FOREWORD

This supplement has been prepared to provide information covering general service repairs for DUTRO which underwent changes in December, 2003.

Applicable models: XZU 305, 345, 404, 414, 424, 434 series

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

Manual Name	Pub. No.
• DUTRO Chassis Workshop Manual	S1–YXZE05
• DUTRO Electrical Wiring Diagram	S1–YXZE05A–SL
• DUTRO Electrical Wiring Diagram	S1–YXZE10A–SL
• N04C–TF Engine Workshop Manual	S5–YN04E01A
• S05C Engine Workshop Manual	S5–YS05E06A
• M550 Manual Transmission Workshop Manual	S1–YXZE09A
• H260 Manual Transmission Workshop Manual	S1–YXZE07A
• H350 Manual Transmission Workshop Manual	S1–YXZE06A

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.

If you find any failures in this manual, you are kindly requested to inform us by using the report form on the next page.

Workshop Manual Quality Report

Att.) Service Manager,
Your Distributor

Pub. No.		Issue Date	
Name of Dealer		Name of Reporter	
Subject			
Problem Description			
Correction Proposal			

CAUTION

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

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

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

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HOW TO USE THIS MANUAL

010VV–01

GENERAL INFORMATION

1. GENERAL DESCRIPTION

(a) This manual is written in accordance with SAE J2008.

(b) Repair operations can be separated into 3 main processes:
1. Diagnosis
2. Removing/Installing, Replacing, Disassembling/Reassembling, Checking and Adjusting
3. Final Inspection

(c) This manual explains the "Diagnosis" (found in the "Diagnostics" section) and "Removing and Installing, Replacing, Disassembling, Installing and Checking, and Adjusting". "Final Inspection" is omitted.

(d) The following essential operations are not written in this manual. However, these operations must be performed in actual situations.
(1) Operations with a jack or lift
(2) Cleaning of a removed part when necessary
(3) Visual check

2. INDEX

(a) An alphabetical INDEX section is provided at the end of the book as a reference to help you find the item to be repaired.

3. PREPARATION

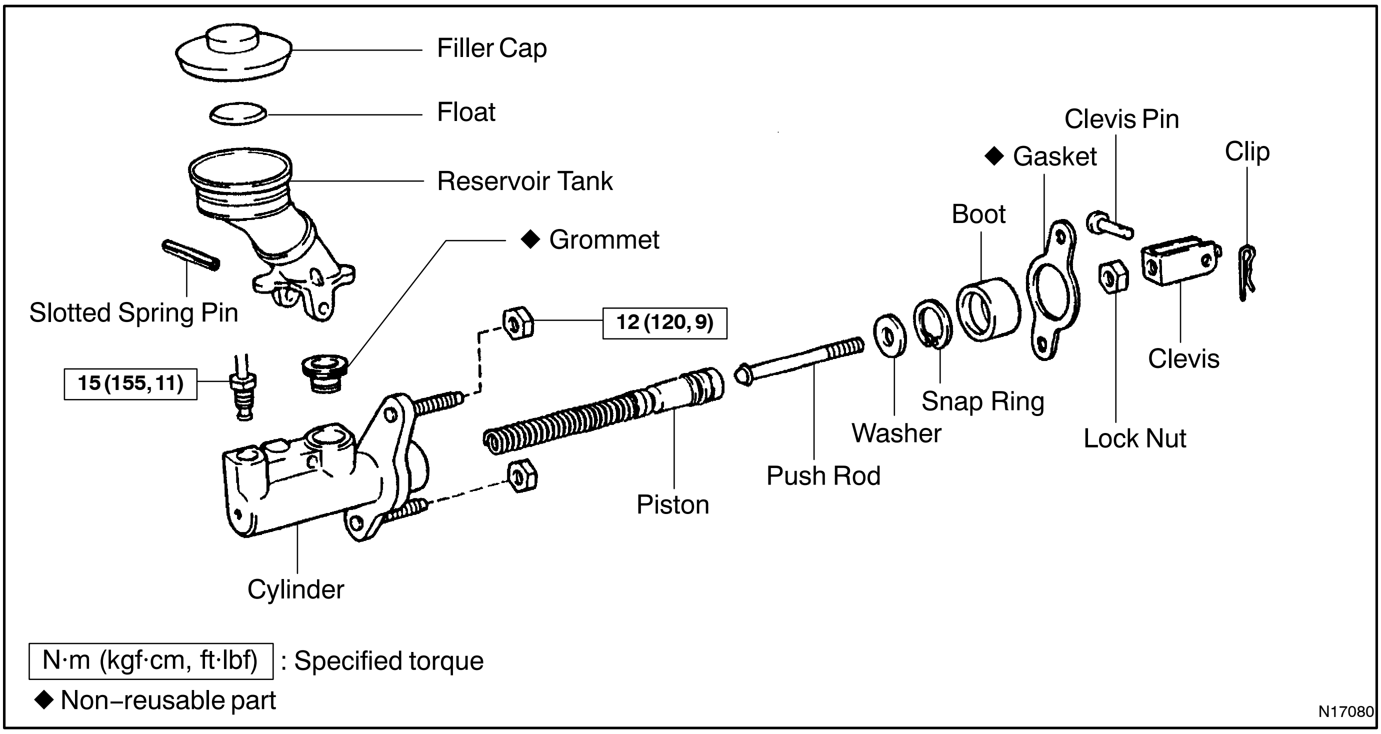
(a) Use of Special Service Tools (SST) and Special Service Materials (SSM) may be required, depending on the repair situation. Be sure to use SST and SSM when they are required and follow the working procedure properly. A list of SST and SSM is in the Preparation section of this manual.

4. REPAIR PROCEDURES

(a) A component illustrations is placed under the title where necessary.

(b) Non–reusable parts, grease application areas, precoated parts and torque specifications are noted in the component illustrations.

Example:

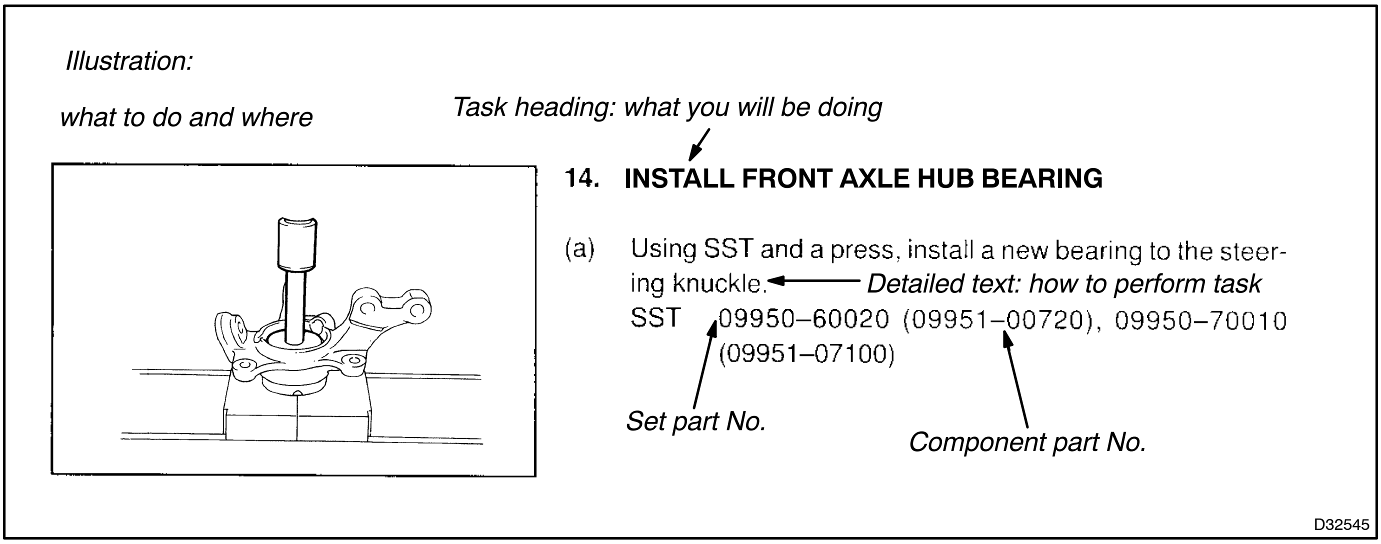


(c) Torque specifications, grease application areas and non–reusable parts are emphasized in the procedures.

NOTICE:
There are cases where such information can only be explained by using an illustration. In these cases, all the information such as torque, oil, etc. are described in the illustration.

(d) The installation procedures are the removal procedures in reverse order. However, only installation procedures requiring additional information are included.
(e) Only items with key points are described in the text. What to do and other details are placed in illustrations next to the text. Both the text and illustrations are accompanied by standard values and notices.
(f) Illustrations of similar vehicle models are sometimes used. In those cases, specific details may be different from the actual vehicle.
(g) Procedures are presented in a step–by–step format:
    (1) The illustration shows what to do and where to do it.
    (2) The task heading tells what to do.
    (3) The explanation text tells how to perform the task. It also has information such as specifications and warnings.

Example:



HINT:
This format provides an experienced technician with a FAST TRACK to the necessary information. The task headings are easy to read and the text below the task heading provides detailed information. Important specifications and warnings are always written in bold type.

5. SERVICE SPECIFICATIONS

(a) SPECIFICATIONS are presented in bold–faced text throughout the manual. The specifications are also found in the Service Specifications section for quick reference.

6. TERMS DEFINITION

CAUTION	Possibility of injury to you or other people.
NOTICE	Possibility of damage to the components being repaired.
HINT	Provides additional information to help you perform repairs.

7. SI UNIT

(a) The units used in this manual comply with the SI UNIT (International System of Units) standard. Units from the metric system and the English system are also provided.

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

IDENTIFICATION INFORMATION

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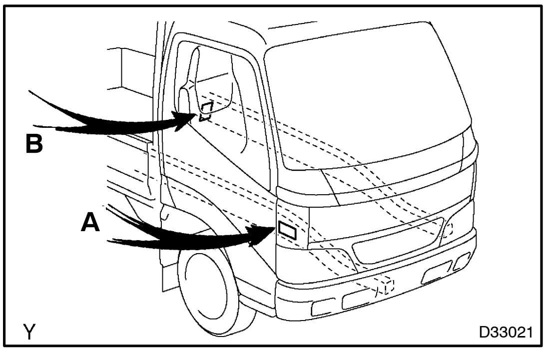
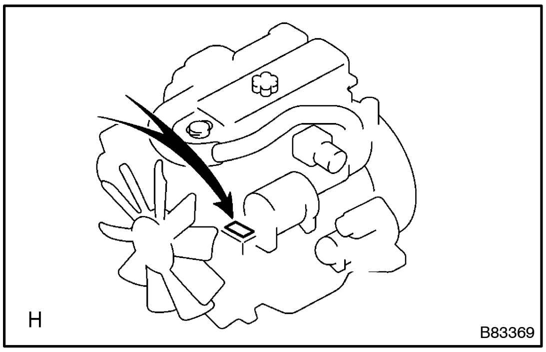
VEHICLE IDENTIFICATION AND SERIAL NUMBERS



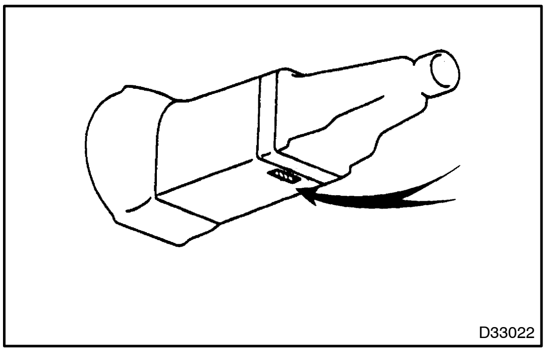
1. VEHICLE IDENTIFICATION NUMBER

(a) The vehicle identification number is stamped on the right frame as shown in the illustration. This number has also been stamped on the manufacturer's plate.
A: Vehicle Identification Number
B: Manufacturer's Plate



2. ENGINE SERIAL NUMBER AND TRANSMISSION SERIAL NUMBER

(a) The engine serial number is stamped on the cylinder block of the engine, as shown in the illustration.



(b) The transmission serial number is stamped on the transmission, as shown in the illustration.

