Ground the negative (–) lead of the voltmeter.

(b) Check the charging circuit as follows:

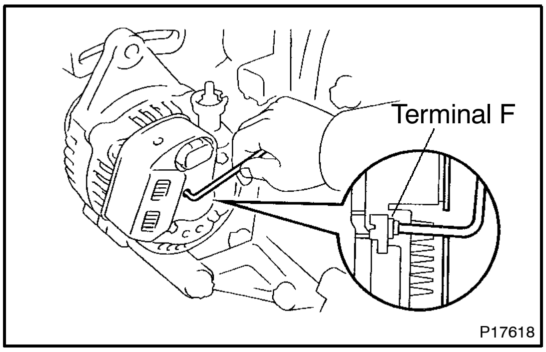
With the engine running from idle to 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage:

10 A or less

Standard voltage:

13.8 – 14.7 V at 25°C (77°F)



P17618

If the voltmeter reading is more than the standard voltage, replace the voltage regulator.

If the voltmeter reading is less than the standard voltage, check the voltage regulator and generator as follows:

- With terminal F grounded, start the engine and check the voltmeter reading of terminal B.
- If the voltmeter reading is more than the standard voltage, replace the IC regulator.
- If the voltmeter reading is less than the standard voltage, check the alternator.

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 blower switch at "HI".

(b) Check the reading on the ammeter.

Standard amperage:

30 A or more

If the ammeter reading is less than the standard amperage, repair the alternator.

HINT:

If the battery is fully charged, the indication will sometimes be less than the standard amperage.