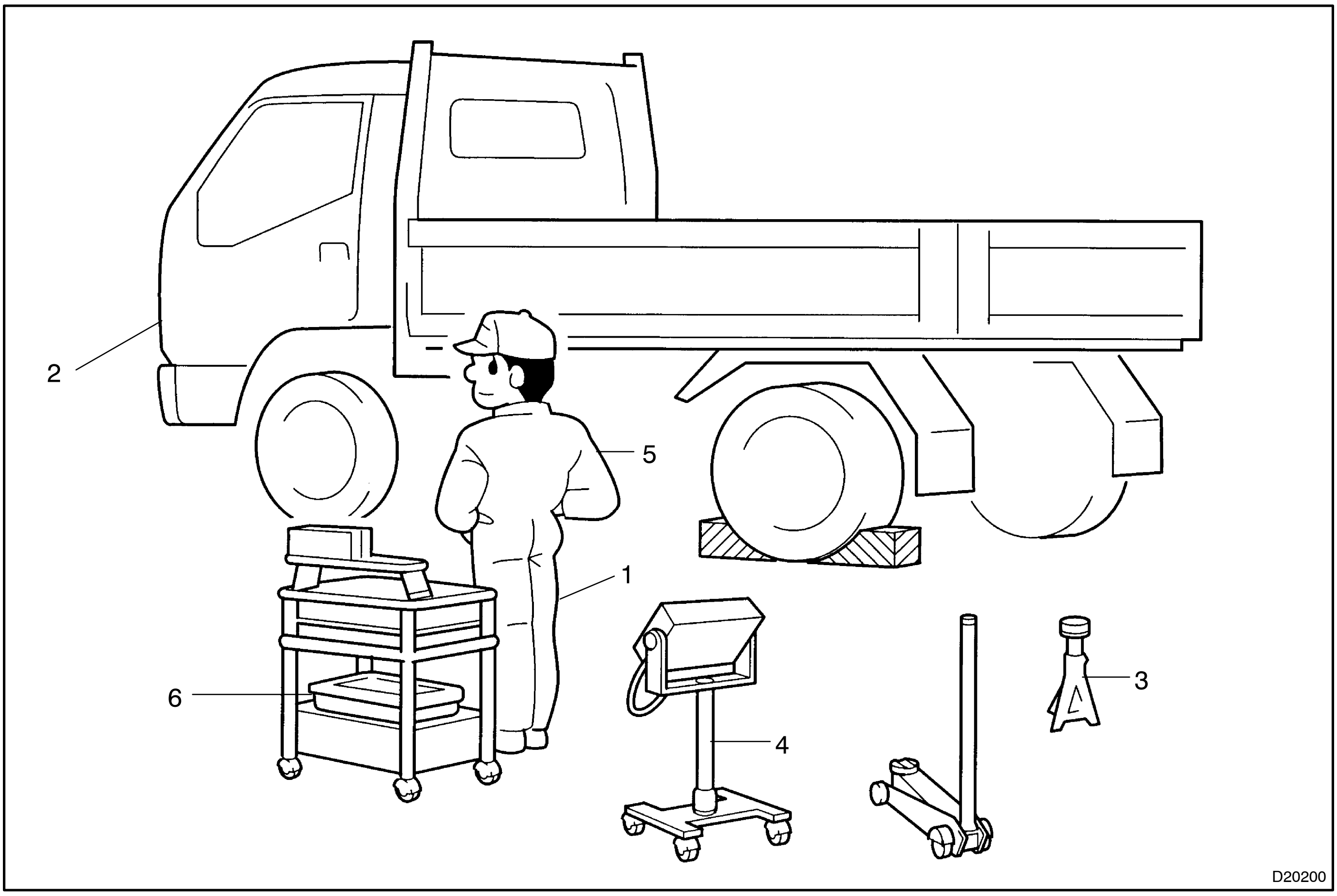
REPAIR INSTRUCTION

010VX–01

PRECAUTION

1. BASIC REPAIR HINT

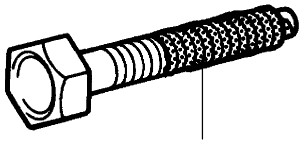
(a) HINTS ON OPERATIONS



1	Looks	• Always wear a clean uniform. • Hat and safety shoes must be worn.
2	Vehicle protection	• Prepare a grille cover, fender cover, seat cover and floor mat before starting the operation.
3	Safe operation	• When working with 2 or more persons, be sure to check safety for one another. • When working with the engine running, make sure to provide ventilation for exhaust fumes in the workshop. • If working on high temperature, high pressure, rotating, moving, or vibrating parts, wear appropriate safety equipment and take extra care not to injure yourself or others. • When jacking up the vehicle, be sure to support the specified location with a safety stand. • When lifting up the vehicle, use appropriate safety equipment.
4	Preparation of tools and measuring gauge	• Before starting operation, prepare a tool stand, SST, gauge, oil and parts for replacement.
5	Removal and installation, disassembly and assembly operations	• Diagnose with a thorough understanding of proper procedures and of the reported problem. • Before removing the parts, check the general condition of the assembly and for deformation and damage. • When the assembly is complicated, take notes. For example, note the total number of electrical connections, bolts, or hoses removed. Add matchmarks to insure re–assembly of components in the original positions. Temporarily mark hoses and their fittings, if needed. • Clean and wash the removed parts if necessary and assemble them after a thorough check.
6	Removed parts	• Place the removed parts in a separate box to avoid mixing them up with the new parts or contaminating the new parts. • As for non–reusable parts such as a gasket, an O–ring, and a self–locking nut, replace them with new ones following the instructions in this manual. • Retain the removed parts for customer inspection, if requested.

(b) JACKING UP AND SUPPORTING VEHICLE

(1) Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations (see page 01–14).



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(c) PRECOATED PARTS

(1) Precoated parts are bolts and nuts. They are coated with a seal lock adhesive at the factory.

(2) If a precoated part is retightened, loosened or moved in anyway, it must be recoated with the specified adhesive.

(3) When reusing precoated parts, clean off the old adhesive and dry the part with compressed air. Then apply new seal lock adhesive appropriate to the bolts and nuts.

NOTICE:
Perform the torque with the lower limit value of the torque tolerance.

(4) Some seal lock agents harden slowly. You may have to wait for the seal lock agent to harden.

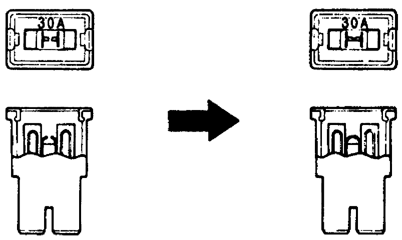
(d) GASKETS

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

(e) BOLTS, NUTS AND SCREWS

(1) Carefully follow all the specifications for tightening torques. Always use a torque wrench.

Medium Current Fuse and High Current Fuse Equal Amperage Rating



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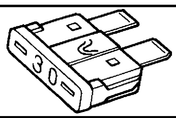
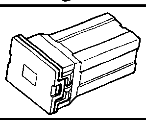
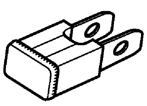
(f) FUSES

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

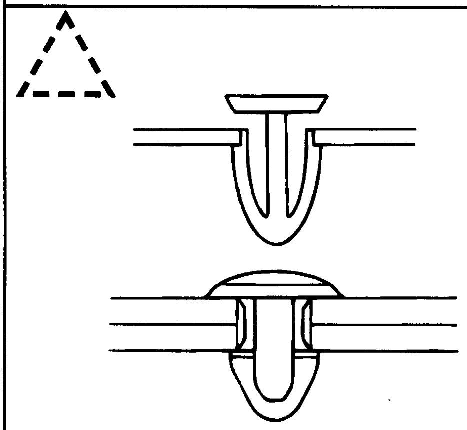
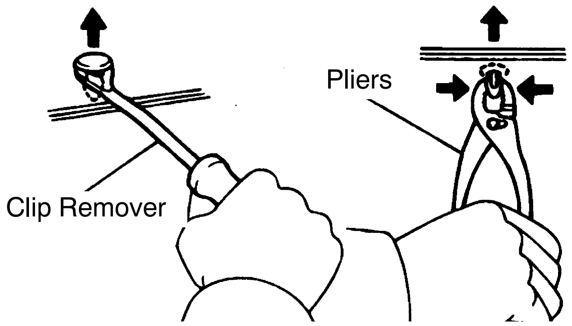
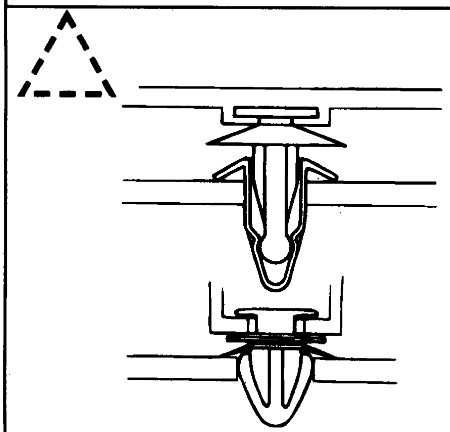
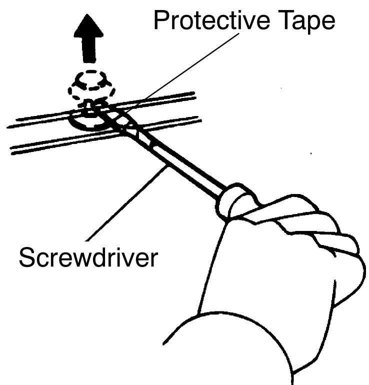
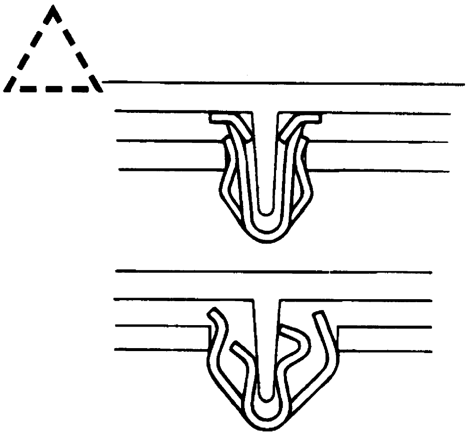
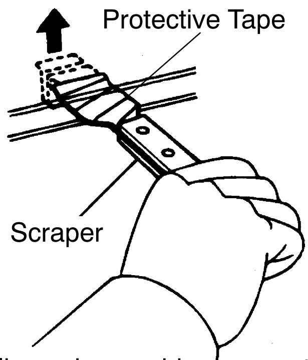
Illustration	Symbol	Part Name	Abbreviation
 BE5594	 IN0365	FUSE	FUSE
 BE5595	 IN0366	MEDIUM CURRENT FUSE	M–FUSE
 D27353	 IN0367	HIGH CURRENT FUSE	H–FUSE

(g) CLIPS

(1) The removal and installation methods of typical clips used in body parts are shown in the table below.

HINT:

If clips are damaged during a procedure, always replace the damaged clip with a new clip.

Shape (Example)	Removal/Installation
	 Remove clips from front or rear using a clip remover or pliers.
	 Remove fasteners using a clip remover or screwdriver.
	 Remove clips using a wide scraper to prevent panel damage.

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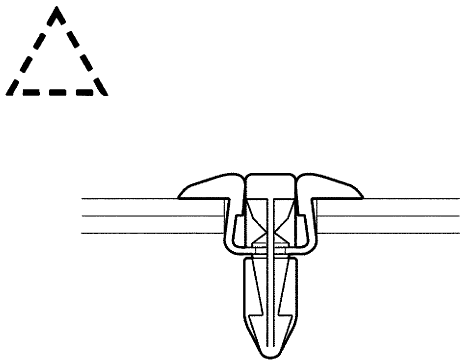
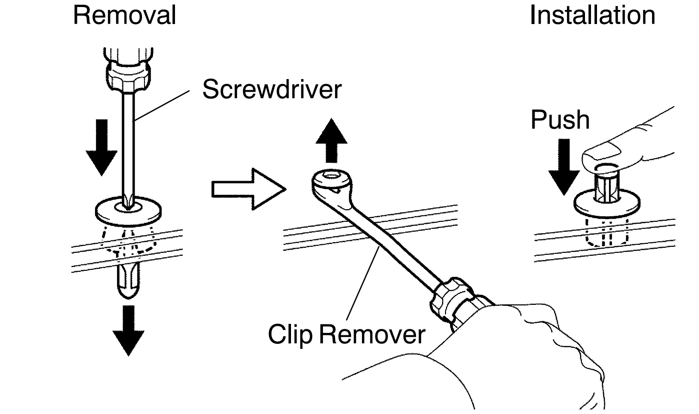
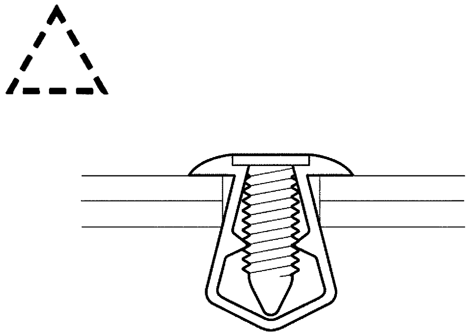
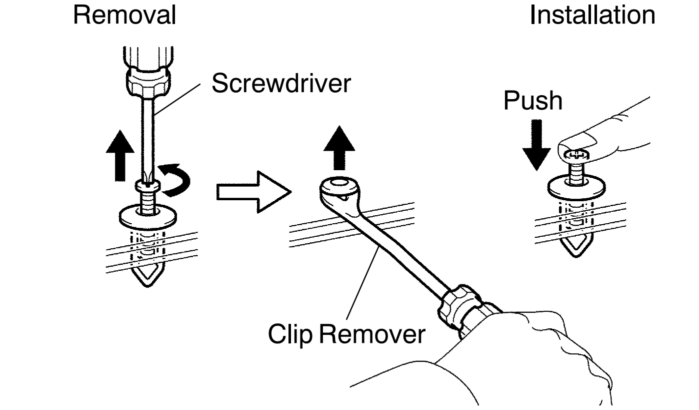
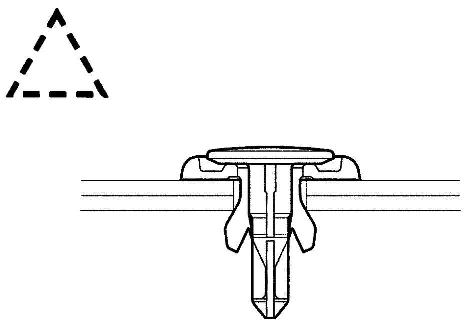
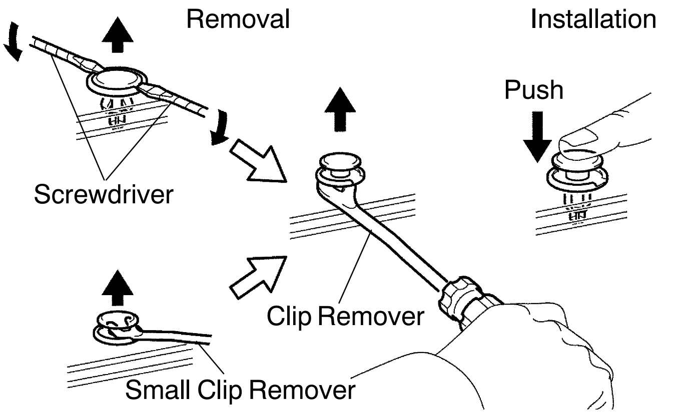
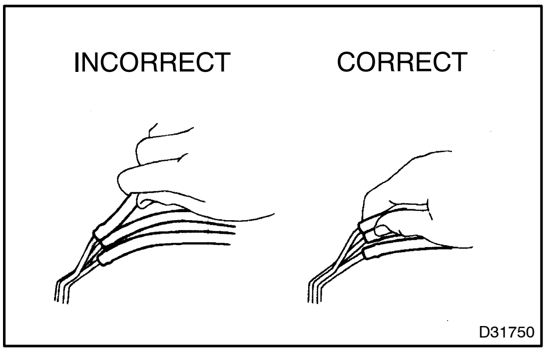
<table>
<tr><th>Shape (Example)</th><th>Removal/Installation</th></tr>
<tr><td></td><td>

Remove rivet by pushing the center pin through and prying out the rivet shell.</td></tr>
<tr><td></td><td>

Remove rivet by unscrewing the center pin and prying out the rivet shell.</td></tr>
<tr><td></td><td>

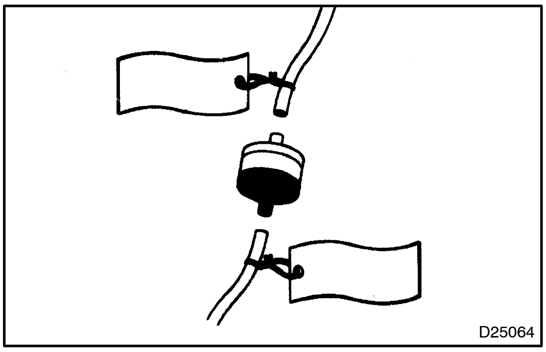
Remove rivet by prying out the pin and then prying out the rivet shell.</td></tr>
</table>

D32182



(h) REMOVAL AND INSTALLATION OF VACUUM HOSES

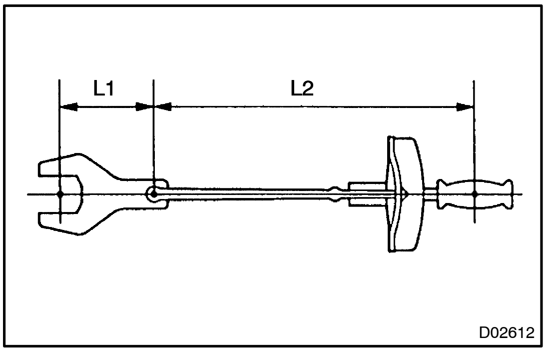
(1) To disconnect vacuum hose, pull and twist from the end of the hose. Do not pull from the middle of the hose as this may cause damage.



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

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

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



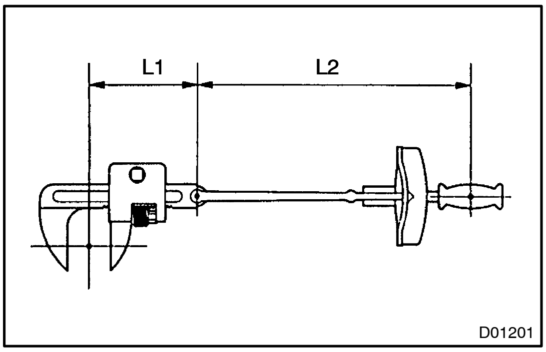
(i) TORQUE WHEN USING TORQUE WRENCH WITH EXTENSION TOOL

(1) If SST or an extension tool is combined with the torque wrench to extend its length, do not tighten the torque wrench to the specified torque values in this manual. The actual torque will be excessive.

(2) Use the formula below to calculate special torque values for situations where SST or an extension tool is combined with the torque wrench.

(3) Formula: T' = T x L2/(L1 + L2)

T'	Reading of torque wrench {N·m (kgf·cm, ft·lbf)}
T	Torque {N·m (kgf·cm, ft·lbf)}
L1	Length of SST or extension tool (cm (in.))
L2	Length of torque wrench (cm (in.))



2. FOR VEHICLES EQUIPPED WITH SRS AIRBAG

HINT:

The HINO DUTRO is equipped with an SRS (Supplemental Restraint System), such as the driver airbag and seat belt pretensioner.

Failure to carry out the service operations in the correct sequence could cause the SRS to unexpectedly deploy during servicing and lead to serious injury.

Furthermore, if a mistake is made when servicing the SRS, it is possible that the SRS may fail to operate properly. Before servicing (including removal or installation of parts, inspection or replacement), be sure to read the following section carefully.

(a) GENERAL NOTICE

(1) As the malfunction symptoms of the SRS are difficult to confirm, the Diagnostic Trouble Codes (DTCs) become the most important source of information when troubleshooting. When troubleshooting the SRS, always check the DTCs before disconnecting the battery (see Pub. No. S1–YXZE05A, page 05–213).

(2) Work must be started at least 90 seconds after the ignition switch is turned to the LOCK position and the negative (–) terminal cable is disconnected from the battery.
(The SRS is equipped with a back–up power source. If work is started within 90 seconds after turning the ignition switch to lock and disconnecting the negative (–) terminal cable from the battery, the SRS may deploy).
When the negative (–) terminal cable is disconnected from the battery, clock and audio system memory is erased. Before starting work, make a note of the settings of each memory system. When work is finished, reset the clock and audio systems as before.

CAUTION:

Never use a back–up power source (battery or other) to avoid erasing system memory. The back–up power source may inadvertently power the SRS and cause it to deploy.

(3) In minor collisions where the SRS does not deploy, the horn button assembly and seat belt pretensioner should be inspected before further use of the vehicle (see Pub. No. S1–YXZE05A, page 60–7 and 60–12).

(4) Never use SRS parts from another vehicle. When replacing parts, use new parts.

(5) Before repairs, remove the airbag sensor if impacts are likely to be applied to the sensor during repairs.

(6) Never disassemble and repair the airbag sensor assembly, horn button assembly or seat belt pretensioner.

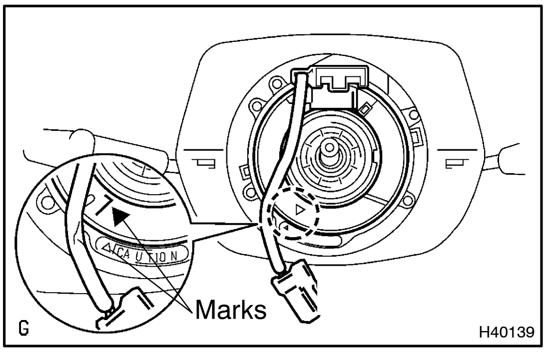
(7) Replace the center airbag sensor assembly and horn button assembly if:1) damage has occurred from being dropped, or 2) cracks, dents or other defects in the case, bracket or connector are present.

(8) Do not directly expose the airbag sensor assembly, horn button assembly to hot air or flames.

(9) Use a voltmeter/ohmmeter with high impedance (10 kΩ/V minimum) for troubleshooting electrical circuits.

(10) Information labels are attached to the SRS components. Follow the instructions on the labels.

(11) After work on the SRS is completed, check the SRS warning lamp (see Pub. No. S1–YXZE05A, page 05–213).



(b) SPIRAL CABLE (in Combination Switch)

(1) The steering wheel must be fitted correctly to the steering column with the spiral cable at the neutral position, otherwise cable disconnection and other troubles may occur. See Pub. No. S1–YXZE05A, page 60–15 concerning the correct installation of the steering wheel.

(c) HORN BUTTON ASSEMBLY (with Airbag)

(1) When removing the horn button assembly or handling a new horn button, it should be placed with the pad surface facing up. See illustration below.
Placing the horn button with the pad surface facing down may lead to a serious accident if the airbag accidentally inflates. Also, do not place anything on top of the horn button.

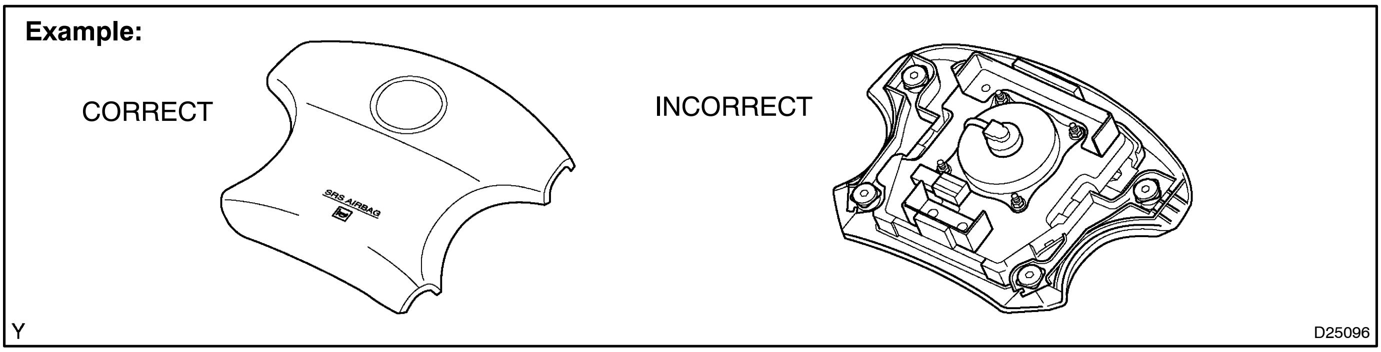
(2) Never measure the resistance of the airbag squib. This may cause the airbag to inflate, which could cause serious injury.

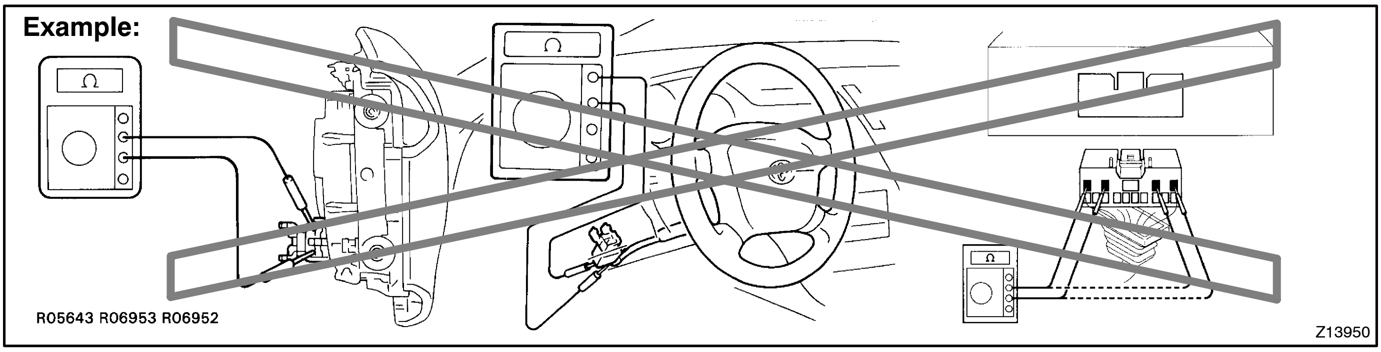
(3) Grease or detergents of any kind should not be applied to the steering wheel pad.

(4) Store the horn button assembly in an area where the ambient temperature is below 93°C (200°F), the humidity is not high and electrical noise is not nearby.

(5) When using electric welding anywhere on the vehicle, disconnect the airbag ECU connectors (4 pins). These connectors contain shorting springs. This feature reduces the possibility of the airbag or seat belt pretensioner deploying due to currents entering the squib wiring.

(6) When disposing of the vehicle or the horn button assembly by itself, the airbag should be inflated using an SST before disposal I (see Pub. No. S1–YXZE05A, page 60–7).
Perform the operation in a safe place away from electrical noise.





(d) SEAT BELT PRETENSIONER

(1) Never measure the resistance of the seat belt pretensioner. This may cause the seat belt pretensioner to activate, which could cause serious injury.

(2) Never disassemble the seat belt pretensioner.

(3) Never install the seat belt pretensioner on another vehicle.