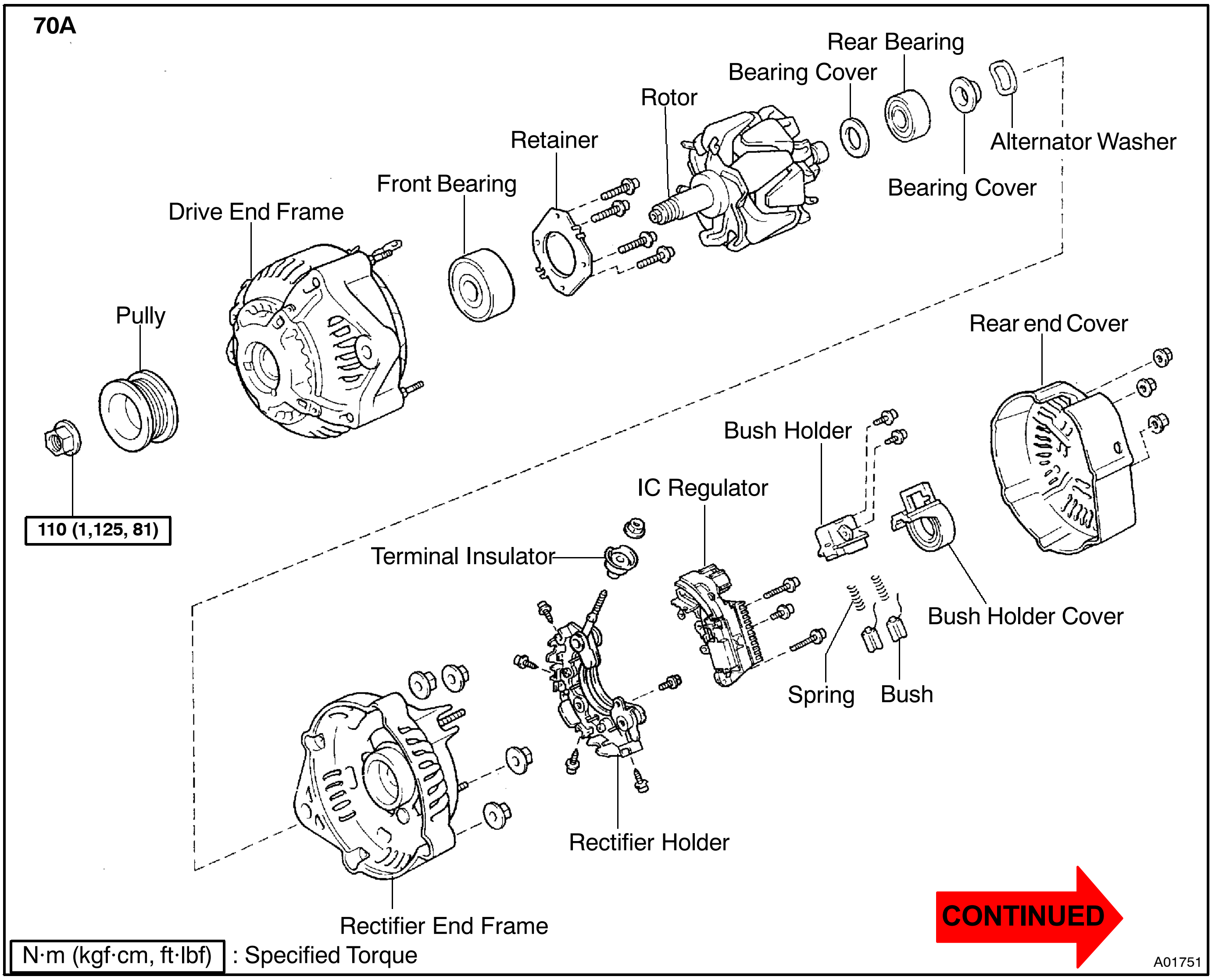
CHARGING – ALTERNATOR

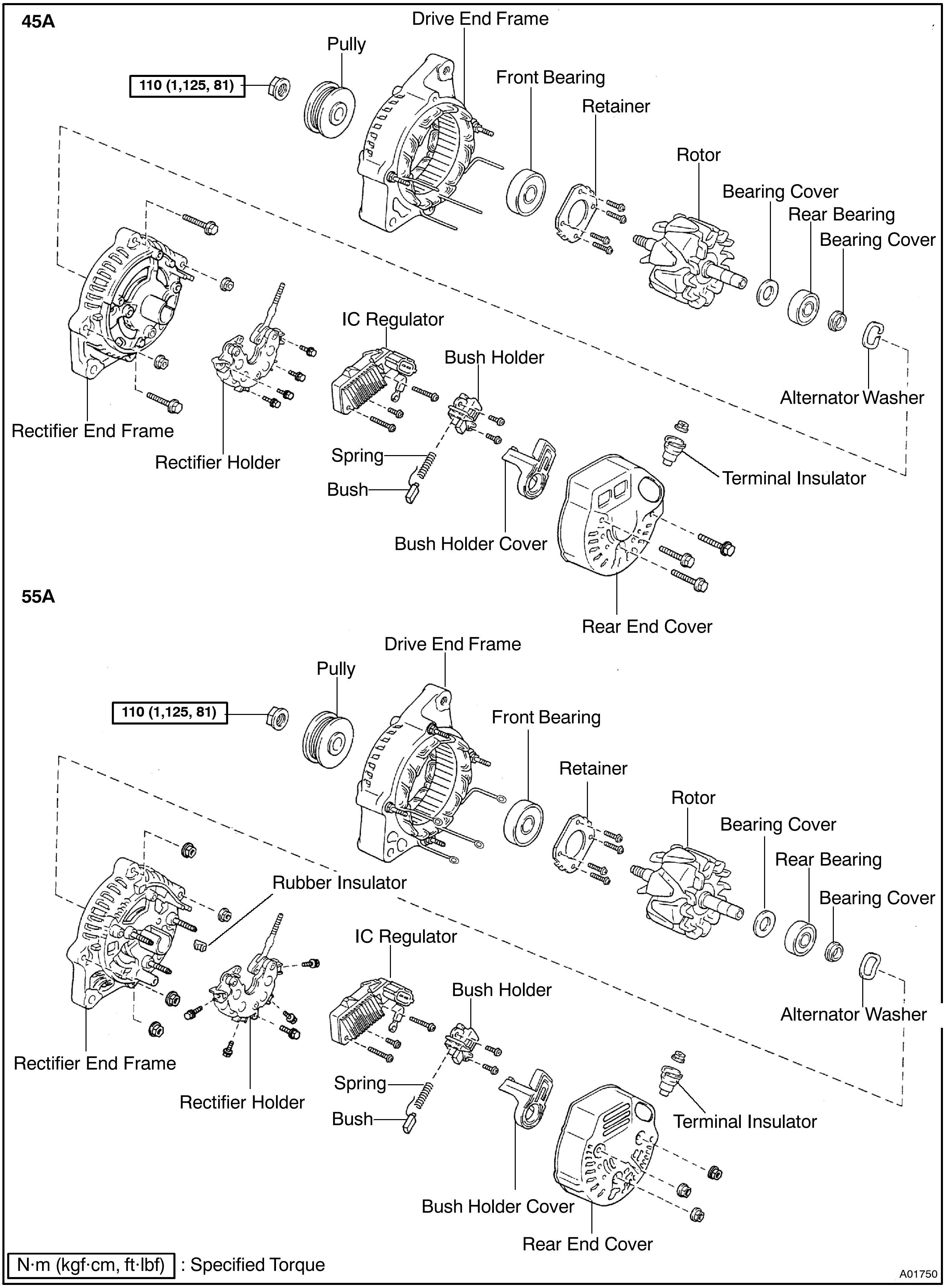
CLICK HERE TO VIEW CHAPTER INDEX

ALTERNATOR

COMPONENTS

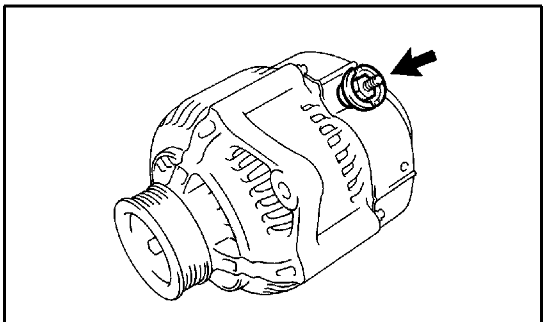
CH035-01




45A
110 (1,125, 81)
Pully
Drive End Frame
Front Bearing
Retainer
Rotor
Bearing Cover
Rear Bearing
Bearing Cover
Alternator Washer
Rectifier End Frame
Rectifier Holder
IC Regulator
Bush Holder
Spring
Bush
Bush Holder Cover
Terminal Insulator
Rear End Cover
55A
110 (1,125, 81)
Pully
Drive End Frame
Front Bearing
Retainer
Rotor
Bearing Cover
Rear Bearing
Bearing Cover
Alternator Washer
Rubber Insulator
Rectifier End Frame
Rectifier Holder
IC Regulator
Bush Holder
Spring
Bush
Bush Holder Cover
Terminal Insulator
Rear End Cover
N·m (kgf·cm, ft·lbf) : Specified Torque
A01750

CH036-01

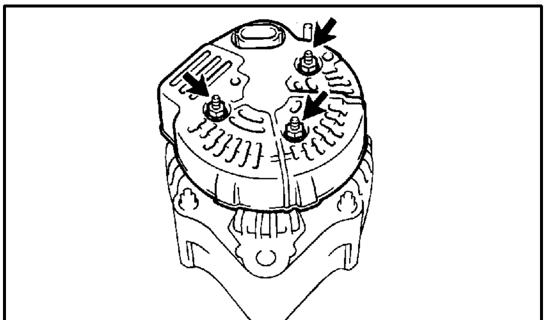
DISASSEMBLY



P14459

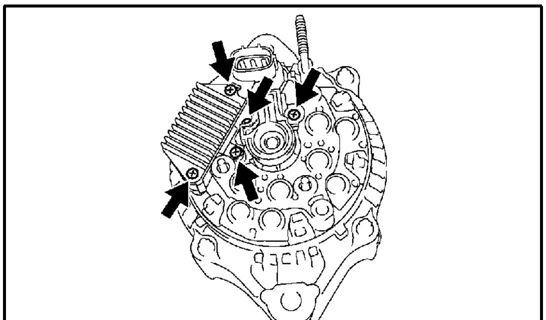
1. REMOVE REAR END COVER

(a) Remove the nut and terminal insulator.