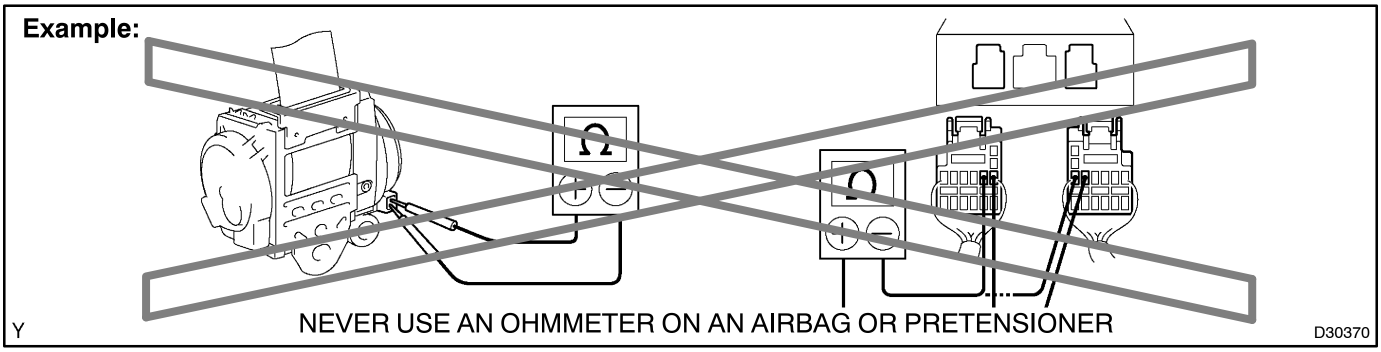
(4) Store the seat belt pretensioner in an area where the ambient temperature is below 80°C (176°F), the humidity is not high and electrical noise is not nearby.

(5) When using electric welding anywhere on the vehicle, disconnect the airbag ECU connectors (2 pins). These connectors contain shorting springs. This feature reduces the possibility of the airbag deploying due to currents entering the squib wiring.

(6) When disposing of a vehicle or the seat belt pretensioner unit by itself, the seat belt pretensioner should be activated before disposal (see Pub. No. S1–YXZE05A, page 61–12). Activate in a safe place away from electrical noise.

(7) As the seat belt pretensioner is hot after being activated, allow some time for it to cool down sufficiently before disposal. Never apply water to try to cool down the seat belt pretensioner.

(8) Grease, detergents, oil or water should not be applied to the front seat outer belt.



(e) AIRBAG SENSOR ASSEMBLY

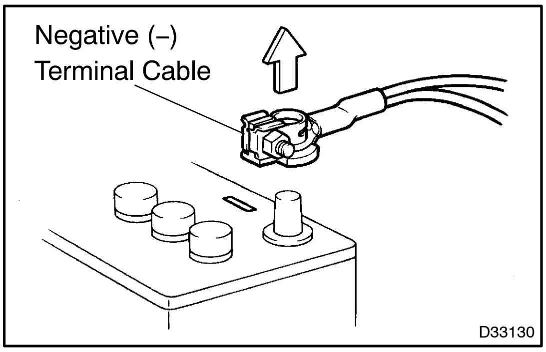
(1) Never reuse an airbag sensor assembly that has been involved in a collision where the SRS has deployed.

(2) The connectors to the airbag sensor assembly should be connected or disconnected with the sensor mounted on the floor. If the connectors are connected or disconnected while the airbag sensor assembly is not mounted to the floor, the SRS may activate.

(3) Work must be started at last 90 seconds after the ignition switch is turned to the LOCK position and the negative (–) terminal cable is disconnected from the battery, even if only loosening the set bolts of the airbag sensor assembly.

(f) WIRE HARNESS AND CONNECTOR

(1) The SRS wire harness is integrated with the instrument panel wire harness assembly. All the connectors in the system are a standard yellow color. If the SRS wire harness becomes disconnected or the connector becomes broken, repair or replace it.



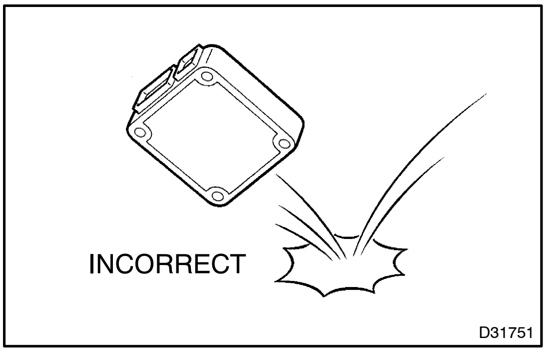
3. ELECTRONIC CONTROL

(a) REMOVAL AND INSTALLATION OF BATTERY TERMINAL

(1) Before performing electronic work, disconnect the battery negative (–) terminal cable beforehand to prevent component and wire damage caused by accidental short circuits.

(2) When disconnecting the terminal cable, turn the ignition switch and lighting switch OFF and loosen the terminal nut completely. Perform these operations without twisting or prying the terminal. Remove the battery cable from the battery post.

(3) Clock settings, radio settings, DTCs and other data are erased when the battery cable is removed. Before removing the battery cable, record any necessary data.



(b) HANDLING OF ELECTRONIC 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 rendered inoperative by static electricity.

(2) To disconnect electronic connectors, pull the connector itself, not the wires.

(3) Be careful not to drop electronic components, such as sensors or relays. If they are dropped on a hard surface, they should be replaced.

(4) When cleaning the engine with steam, protect the electronic components, air filter and emission–related components from water.

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

(6) When checking the resistance of a wire connector, insert the tester probe carefully to prevent terminals from bending.

4. REMOVAL AND INSTALLATION OF FUEL CONTROL PARTS

(a) PLACE FOR REMOVING AND INSTALLING OF FUEL SYSTEM PARTS

(1) Work in a place with good air ventilation that does not have welders, grinders, drills, electric motors, stoves, or any other ignition sources.

(2) Never work in a pit or near a pit as vaporized fuel will collect in those places.

(b) REMOVING AND INSTALLING OF FUEL SYSTEM PARTS

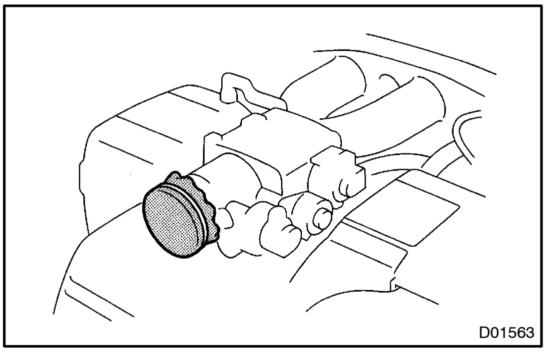
(1) Prepare a fire extinguisher before starting operation.

(2) To prevent static electricity, install a ground on the fuel changer, vehicle and fuel tank, and do not spray the area with water. The work surface will become slippery. Do not clean up spills with water as this will spread and gasoline and create a fire hazard.

(3) Avoid using electric motors, working lights and other electric equipment that can cause sparks or high temperatures.

(4) Avoid using iron hammers as they may create sparks.

(5) Dispose of fuel–contaminated shop rags separately using a fire resistant container.

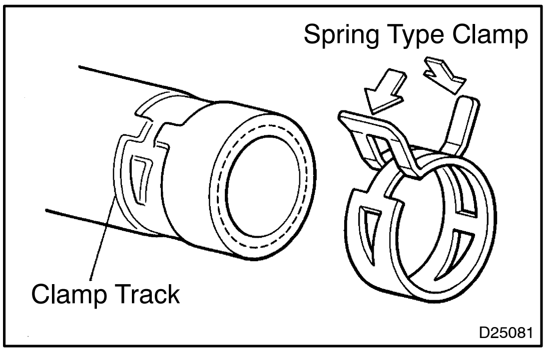


5. REMOVAL AND INSTALLATION OF ENGINE INTAKE PARTS

(a) If any metal tip is mixed in the inlet pass, that may damage the engine and turbocharger.

(b) When removing and installing the inlet system parts, cover the openings of the removed parts and engine openings. Use clean shop rags, gummed tape, or other suitable materials.

(c) When installing the inlet system parts, check that no metal particles have entered the engine or the installed part.



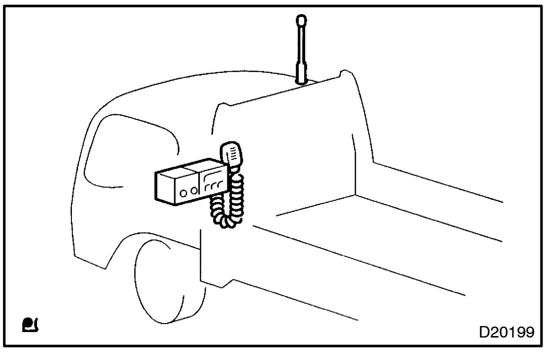
6. HANDLING OF HOSE CLAMPS

(a) Before removing the hose, check the clamp position so that it can be reinstalled in the same position.

(b) Replace deformed or dented clamps with a new one.

(c) When reusing a hose, attach the clamp on the clamp track portion of the hose.

(d) For a spring type clamp, you may want to spread the tabs slightly after installation by pushing in the direction of the arrow marks as shown in the illustration.



7. FOR VEHICLES EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

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

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

(c) Keep the antenna and feeder separate from other wirings as much as possible. This will prevent signals from the communication equipment from affecting vehicle equipment and vice–versa.

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

(e) Do not install any high–powered mobile communication system.

010VY–01

VEHICLE LIFT AND SUPPORT LOCATIONS

1. NOTICE ABOUT VEHICLE CONDITION WHEN JACKING UP THE VEHICLE

(a) The vehicle must be unloaded before jacking up the vehicle. Never jack up/lift up a heavily loaded vehicle.

(b) When removing heavy equipment such as the engine and transmission, the center of gravity of the vehicle may shift. To stabilize the vehicle: place a balance weight in a location where it will not roll or shift; or use a mission jack to hold the jacking support.

2. NOTICE FOR USING 4 POST LIFT

(a) Follow the safety procedures outlined in its instruction manual.

(b) Use precautionary measures to prevent the free beam from damaging tires or wheels.

(c) Use wheel chocks to secure the vehicle.

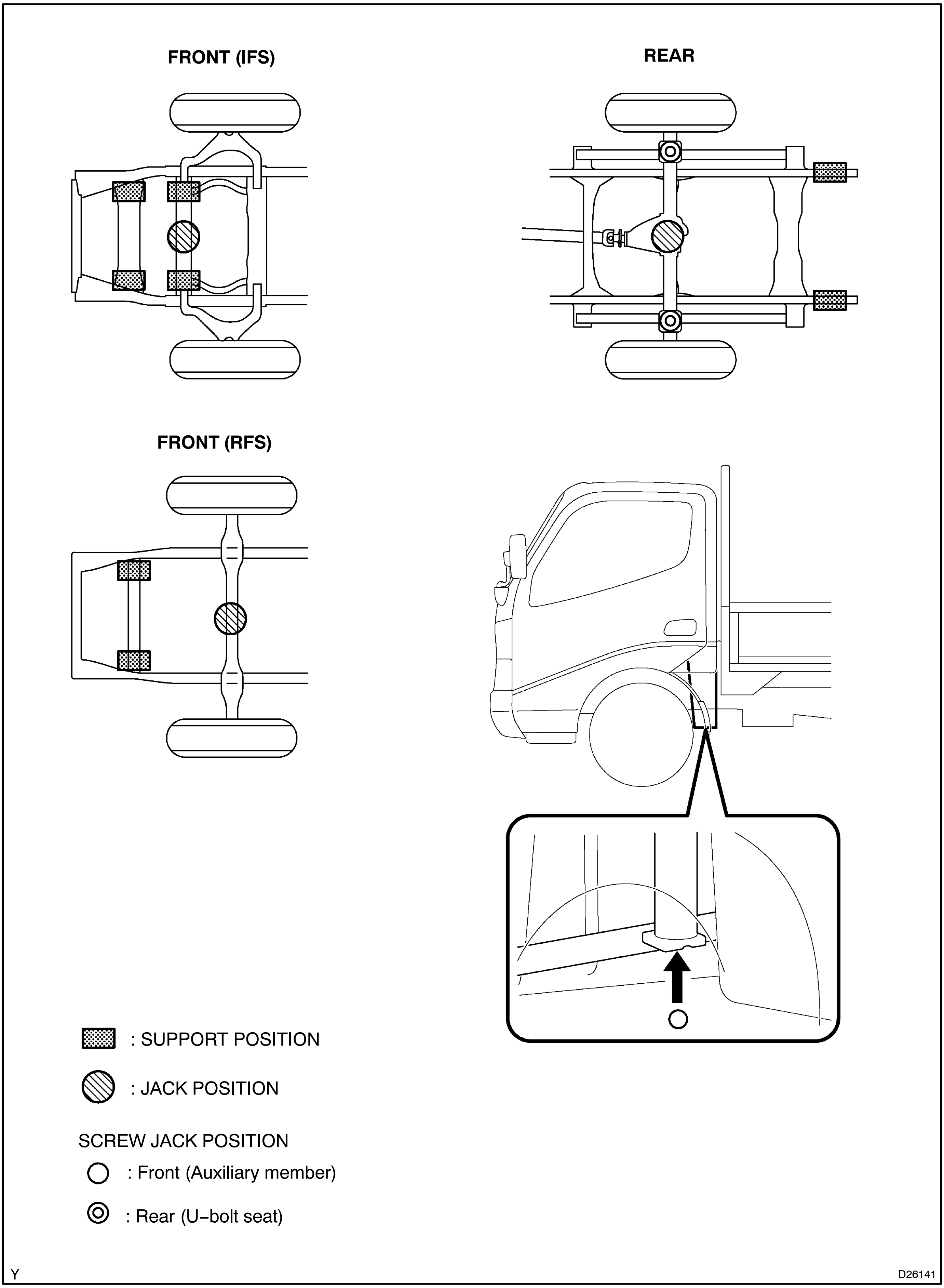
3. NOTICE FOR USING JACK AND SAFETY STAND

(a) Work in a flat area using wheel chocks at all times.

(b) Support the specified location with a jack and safety stand accurately.

(c) Do not work or leave the vehicle with a support only by a jack. Be sure to support the vehicle together with a safety stand.

(d) Be careful and accurate in jacking up and down the vehicle.


FRONT (IFS)
REAR
FRONT (RFS)
: SUPPORT POSITION
: JACK POSITION
SCREW JACK POSITION
: Front (Auxiliary member)
: Rear (U–bolt seat)
Y
D26141

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

010VZ–01

GENERAL INFORMATION

A large number of ECU controlled systems are used in the HINO DUTRO. In general, ECU controlled systems are considered to be very intricate, requiring a high level of technical knowledge to troubleshoot. However, most problem checking procedures only involve inspecting the ECU controlled system's circuits one by one. An adequate understanding of the system and a basic knowledge of electricity is enough to perform effective troubleshooting, accurate diagnoses and necessary repairs. Detailed information and troubleshooting procedures on major ECU controlled systems in this vehicle are outlined below:

System	See Page
1. ECD System (N04C–TF)	05–1
2. ABS & BA System	05–178
3. Easy & Smooth Starting System	05–265

FOR USING HAND–HELD TESTER

- Before using the tester (with 24 V VIM), the tester's operator manual should be read thoroughly.
- If the scan tool or tester cannot communicate with the ECU controlled systems when you have connected the cable of the tester to the DLC3 with the ignition switch and tester turned ON, there is a problem on the vehicle side or tester side.
  (1) If communication is normal when the tester is connected to another vehicle, inspect the diagnosis data link line (Bus⊕line) or ECU power circuit of the vehicle.
  (2) If communication is still impossible when the tester is connected to another vehicle, the problem is probably in the tester itself. Perform the Self Test procedures outlined in the tester operator's manual.

010W0–01

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:
Carry out troubleshooting in accordance with the procedures below. Only a basic procedure is shown. Details in the Diagnostic Section show the most effective methods for each circuit. Confirm the troubleshooting procedures for the circuit you are working on before beginning troubleshooting.

1	**VEHICLE BROUGHT TO WORKSHOP**

2	**CUSTOMER PROBLEM ANALYSIS**

(a) Ask the customer about the conditions and environment when the problem occurred.

3	**SYMPTOM CONFIRMATION AND DTC (AND FREEZE FRAME DATA) CHECK**

(a) Check the battery positive voltage.
Standard: 18 to 27 V (Engine stopped)
(b) Visually check the wire harness, connectors and fuses for open and short circuits.
(c) Warm up the engine to the normal operating temperature.
(d) Confirm the problem symptoms and conditions, and check for DTCs according to the related chart.

OK → **Go to step 5**

NG

4	**DTC CHART**

(a) Check the results obtained in step 3. Then confirm the inspection procedures for the system or part using the DTC chart.

→ **Go to step 6**

5	**PROBLEM SYMPTOMS CHART**

(a) Check the results obtained in step 3. Confirm the inspection procedures for the system or part using the problem symptoms table.

6	**CIRCUIT INSPECTION OR PARTS INSPECTION**

(a) Confirm the circuit or part that should be checked using the problem symptoms table or the results obtained in step 4.

7	**REPAIR**

(a) Repair the affected system or part according to the instructions in step 6.

8	**CONFIRMATION TEST**

(a) After completing repairs, confirm that the malfunction no longer exists. If the malfunction does not recur, perform a confirmation test under the same conditions and in the same environment as when it occurred the first time.

END

CUSTOMER PROBLEM ANALYSIS

HINT:

- In troubleshooting, the problem symptoms must be confirmed accurately. Preconceptions should be discarded in order to give an accurate judgement. To clearly understand what the problem symptoms are, it is extremely important to ask the customer about the problem and the conditions at the time it occurred.
- As much information as possible should be gathered for reference. Even past problems that seem unrelated may also help in some cases. In the Diagnostic Section, a customer problem analysis table is provided for each system.
- 5 items are important points in the problem analysis:

Important Points with 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) Supplemental Restraint System check sheet.

CUSTOMER PROBLEM ANALYSIS CHECK

SUPPLEMENTAL RESTRAINT SYSTEM Check Sheet

Inspector's Name

Customer's Name		**VIN**	
		Production Date	/ /
		License Plate No.	
Date Vehicle Brought In	/ /	**Odometer Reading**	**km** **miles**

Date Problem First Occurred	/ /
Weather	☐ **Fine** ☐ **Cloudy** ☐ **Rainy** ☐ **Snowy** ☐ **Other**
Temperature	**Approx.**

Vehicle Operation	☐ **Starting** ☐ **Idling** ☐ **Driving** [☐ **Constant speed** ☐ **Acceleration** ☐ **Deceleration** ☐ **Other**]

SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE

HINT:

The diagnostic system in the TOYOTA DYNA has various functions.

- The first function is the Diagnostic Trouble Code (DTC) check. In a DTC check, a previous malfunction's DTC can be checked by a technician during troubleshooting. (A DTC is a code stored in the ECU memory whenever a malfunction in the signal circuits to the ECU occurs.)
- Another function is the Input Signal Check, which checks if the signals from various switches are sent to the ECU correctly.

  By using these functions, the problem areas can be narrowed down and troubleshooting is more effective.

  Diagnostic functions are incorporated in the following systems in the HINO DUTRO:

System	Diagnostic Trouble Code Check	Input Signal Check (Sensor Check)	Diagnotis Test Mode (Active Test)
ECD System (N04C–TF)	○ (with Check Mode)	○	○
ABS & BA System	○		
Easy & Smooth Starting System	○		

- In the DTC check, it is very important to determine whether the problem indicated by the DTC is: 1) still occurring, or 2) occurred in the past but has since returned to normal. In addition, the DTC should be compared to the problem symptom to see if they are related. For this reason, DTCs should be checked before and after confirmation of symptoms (i.e., whether or not problem symptoms exist) to determine current system conditions, as shown in the flowchart below.

  Never skip the DTC check. Failure to check DTCs may, depending on the case, result in unnecessary troubleshooting for systems operating normally or lead to repairs not pertinent to the problem. Follow the procedures listed in the flowchart in the correct order.
- A flowchart showing how to proceed with troubleshooting using the DTC check is shown below. Directions from the flowchart will indicate how to proceed either to DTC troubleshooting or to the troubleshooting of the problem symptoms.

1	DTC CHECK

2	MAKE A NOTE OF DTCS DISPLAYED AND THEN CLEAR THE MEMORY

3	SYMPTOM CONFIRMATION

a	Symptoms exist
b	No symptoms exist

a → **Go to step 5**

b

4	SIMULATION TEST USING SYMPTOM SIMULATION METHODS

5 DTC CHECK

a	DTC displayed
b	No DTC displayed

a → **TROUBLESHOOTING OF PROBLEM INDICATED BY DTC**

b

6 SYMPTOM CONFIRMATION

a	No symptoms exist
b	Symptoms exist

If a DTC was displayed in the initial DTC check, the problem may have occurred in a wire harness or connector in that circuit in the past. Check the wire harness and connectors (see page 01–27).

a → **SYSTEM NORMAL**

b

TROUBLESHOOTING OF EACH PROBLEM SYMPTOM

The problem is still occurring in a place other than the diagnostic circuit (the DTC displayed first is either for a past problem or a secondary problem).

SYMPTOM SIMULATION

HINT:

The most difficult case in troubleshooting is when no problem symptoms occur. In such cases, a thorough customer problem analysis must be carried out. A simulation of the same or similar conditions and environment in which the problem occurred in the customer's vehicle should be carried out. No matter how much skill or experience a technician has, troubleshooting without confirming the problem symptoms will lead to important repairs being overlooked and mistakes or delays.

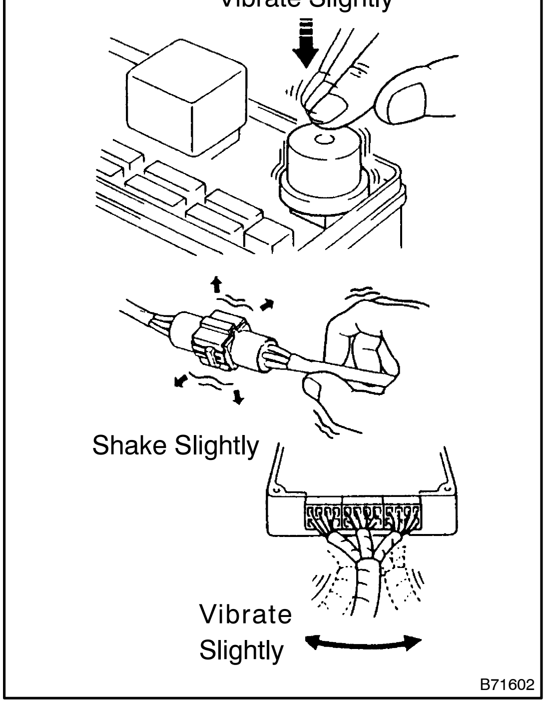
For example:

With a problem that only occurs when the engine is cold or occurs as a result of vibration caused by the road while driving, the problem can never be determined if the symptoms are being checked on a stationary vehicle or a vehicle with a warmed–up engine.

Vibration, heat or water penetration (moisture) is difficult to reproduce. The symptom simulation tests below are effective substitutes for the conditions and can be applied on a stationary vehicle.

Important points in the symptom simulation test:

In the symptom simulation test, the problem symptoms as well as the problem area or parts must be confirmed. First, narrow down the possible problem circuits according to the symptoms. Then, connect the tester and carry out the symptom simulation test, judging whether the circuit being tested is defective or normal. Also, confirm the problem symptoms at the same time. Refer to the problem symptoms table for each system to narrow down the possible causes.



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1. VIBRATION METHOD: When vibration seems to be the major cause.

(a) PART AND SENSOR

(1) Apply slight vibration with a finger to the part of the sensor considered to be the cause of the problem and check whether or not the malfunction occurs.

HINT:

Applying strong vibration to relays may open relays.

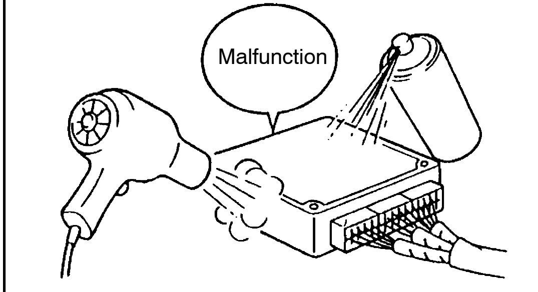
(b) CONNECTORS

(1) Slightly shake the connector vertically and horizontally.

(c) WIRE HARNESS

(1) Slightly shake the wire harness vertically and horizontally.

The connector joint and fulcrum of the vibration are the major areas that should be checked thoroughly.



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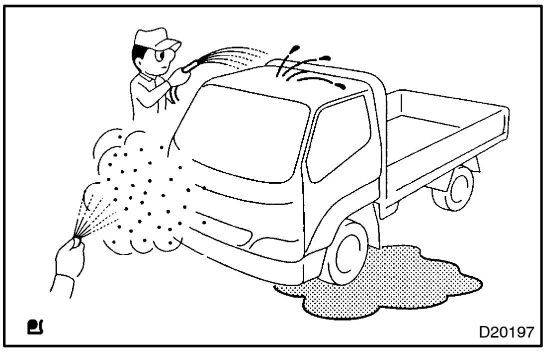
2. HEAT METHOD: If the problem seems to occur when the area in question is heated.

(a) Heat the component that is the possible cause of the malfunction with a hair dryer or similar device. Check if the malfunction occurs.

NOTICE:

- **Do not heat to more than 60°C (140°F). Exceeding this temperature may damage components.**
- **Do not apply heat directly to the parts in the ECU.**



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

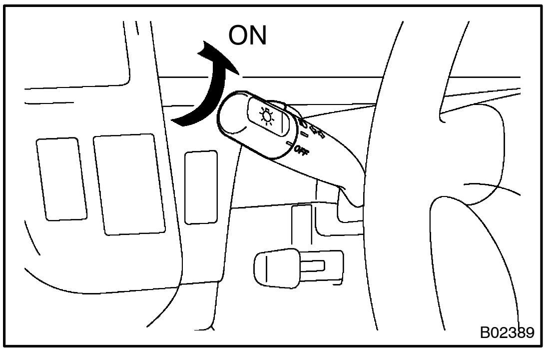
(a) Sprinkle water onto the vehicle and check if the malfunction occurs.