P14460

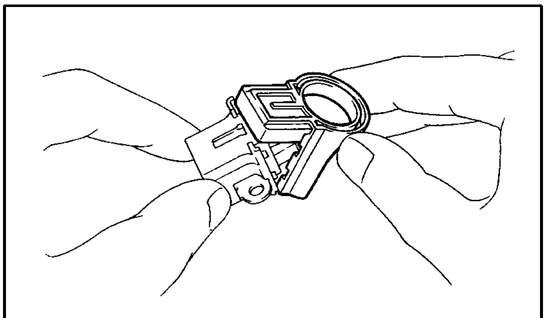
(b) Remove the 3 nuts, and end cover.



A01820

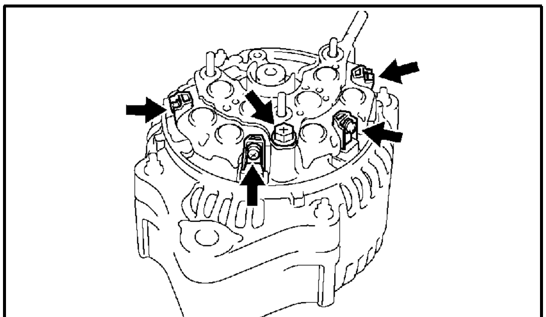
2. REMOVE BRUSH HOLDER AND IC REGULATOR

(a) Remove the 5 screws, brush holder and IC regulator.



P13688

(b) Remove the brush holder cover from the brush holder.



A01825

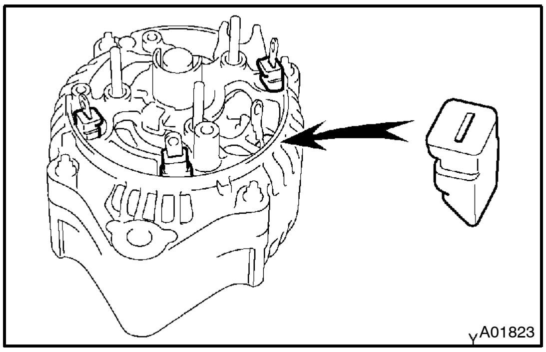
3. 55A:, 70:A
REMOVE RECTIFIER HOLDER

(a) Remove the 4 screws and the bolts.

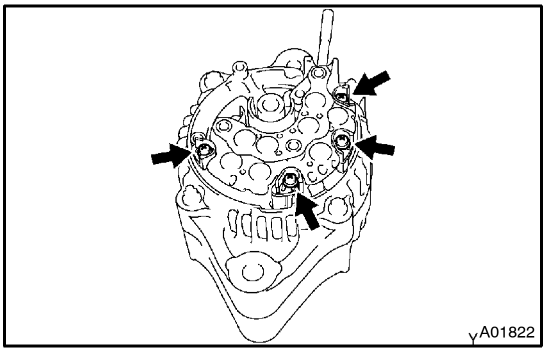
CONTINUED

CLICK HERE TO VIEW CHAPTER INDEX

3RZ-F,3RZ-FE Pages From Supplement
TO MODEL INDEX

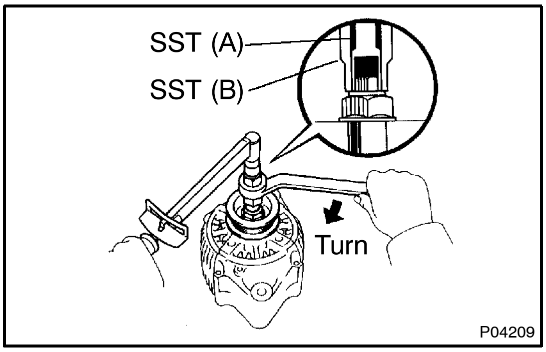


(b) 55A:
Remove the 4 rubber insulators.



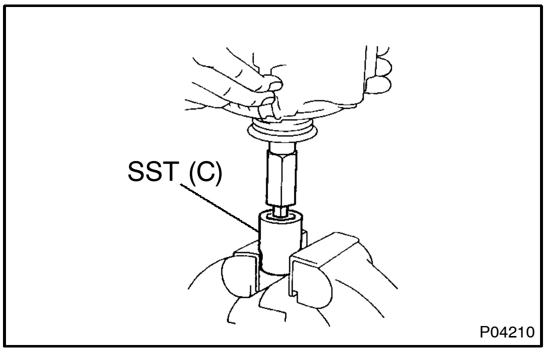
4. 45A:
REMOVE RECTIFIER HOLDER

(a) Remove the 4 screws.
(b) Using needle-nose pliers, straighten the stator lead wire.
(c) Remove the rectifier holder.

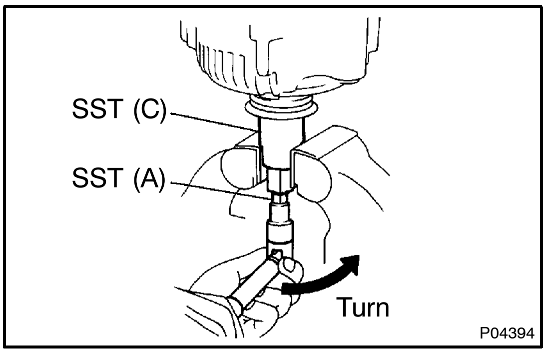


5. REMOVE PULLEY

(a) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820-63010
Torque:39 N·m (400 kgf·cm, 29 ft·lbf)
(b) Check that SST (A) is secured to the rotor shaft.



(c) Mount SST (C) in a vise.
(d) Install SST (B) into SST (C), and attach the pulley nut to SST (C).

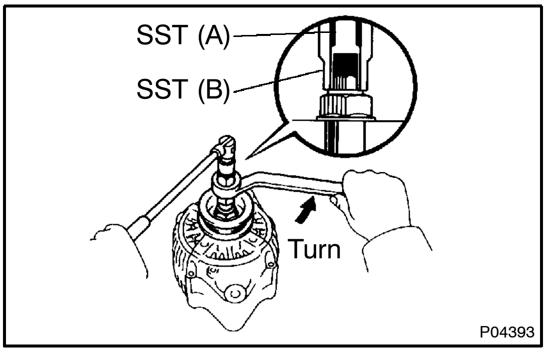


(e) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.

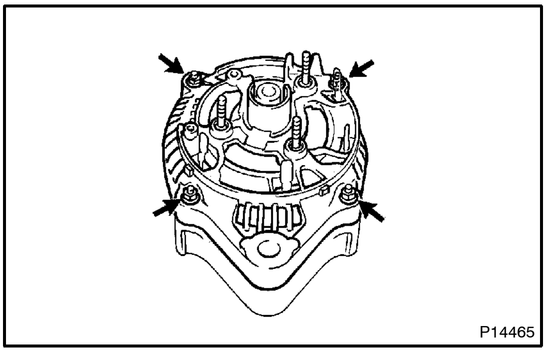
NOTICE:
To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half of a turn.

(f) Remove the alternator from SST (C).

CONTINUED

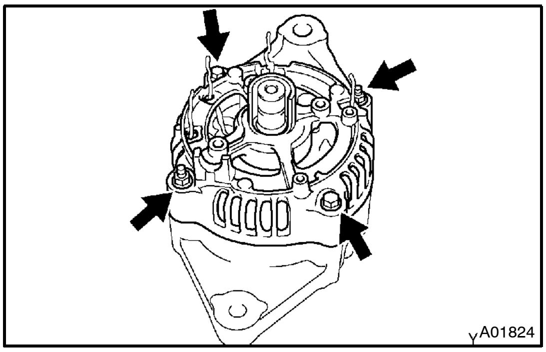


(g) Turn SST (B) and remove SST (A and B).
(h) Remove the pulley nut and pulley.

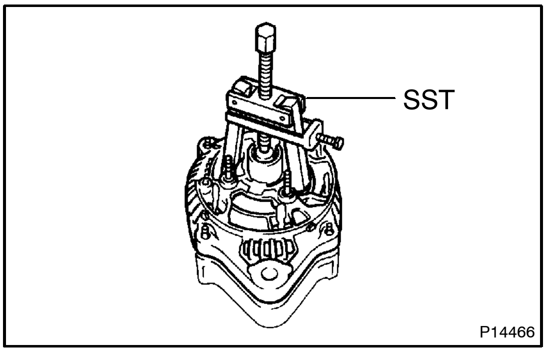


6. REMOVE RECTIFIER END FRAME

(a) 55A:, 70A:
Remove the 4 nuts.



(b) 45A:
Remove the 2 nuts and 2 bolts.

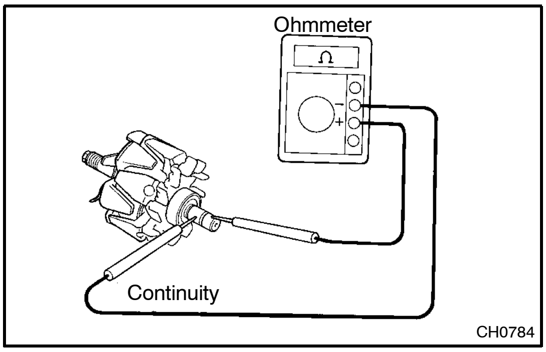


(c) Using SST, remove the rectifier end frame.
SST 09286–46011

7. REMOVE ROTOR FROM DRIVE END FRAME

CH037-01

INSPECTION



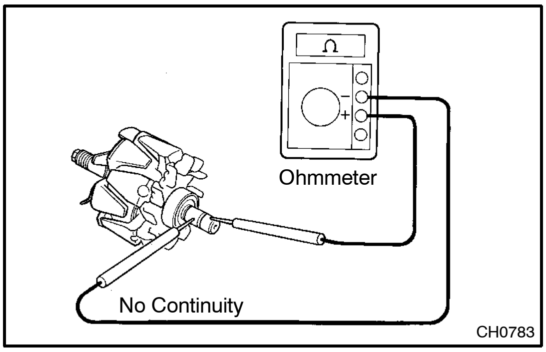
CH0784

1. INSPECT ROTOR FOR OPEN CIRCUIT

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

Standard resistance (Cold):
45A: 2.1 – 2.5 Ω
55A: 2.7 – 3.1 Ω
70A: 2.1 – 2.5 Ω

If there is no continuity, replace the rotor.

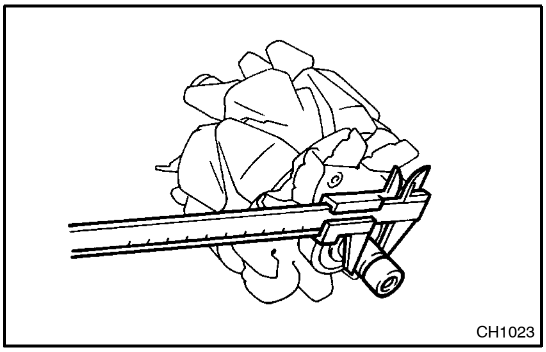


CH0783

2. 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.