NOTICE:

- **Never sprinkle water directly into the engine compartment. Indirectly change the temperature and humidity by applying water spray onto the front of the radiator.**
- **Never apply water directly onto the electronic components.**

HINT:

If the vehicle has or had a water leakage problem, the leakage may have damaged the ECU or connections. Look for evidence of corrosion or shorts. Proceed with caution during water tests.



4. HIGH ELECTRICAL LOAD METHOD: When a malfunction seems to occur when electrical load is excessive.

(a) Turn on the heater blower, headlights, rear window defogger and all other electrical loads. Check if the malfunction reoccurs.

DIAGNOSTIC TROUBLE CODE CHART

Use Diagnostic Trouble Codes (DTCs) (from the DTC checks) in the table below to determine the trouble area and proper inspection procedure. The Supplemental Restraint System (SRS) DTC chart is shown below as an example.

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

- Trouble Area
  Indicates the suspected problem areas.

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

DIAGNOSTIC TROUBLE CODE CHART

If a malfunction code is displayed during the DTC check, check the circuit for that code listed in the table below (Proceed to the page given for that circuit).

DTC No. (See Page)	Detection Item	Trouble Area	SRS Warning Light
B0100/13 (05–119)	• Short in D squib circuit	• Steering wheel pad (squib) • Spiral cable • Airbag sensor assembly • Wire harness	ON
B0101/14 (05–124)	• Open in D squib circuit	• Steering wheel pad (squib) • Spiral cable • Airbag sensor assembly • Wire harness	ON
B0102/11 (05–128)	• Short in D squib circuit (to ground)	• Steering wheel pad (squib) • Spiral cable • Airbag sensor assembly • Wire harness	ON
B0103/12 (05–132)	• Short in D squib circuit (to B+)	• Steering wheel pad (squib) • Spiral cable • Airbag sensor assembly • Wire harness	ON
B0105/53 (05–136)	• Short in P squib circuit	• Front passenger airbag assembly (squib) • Airbag sensor assembly • Wire harness	ON
B0106/54	• Open in P squib circuit	• Front passenger airbag assembly (squib) • Airbag sensor assembly • Wire harness	
	b circuit (to Ground)	• Front passenger airbag assembly (squib) • Airbag sensor assembly • Wire harness	

PROBLEM SYMPTOMS TABLE

The suspected circuits or parts for each problem symptom are shown in the table below. Use this table to troubleshoot when, during a DTC check, a "Normal" code is displayed but the problem is still occurring. Numbers in the table show the inspection order in which the circuits or parts should be checked.

HINT:

In some cases, the problem is not detected by the diagnostic system even though a problem symptom is present. It is possible that the problem is occurring outside the detection range of the diagnostic system, or that the problem is occurring in a completely different system.

- Page
  Indicates the page where the flowchart for each circuit is located.

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

- Problem Symptom

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

PROBLEM SYMPTOMS TABLE

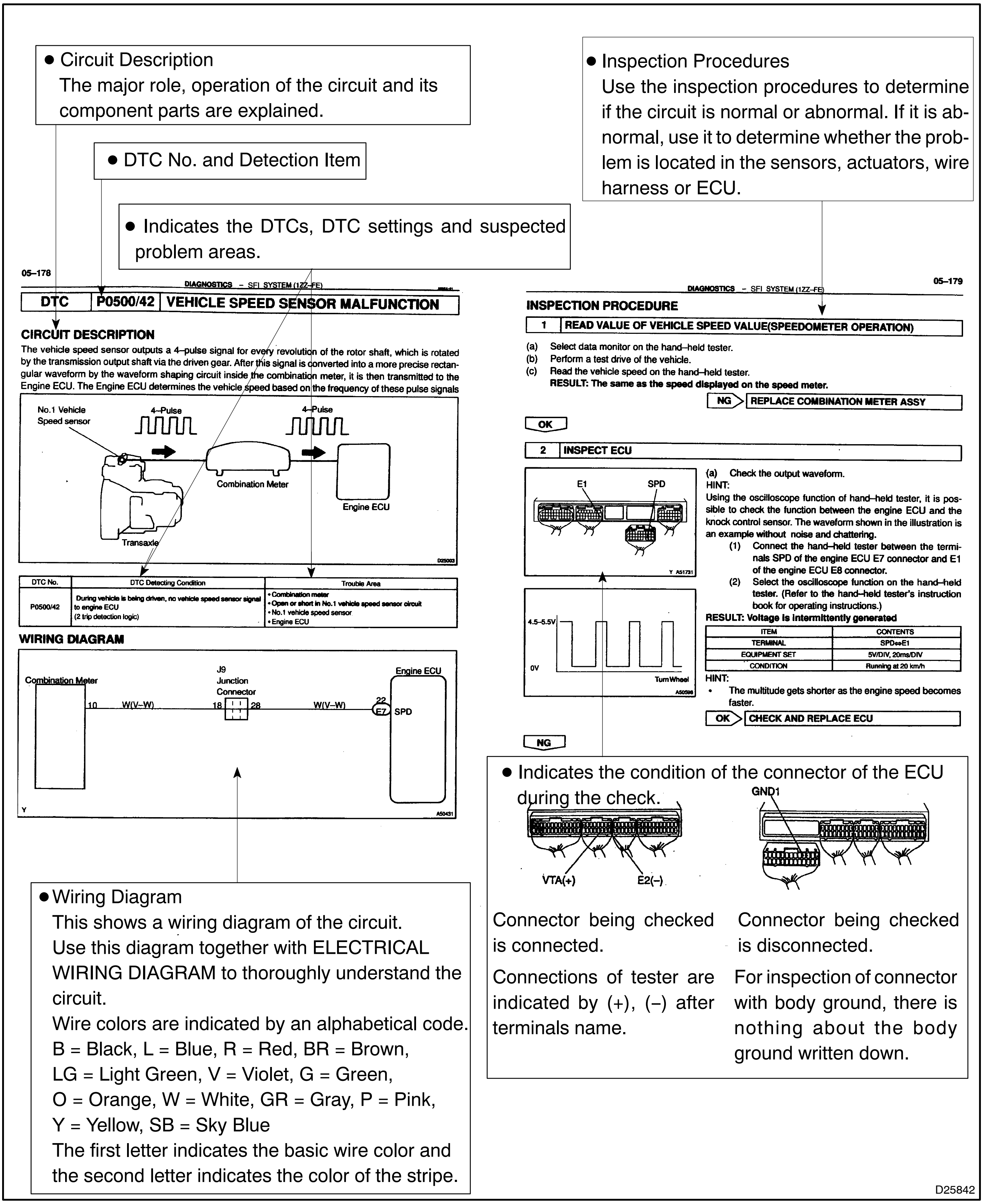
HINT:

Inspect the "Fuse" and "Relay" before confirming the suspected area in the charts below (see page 68–1).

Symptom	Suspected Area	See Page
Black screen	1. Power source circuit (multi–display assy) 2. Multi–display	05–1267 67–7
Screen cannot be dimmer in night time	1. SRS warning light circuit (multi–display assy) 2. Multi–display assy	05–1277 67–7
A navigation system cannot be operated	1. Steering pad switch circuit 2. AVC–LAN circuit (radio receiver assy–multi–display assy) 3. Radio receiver assy 4. Multi–display assy	05–1183 05–1303 67–5 67–7

CIRCUIT INSPECTION

How to read and use each page is shown below.



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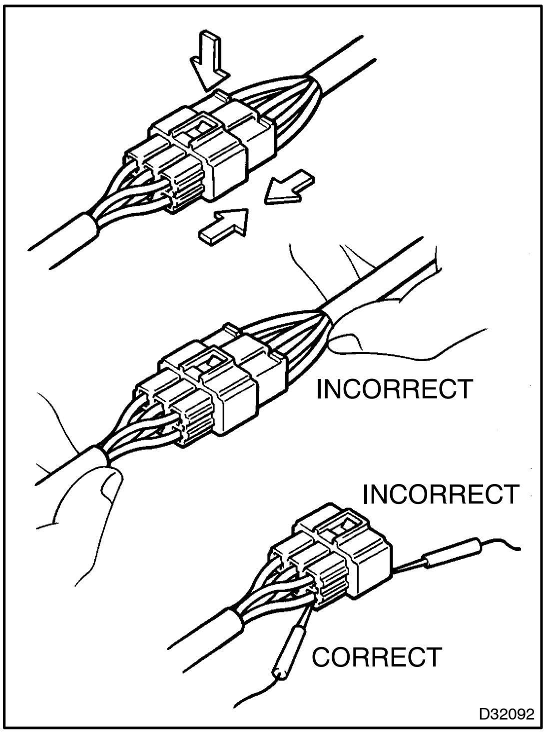
010W1–01

ELECTRONIC CIRCUIT INSPECTION PROCEDURE

1. BASIC INSPECTION

(a) RESISTANCE MEASURING CONDITION OF ELECTRONIC PARTS

(1) Unless stated, all resistance measurements should be made at an ambient temperature of 20°C (68°F). Resistance measurements may be outside the specifications if measured at high temperatures, i.e. immediately after the vehicle has been running. Measurements should be made after the engine has cooled down.



(b) HANDLING CONNECTORS

(1) When disconnecting a connector, first squeeze the mating halves tightly together to release the lock, then press the lock claw and separate the connector.

(2) When disconnecting a connector, do not pull on the harnesses. Grasp the connector directly and separate it.

(3) Before connecting the connector, check that there are no deformed, damaged, loose or missing terminals.

(4) When connecting a connector, press firmly until you hear the lock close with a ”click” sound.

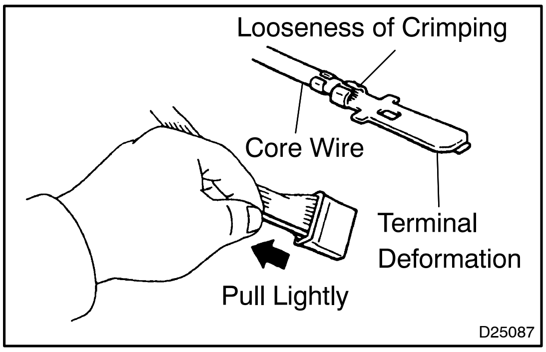
(5) If checking the connector with a TOYOTA electrical tester, check it from the backside (harness side) of the connector using a mini test lead.

NOTICE:

- **As a waterproof connector cannot be checked from the backside, check by connecting a sub–harness.**
- **Do not damage the terminals by moving the inserted tester needle.**

(c) CHECKING CONNECTORS

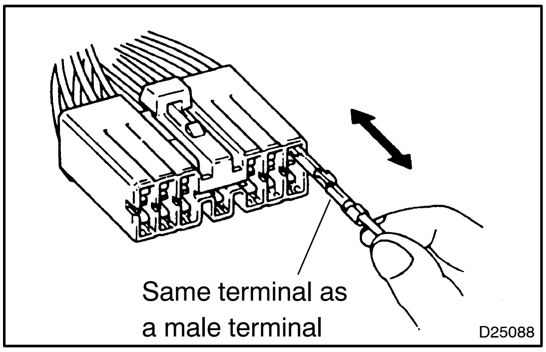
(1) Checking when the connector is connected:
Squeeze the connector together to confirm that it is fully inserted and locked.



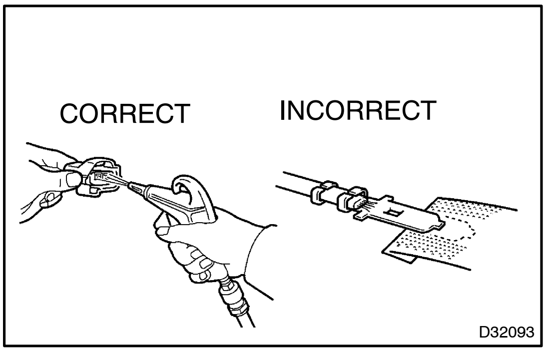
(2) Checking when the connector is disconnected:
Check by pulling the wire harness lightly from the backside of the connector. Look for unlatched terminals, missing terminals, loose crimps or broken conductor wires.
Check visually for corrosion, metallic or foreign objects and water; and bent, rusted, overheated, contaminated, and deformed terminals.

NOTICE:

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



(3) Checking the contact pressure of the terminal: Prepare a spare male terminal. Insert it into a female terminal, and check for good tension when inserting and after full engagement.

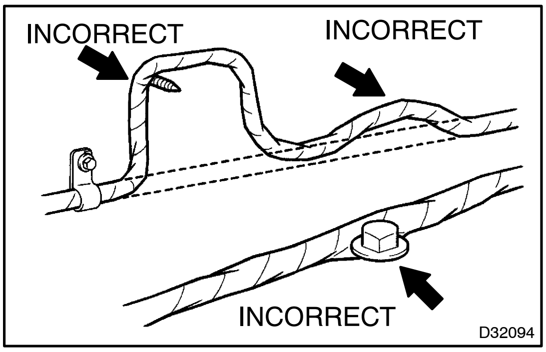


(d) REPAIR METHOD OF CONNECTOR TERMINAL

(1) If there is any dirt on the terminal, clean the contact point using an air gun or shop rag. Never polish the contact point using sandpaper as the platings may come off.

(2) If there is abnormal contact pressure, replace the female terminal. If the male terminal is gold–plated (gold color), use a gold–plated female terminal; if it is silver–plated (silver color), use a silver–plated female terminal.