CH1023

3. INSPECT SLIP RINGS

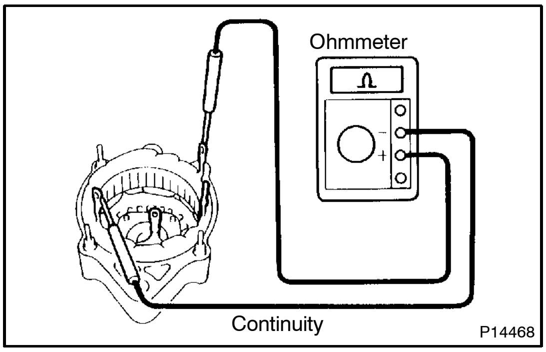
(a) Check that the slip rings are not rough or scored.

If rough or scored, replace the rotor.

(b) Using a vernier caliper, measure the slip ring diameter.

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.

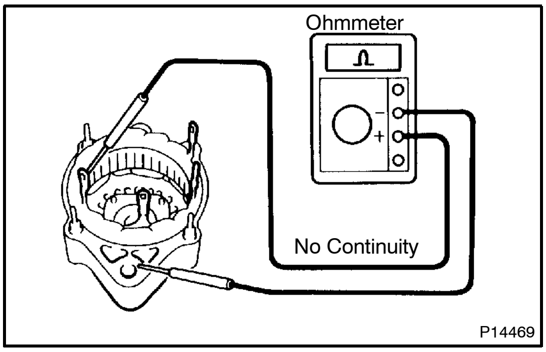


P14468

4. 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.



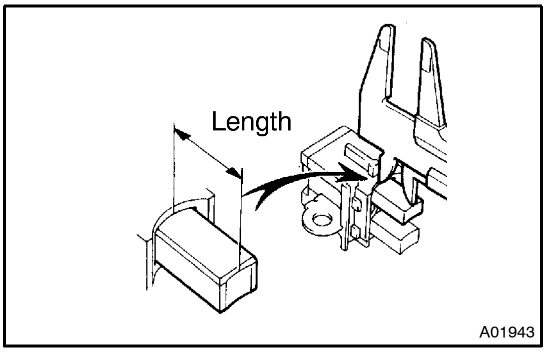
P14469

5. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil lead and drive end frame.

If there is continuity, replace the drive end frame assembly.

CONTINUED

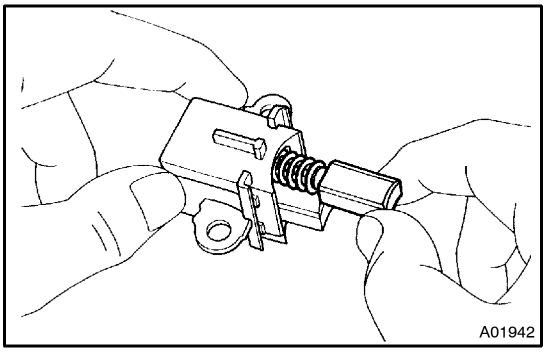


6. INSPECT EXPOSED BRUSH LENGTH

Using vernier calipers, measure the exposed brush length.

Standard exposed length:
10.5 mm (0.413 in.)
Minimum exposed length:
1.5 mm (0.059 in.)

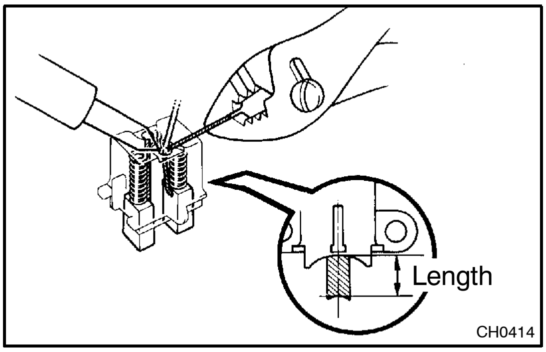
If the exposed length is less than the minimum, replace the brushes.



7. IF NECESSARY, REPLACE BRUSHES

(a) Unsolder and remove the brush and spring.

(b) Run the wire of a new brush through the hole in the brush holder, and insert the spring and brush into the brush holder.



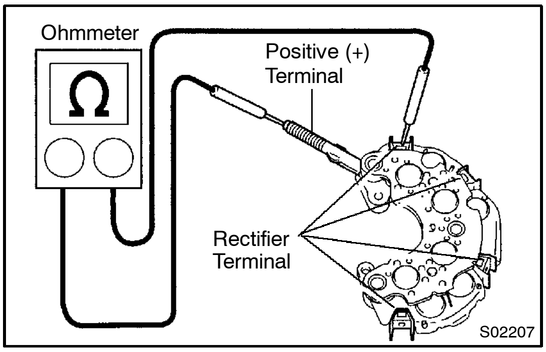
(c) Solder the brush wire to the brush holder at specified exposed length.

Exposed length:
10.5 mm (0.413 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 area.



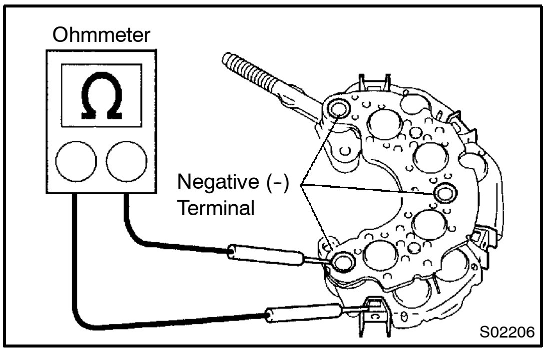
8. INSPECT POSITIVE RECTIFIER

(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.



9. INSPECT NEGATIVE RECTIFIER

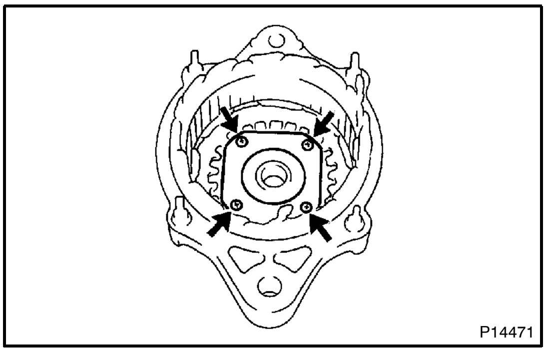
(a) Using an ohmmeter, connect one tester probe to each negative (-) terminal and the other to each rectifier terminal.

(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.

CONTINUED

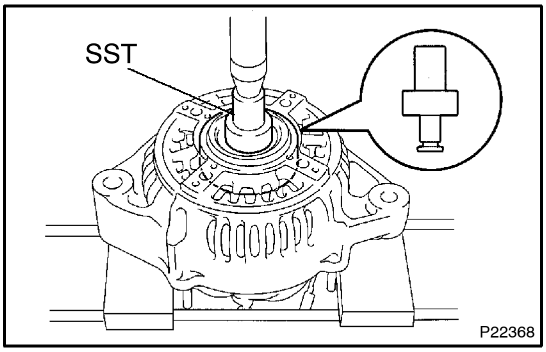

P14471

10. INSPECT FRONT BEARING

Check that the bearing is not rough or worn.

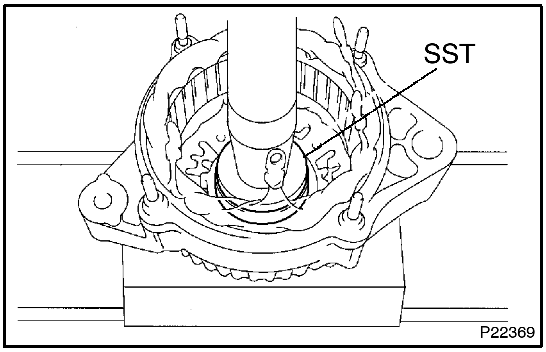
11. IF NECESSARY, REPLACE FRONT BEARING

(a) Remove the 4 screws, bearing retainer and bearing.



P22368

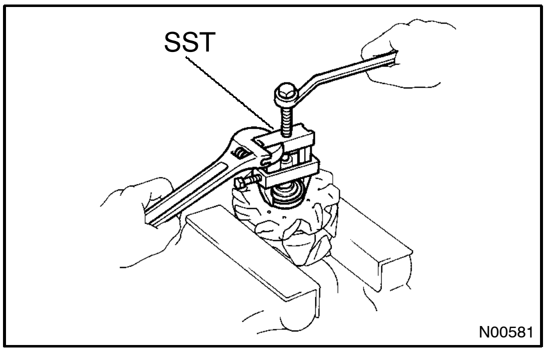
(b) Using SST and press, press out the bearing.
SST 09950-60010 (09951-00260, 09952-06010)



P22369

(c) Using SST and a press, press in a new bearing.
SST 09950-60010 (09951-00500)

(d) Install the bearing retainer with the 4 screws.
Torque: 2.5 N.m (27 kgf·cm, 23 in. lbf)



N00581

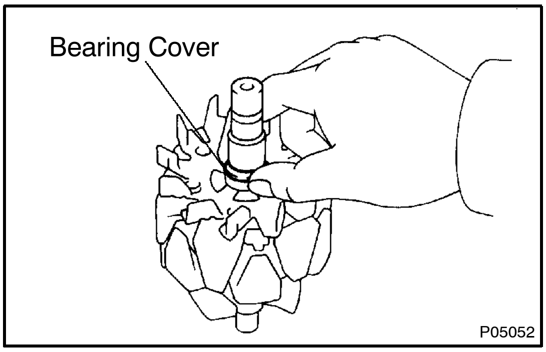
12. INSPECT REAR BEARING

Check that the bearing is not rough or worn.

13. IF NECESSARY, REPLACE REAR BEARING

(a) Using SST, remove the bearing covers and bearing.
SST 09820-00021

NOTICE:
Be careful not to damage the fan.



P05052

(b) Place the bearing cover on the rotor.

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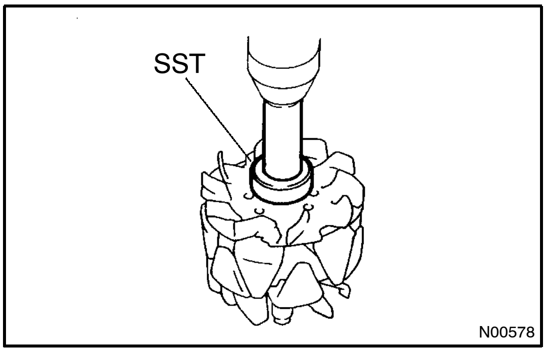
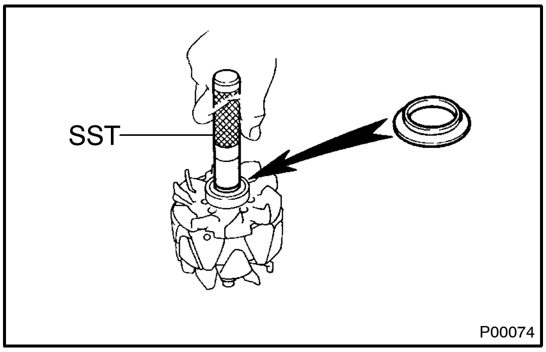