(3) Damaged, deformed, or corroded terminals should be replaced. If the terminal will not lock into the housing, the housing may have to be replaced.



(e) HANDLING OF WIRE HARNESS

(1) If removing a wire harness, check the wiring and clamping before proceeding so that it can be restored in the same way.

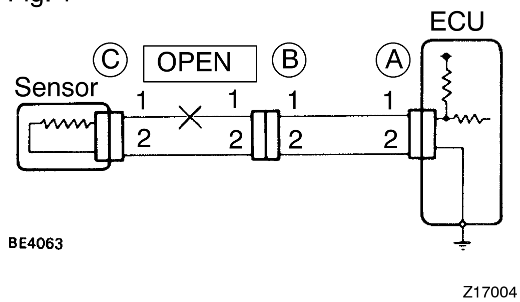
(2) Never twist, pull or slacken the wire harness more than necessary.

(3) Never make the wire harness come into contact with a high temperature part, or rotating, moving, vibrating or sharp–edged parts. Avoid panel edges, screw tips and similar sharp items.

(4) When installing parts, never pinch the wire harness.

(5) Never cut or break the cover of the wire harness. If it is cut or broken, replace it or securely repair it with vinyl tape.

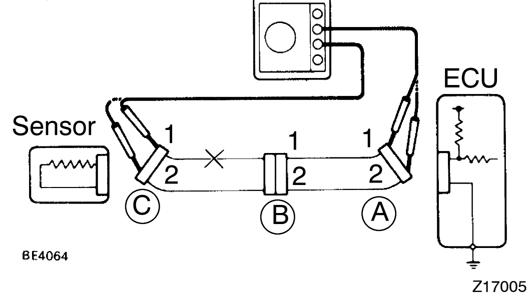
Fig. 1



2. CHECK OPEN CIRCUIT

(a) For an open circuit in the wire harness in Fig. 1, perform a resistance check (step b) or a voltage check (step c).

Fig. 2



(b) Check the resistance.

(1) Disconnect connectors A and C, and measure the resistance between them.

HINT:

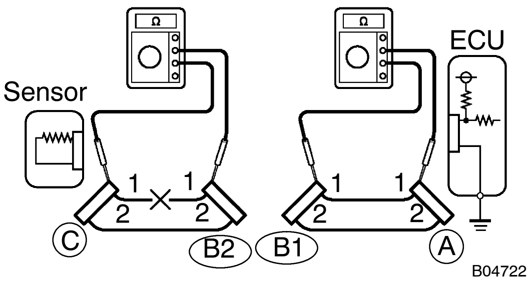
Measure the resistance while lightly shaking the wire harness vertically and horizontally.

Fig. 2:

Tester Connection	Specified Condition
Connector A terminal 1 – Connector C terminal 1	10 kΩ or higher
Connector A terminal 2 – Connector C terminal 2	Below 1 Ω

If your results match the examples above, an open circuit exists between terminal 1 of connector A and terminal 1 of connector C.

Fig. 3



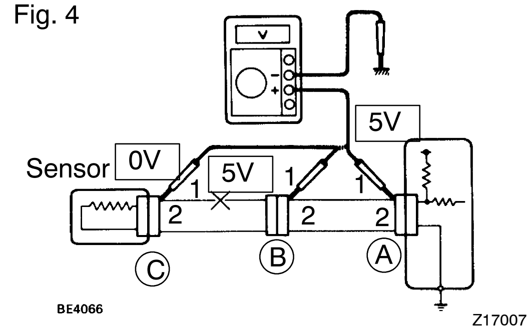
(2) Disconnect connector B and measure the resistance between the connectors.

Fig. 3:

Tester Connection	Specified Condition
Connector A terminal 1 – Connector B1 terminal 1	Below 1 Ω
Connector B2 terminal 1 – Connector C terminal 1	10 kΩ or higher

If your results match the examples above, an open circuit exists between terminal 1 of connector B2 and terminal 1 of connector C.

Fig. 4



(c) Check the voltage.

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

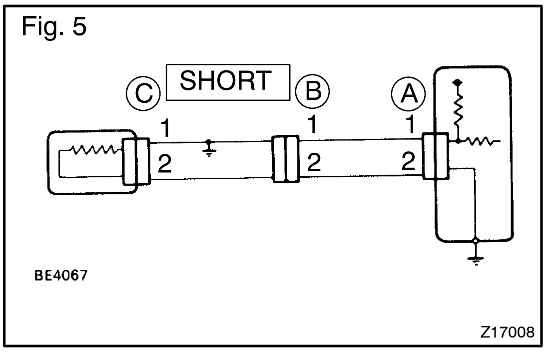
Fig. 4:

With each connector still connected, measure the voltage between the body ground and these terminals (in this order): 1) terminal 1 of connector A at the ECU 5 V output terminal, 2) terminal 1 of connector B, and 3) terminal 1 of connector C.

(2) Example results:

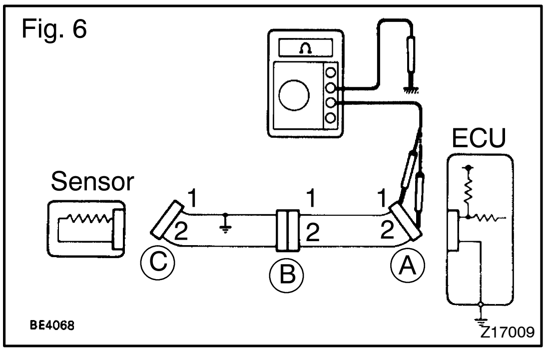
Tester Connection	Specified Condition
Connector A terminal 1 – Body ground	5 V
Connector B terminal 1 – Body ground	5 V
Connector C terminal 1 – Body ground	0 V

If your results match the examples above, an open circuit exists in the wire harness between terminal 1 of B and terminal 1 of C.



3. CHECK SHORT CIRCUIT

(a) If the wire harness is ground shorted (Fig. 5), locate the section by conducting a resistance check with the body ground (below).



(b) Check the resistance with the body ground.

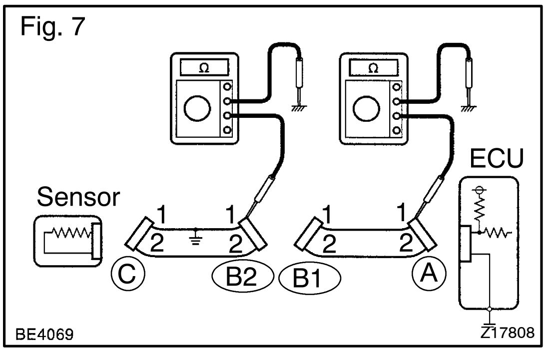
(1) Disconnect connectors A and C, and measure the resistance between terminals 1 and 2 of connector A and the body ground.

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

Fig. 6:

Tester Connection	Specified Condition
Connector A terminal 1 – Body ground	Below 1 Ω
Connector A terminal 2 – Connector C terminal 2	10 kΩ or higher

If your results match the examples above, a short circuit exists between terminal 1 of connector A and terminal 1 of connector C.



(2) Disconnect connector B and measure the resistance between terminal 1 of connector A and the body ground, and terminal 1 of connector B2 and the body ground.

Fig. 7:

Tester Connection	Specified Condition
Connector A terminal 1 – Body ground	10 kΩ or higher
Connector B2 terminal 1 – Body ground	Below 1 Ω

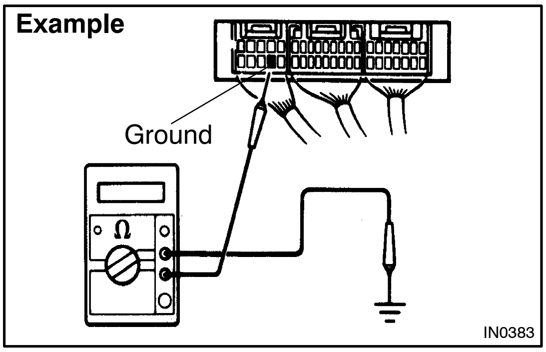
If your results match the examples above, a short circuit exists between terminal 1 of connector B2 and terminal 1 of connector C.

4. CHECK AND REPLACE ECU

NOTICE:

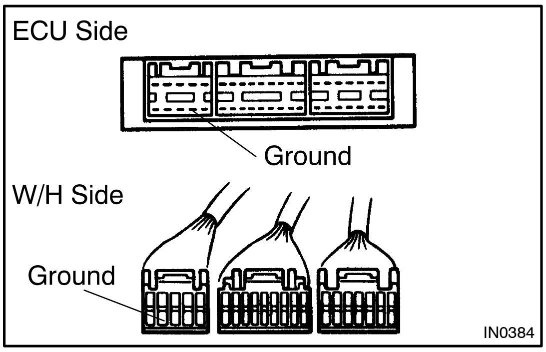
- **The connector should not be disconnected from the ECU. Perform the inspection from the backside of the connector on the wire harness side.**
- **When no measuring condition is specified, perform the inspection with the engine stopped and the ignition switch ON.**
- **Check that the connectors are fully seated. Check for loose, corroded or broken wires.**

(a) First check the ECU ground circuit. If it is faulty, repair it. If it is normal, the ECU could be faulty. Replace the ECU with a normal functioning one and check if the symptoms occur. If the trouble symptoms stop, replace the ECU.



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

Resistance: Below 1 Ω



(2) Disconnect the ECU connector. Check the ground terminals (on the ECU side and wire harness side) for evidence of bending, corrosion or foreign material. Lastly check the contact pressure of the female terminals.

TERMS

ABBREVIATIONS USED IN THIS MANUAL

010W2–01

Abbreviations	Meaning
ABS	Anti–Lock Brake System
A/C	Air Conditioner
AC	Alternating Current
ACC	Accessory
ACIS	Acoustic Control Induction System
ACM	Active Control Engine Mount
ACSD	Automatic Cold Start Device
A.D.D.	Automatic Disconnecting Differential
A/F	Air–Fuel Ratio
AFS	Adaptive Front–Lighting System
AHC	Active Height Control Suspension
ALR	Automatic Locking Retractor
ALT	Alternator
AMP	Amplifier
ANT	Antenna
APPROX.	Approximately
ASSY	Assembly
A/T, ATM	Automatic Transmission (Transaxle)
ATF	Automatic Transmission Fluid
AUTO	Automatic
AUX	Auxiliary
AVG	Average
AVS	Adaptive Variable Suspension
B+	Battery Voltage
BA	Brake Assist
BACS	Boost Altitude Compensation System
BAT	Battery
BDC	Bottom Dead Center
B/L	Bi–Level
B/S	Bore–Stroke Ratio
BTDC	Before Top Dead Center
BVSV	Bimetallic Vacuum Switching Valve
CAN	Controller Area Network
Calif.	California
CB	Circuit Breaker
CCo	Catalytic Converter For Oxidation
CD	Compact Disc
CF	Cornering Force
CG	Center Of Gravity
CH	Channel
CKD	Complete Knock Down
COMB.	Combination
CPE	Coupe
CPS	Combustion Pressure Sensor
CPU	Central Processing Unit
CRS	Child Restraint System
CTR	Center
C/V	Check Valve

Abbreviations	Meaning
CV	Control Valve
CW	Curb Weight
DC	Direct Current
DEF	Defogger
DFL	Deflector
DIFF.	Differential
DIFF. LOCK	Differential Lock
D/INJ	Direct Injection
DLC	Data Link Connector
DLI	Distributorless Ignition
DOHC	Double Overhead Camshaft
DP	Dash Pot
DS	Dead Soak
DSP	Digital Signal Processor
DTC	Diagnostic Trouble Code
DVD	Digital Versatile Disc
EBD	Electric Brake Force Distribution
EC	Electrochoromic
ECAM	Engine Control And Measurement System
ECD	Electronically Controlled Diesel
ECDY	Eddy Current Dynamometer
ECT	Electronic Control Transmission
ECU	Electronic Control Unit
ED	Electro–Deposited Coating
EDU	Electronic Driving Unit
EDIC	Electric Diesel Injection Control
EFI	Electronic Fuel Injection
E/G	Engine
EGR	Exhaust Gas Recirculation
EGR–VM	EGR–Vacuum Modulator
ELR	Emergency Locking Retractor
EMPS	Electric Motor Power Steering
ENG	Engine
ES	Easy & Smooth
ESA	Electronic Spark Advance
ETCS–i	Electronic Throttle Control System–intelligent
EVAP	Evaporative Emission Control
EVP	Evaporator
E–VRV	Electric Vacuum Regulating Valve
EX	Exhaust
FE	Fuel Economy
FF	Front–Engine Front–Wheel–Drive
F/G	Fuel Gauge
FIPG	Formed In Place Gasket
FL	Fusible Link
F/P	Fuel Pump
FPU	Fuel Pressure Up
Fr	Front
F/W	Flywheel
FW/D	Flywheel Damper
FWD	Front–Wheel–Drive