(c) Using SST and a press, press in a new bearing.
SST 09820-00030



(d) Using SST, push in the bearing cover.
SST 09285-76010

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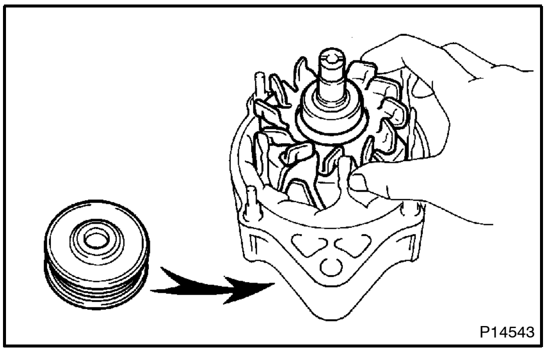
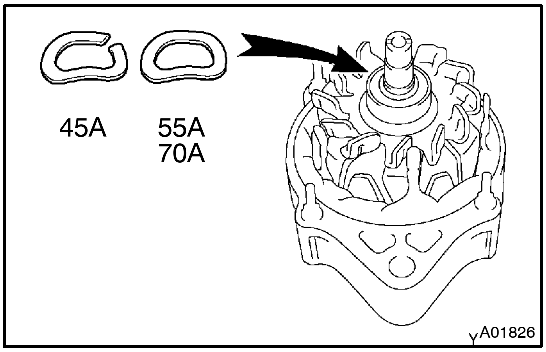
CH038-01

REASSEMBLY



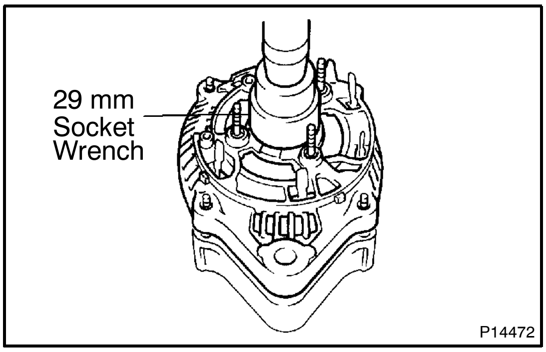
1. PLACE DRIVE END FRAME ON PULLEY

2. INSTALL ROTOR TO DRIVE END FRAME



3. INSTALL RECTIFIER END FRAME

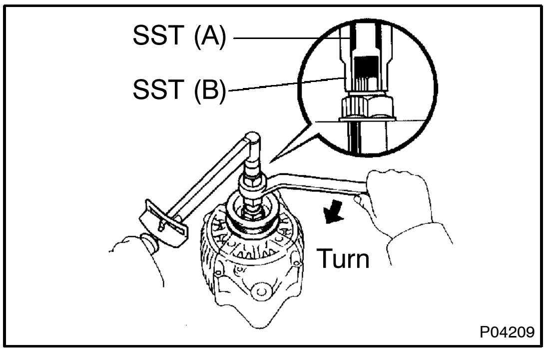
(a) Place the alternator washer on the rotor.



(b) Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.

(c) 55A:, 70A:
Install the 4 nuts.
Torque: 4.5 N·m (46 kgf·cm, 40 in.·lbf)

(d) 45A:
Install the 2 nut and 2 bolts.
Torque: 4.5 N·m (46 kgf·cm, 40 in.·lbf)

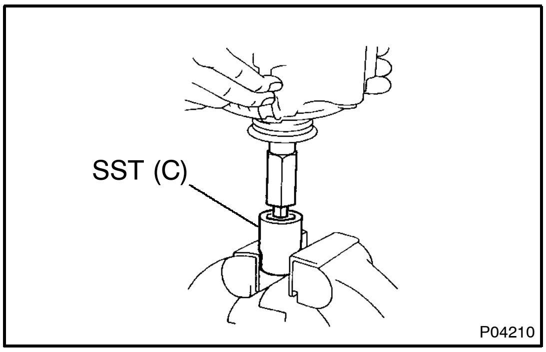


4. INSTALL PULLEY

(a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

(b) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820-63010
Torque:39 N·m (400 kgf·cm, 29 ft·lbf)

(c) Check that SST (A) is secured to the pulley shaft.



(d) Mount SST (C) in a vise.

(e) Install SST (B) into (C), and attach the pulley nut to SST (C).

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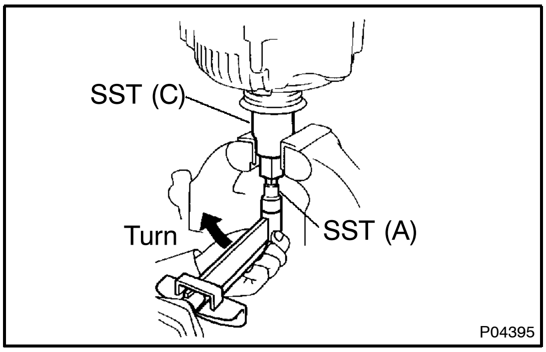
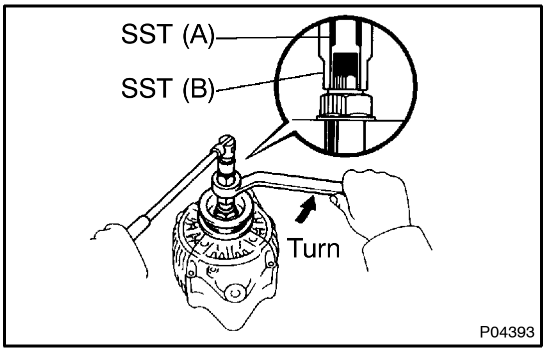
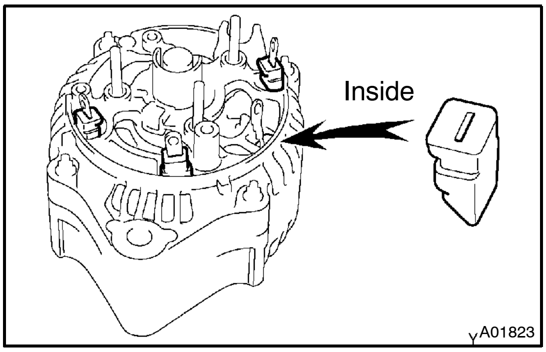


(f) To torque the pulley nut, turn SST (A) in the direction shown in the illustration.
Torque:110 N·m (1,125 kgf·cm, 81 ft·lbf)

(g) Remove the alternator from SST (C).



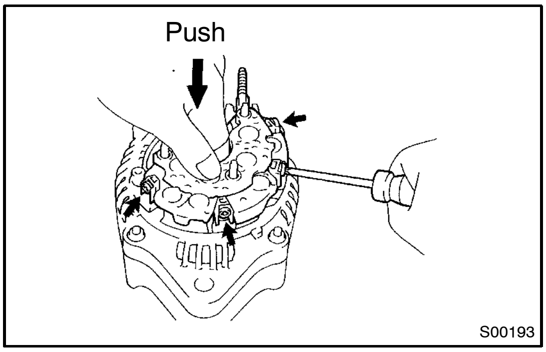
(h) Turn SST (B), and remove SST (A and B).



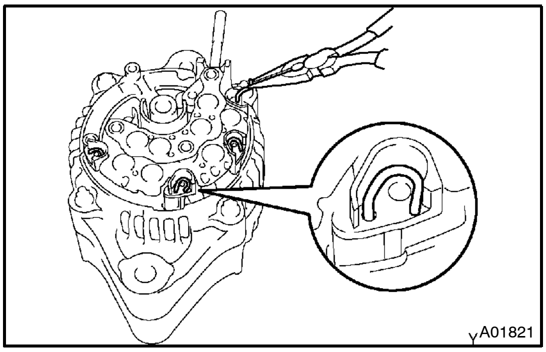
5. 55A:, 70A:
INSTALL RECTIFIER HOLDER

(a) 55A:
Install the 4 rubber insulators on the lead wires.

NOTICE:
Be careful of the rubber insulators installation direction.



(b) Install the rectifier holder with the 4 screws.
Torque:2.0 N·m (20 kgf·cm, 17.4 in.·lbf)



6. 45A:
INSTALL RECTIFIER HOLDER

(a) Install the rectifier holder.

(b) Bend the 4 stator lead wires as shown in the illustration.

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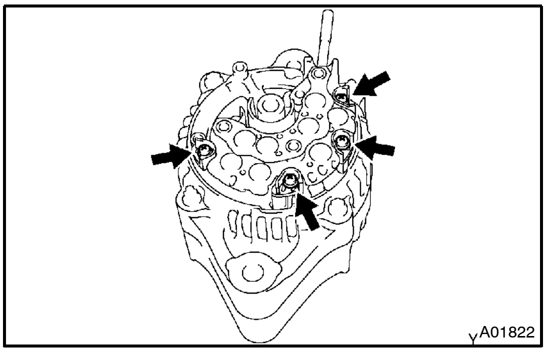
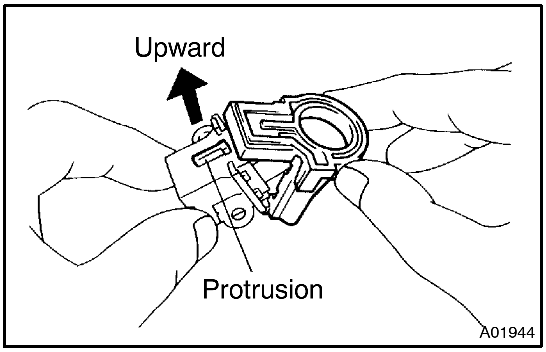


(c) Install the 4 screws.
Torque:2.0 N·m (20 kgf·cm, 17.4 in.·lbf)

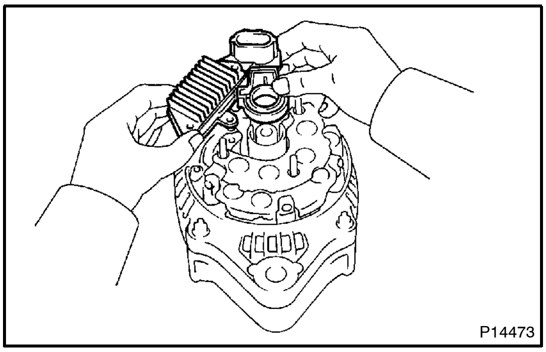


7. INSTALL IC REGULATOR AND BRUSH HOLDER

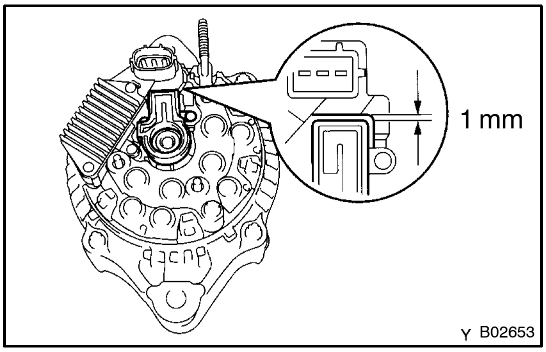
(a) Install the brush holder cover to the brush holder.

NOTICE:

Be careful of the holder installation direction.



(b) Place the IC regulator together with the brush holder horizontally on the rectifier end frame.



(c) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and connector.
(d) **2.0 N·m (20 kgf·cm, 17.4 in.·lbf)**
(e) 55A:, 70A:
Install the bolt the rectifier holder to rectifier end frame.
Torque:3.9 N·m (40 kgf·cm, 35 in.·lbf)

8. INSTALL REAR END COVER

(a) Install the end cover with the 3 nuts.
Torque:4.5 N·m (46 kgf·cm, 40 in.·lbf)
(b) Install the terminal insulator with the nut.
Torque:4.1 N·m (42 kgf·cm, 36 in.·lbf)

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