Abbreviations	Meaning
GAS	Gasoline
GND	Ground
GSA	Gear Shift Actuator
GPS	Global Positioning System
HAC	High Altitude Compensator
H/B	Hatchback
H–FUSE	High Current Fuse
HI	High
HID	High Intensity Discharge (Head Lamp)
HPU	Hydraulic Power Unit
HSG	Housing
HT	Hard Top
HV	Hybrid Vehicle
HWS	Heated Windshield System
IC	Integrated Circuit
IDI	Indirect Diesel Injection
IFS	Independent Front Suspension
IG	Ignition
IIA	Integrated Ignition Assembly
IN	Intake (Manifold, Valve)
INT	Intermittent
I/P	Instrument Panel
IRS	Independent Rear Suspension
ISC	Idle Speed Control
J/B	Junction Block
J/C	Junction Connector
KD	Kick–Down
LAN	Local Area Network
LB	Liftback
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	Left–Hand
LHD	Left–Hand Drive
L/H/W	Length, Height, Width
LLC	Long–Life Coolant
LNG	Liquified Natural Gas
LO	Low
LPG	Liquified Petroleum Gas
LSD	Limited Slip Differential
LSP & PV	Load Sensing Proportioning And Bypass Valve
LSPV	Load Sensing Proportioning Valve
MAP	Manifold Absolute Pressure
MAX.	Maximum
MIC	Microphone
MIL	Malfunction Indicator Lamp
MIN.	Minimum
MG1	Motor Generator No.1
MG2	Motor Generator No.2
MMT	Multi–mode Manual Transmission
MP	Multipurpose
MPI	Multipoint Electronic Injection

Abbreviations	Meaning
MPX	Multiplex Communication System
M/T, MTM	Manual Transmission (Transaxle)
MT	Mount
MTG	Mounting
N	Neutral
NA	Natural Aspiration
No.	Number
O2S	Oxygen Sensor
OC	Oxidation Catalyst
OCV	Oil Control Valve
O/D	Overdrive
OEM	Original Equipment Manufacturing
OHC	Overhead Camshaft
OHV	Overhead Valve
OPT	Option
ORVR	On–board Refilling Vapor Recovery
O/S	Oversize
PBD	Power Back Door
P & BV	Proportioning And Bypass Valve
PCS	Power Control System
PCV	Positive Crankcase Ventilation
PKB	Parking Brake
PPS	Progressive Power Steering
PROM	Programmable Read Only Memory
PS	Power Steering
PSD	Power Slide Door
PTC	Positive Temperature Coefficient
PTO	Power Take–Off
P/W	Power Window
PZEV	Partial Zero Emission Vehicle
R & P	Rack And Pinion
RAM	Random Access Memory
R/B	Relay Block
RBS	Recirculating Ball Type Steering
R/F	Reinforcement
RFS	Rigid Front Suspension
RH	Right–Hand
RHD	Right–Hand Drive
RLY	Relay
ROM	Read Only Memory
Rr	Rear
RRS	Rigid Rear Suspension
RSE	Rear Seat Entertainment
RWD	Rear–Wheel Drive
SC	Supercharger
SCV	Swirl Control Valve
SDN	Sedan
SEN	Sensor
SICS	Starting Injection Control System
SOC	State Of Charge
SOHC	Single Overhead Camshaft

Abbreviations	Meaning
SPEC	Specification
SPI	Single Point Injection
SRS	Supplemental Restraint System
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
STJ	Cold–Start Fuel Injection
SW	Switch
SYS	System
T/A	Transaxle
TACH	Tachometer
TBI	Throttle Body Electronic Fuel Injection
TC	Turbocharger
TCCS	Computer–Controlled System
TCV	Timing Control Valve
TDC	Top Dead Center
TEMP.	Temperature
TEMS	Electronically Modulated Suspension
TFT	Toyota Free–Tronic
TIS	Total Information System For Vehicle Development
T/M	Transmission
TRAC	Traction Control System
TURBO	Turbocharge
TWC	Three–Way Catalyst
U/D	Underdrive
U/S	Undersize
VCV	Vacuum Control Valve
VENT	Ventilator
VGRS	Variable Gear Ratio Steering
VIM	Vehicle Interface Module
VIN	Vehicle Identification Number
VPS	Variable Power Steering
VSC	Vehicle Stability Control
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
VVT–i	Variable Valve Timing–intelligent
w/	With
WGN	Wagon
W/H	Wire Harness
w/o	Without
WU–TWC	Warm Up Three–way Catalytic Converter
WU–OC	Warm Up Oxidation Catalytic Converter
1st	First
2nd	Second
2WD	Two Wheel Drive Vehicle (4 x 2)
3rd	Third
4th	Fourth
4WD	Four Wheel Drive Vehicle (4 x 4)
4WS	Four Wheel Steering System
5th	Fifth

010W3–01

GLOSSARY OF SAE AND HINO TERMS

This glossary lists all SAE–J1930 terms and abbreviations used in this manual in compliance with SAE recommendations, as well as their HINO equivalents.

SAE ABBREVIATIONS	SAE TERMS	HINO TERMS ( )—ABBREVIATIONS
A/C	Air Conditioning	Air Conditioner
ACL	Air Cleaner	Air Cleaner (A/CL)
AIR	Secondary Air Injection	Air Injection (AI)
AP	Accelerator Pedal	–
B+	Battery Positive Voltage	Battery Voltage (+B)
BARO	Barometric Pressure	High Altitude Compensator (HAC)
CAC	Charge Air Cooler	Intercooler
CARB	Carburetor	Carburetor
CFI	Continuous Fuel Injection	–
CKP	Crankshaft Position	Crank Angle
CL	Closed Loop	Closed Loop
CMP	Camshaft Position	Cam Angle
CPP	Clutch Pedal Position	–
CTOX	Continuous Trap Oxidizer	–
CTP	Closed Throttle Position	LL ON, Idle ON
DFI	Direct Fuel Injection (Diesel)	Direct Injection (D/INJ)
DI	Distributor Ignition	–
DLC1 DLC2 DLC3	Data Link Connector 1 Data Link Connector 2 Data Link Connector 3	1: Check Connector 2: Total Diagnosis Communication Link (TDCL) 3: OBD II Diagnostic Connector
DTC	Diagnostic Trouble Code	Diagnostic Trouble Code
DTM	Diagnostic Test Mode	–
ECL	Engine Control Level	–
ECM	Engine Control Module	Engine ECU (Electronic Control Unit)
ECT	Engine Coolant Temperature	Coolant Temperature, Water Temperature (THW)
EEPROM	Electrically Erasable Programmable Read Only Memory	Electrically Erasable Programmable Read Only Memory (EEPROM), Erasable Programmable Read Only Memory (EPROM)
EFE	Early Fuel Evaporation	Cold Mixture Heater (CMH), Heat Control Valve (HCV)
EGR	Exhaust Gas Recirculation	Exhaust Gas Recirculation (EGR)
EI	Electronic Ignition	Distributorless Ignition (DLI)
EM	Engine Modification	Engine Modification (EM)
EPROM	Erasable Programmable Read Only Memory	Programmable Read Only Memory (PROM)
EVAP	Evaporative Emission	Evaporative Emission Control (EVAP)
FC	Fan Control	–
FEEPROM	Flash Electrically Erasable Programmable Read Only Memory	–
FEPROM	Flash Erasable Programmable Read Only Memory	–
FF	Flexible Fuel	–
FP	Fuel Pump	Fuel Pump
GEN	Generator	Alternator
GND	Ground	Ground (GND)

HO2S	Heated Oxygen Sensor	Heated Oxygen Sensor (HO_2S)
IAC	Idle Air Control	Idle Speed Control (ISC)
IAT	Intake Air Temperature	Intake or Inlet Air Temperature
ICM	Ignition Control Module	–
IFI	Indirect Fuel Injection	Indirect Injection (IDL)
IFS	Inertia Fuel–Shutoff	–
ISC	Idle Speed Control	–
KS	Knock Sensor	Knock Sensor
MAF	Mass Air Flow	Air Flow Meter
MAP	Manifold Absolute Pressure	Manifold Pressure Intake Vacuum
MC	Mixture Control	Electric Bleed Air Control Valve (EBCV) Mixture Control Valve (MCV) Electric Air Control Valve (EACV)
MDP	Manifold Differential Pressure	–
MFI	Multiport Fuel Injection	Electronic Fuel Injection (EFI)
MIL	Malfunction Indicator Lamp	Check Engine Lamp
MST	Manifold Surface Temperature	–
MVZ	Manifold Vacuum Zone	–
NVRAM	Non–Volatile Random Access Memory	–
O2S	Oxygen Sensor	Oxygen Sensor, O_2 Sensor (O_2S)
OBD	On–Board Diagnostic	On–Board Diagnostic System (OBD)
OC	Oxidation Catalytic Converter	Oxidation Catalyst Convert (OC), CCo
OP	Open Loop	Open Loop
PAIR	Pulsed Secondary Air Injection	Air Suction (AS)
PCM	Powertrain Control Module	–
PNP	Park/Neutral Position	–
PROM	Programmable Read Only Memory	–
PSP	Power Steering Pressure	–
PTOX	Periodic Trap Oxidizer	Diesel Particulate Filter (DPF) Diesel Particulate Trap (DPT)
RAM	Random Access Memory	Random Access Memory (RAM)
RM	Relay Module	–
ROM	Read Only Memory	Read Only Memory (ROM)
RPM	Engine Speed	Engine Speed
SC	Supercharger	Supercharger
SCB	Supercharger Bypass	Electronic Air Bypass Valve (E–ABV)
SFI	Sequential Multiport Fuel Injection	Electronic Fuel Injection (EFI), Sequential Injection
SPL	Smoke Puff Limiter	–
SRI	Service Reminder Indicator	–
SRT	System Readiness Test	–
ST	Scan Tool	–
TB	Throttle Body	Throttle Body
TBI	Throttle Body Fuel Injection	Single Point Injection Central Fuel Injection (Ci)
TC	Turbocharger	Turbocharger
TCC	Torque Converter Clutch	Torque Converter

TCM	Transmission Control Module	Transmission ECU, ECT ECU
TP	Throttle Position	Throttle Position
TR	Transmission Range	–
TVV	Thermal Vacuum Valve	Bimetallic Vacuum Switching Valve (BVSV) Thermostatic Vacuum Switching Valve (TVSV)
TWC	Three–Way Catalytic Converter	Three–Way Catalytic (TWC) Manifold Converter CC_{RO}
TWC+OC	Three–Way + Oxidation Catalytic Converter	CC_R + CCo
VAF	Volume Air Flow	Air Flow Meter
VR	Voltage Regulator	Voltage Regulator
VSS	Vehicle Speed Sensor	Vehicle Speed Sensor
WOT	Wide Open Throttle	Full Throttle
WU–OC	Warm Up Oxidation Catalytic Converter	–
WU–TWC	Warm Up Three–Way Catalytic Converter	–
3GR	Third Gear	–
4GR	Fourth Gear	–

PREPARATION

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PREPARATION 02–17

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)

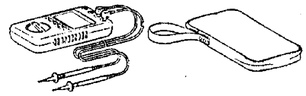
NOTE: The following pages contain only the points which differ from the above listed manuals.

ENGINE CONTROL SYSTEM

023W5–01

PREPARATION

Recomended Tools

	09082–00040	Electrical Tester	ECD SYSTEM(N04C–TF)

Equipment

Hand–held tester	
Service Wire Harness	
Torque wrench	

SSM

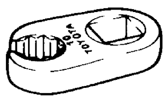
	08826–00080	Seal Packing Black or equivalent (FIPG)	VENTURI ASSY(N04C–TF)

FUEL

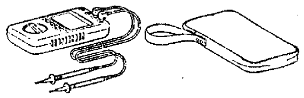
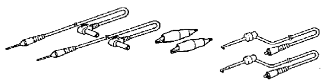
PREPARATION

023VX–01

SST

	09023–12900	Union Nut Wrench 19mm	SUPPLY PUMP ASSY(N04C–TF) COMMON RAIL ASSY(N04C–TF) INJECTOR ASSY(N04C–TF)

Recomended Tools

	09082–00040	Electrical Tester	FUEL SYSTEM(N04C–TF)
	(09083–00150)	Test Lead Set	FUEL SYSTEM(N04C–TF)

Equipment

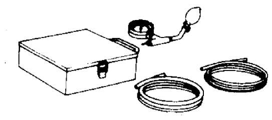
Hand–held Tester	
Ohmmeter	
Torque wrench	
Tape	

INTAKE

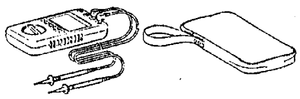
023W6–01

PREPARATION

SST

	09992–00242	Turbocharger Pressure Gauge	TURBOCHARGER SYSTEM (N04C–TF)

Recomended Tools

	09082–00040	Electrical Tester	TURBOCHARGER SYSTEM (N04C–TF)

Equipment

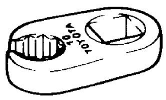
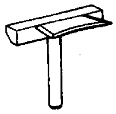
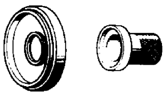
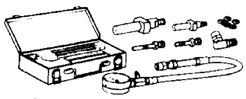
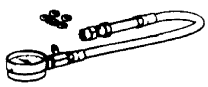
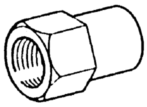
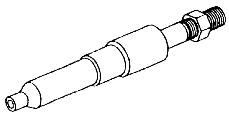
Torque wrench	

ENGINE MECHANICAL

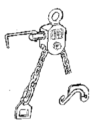
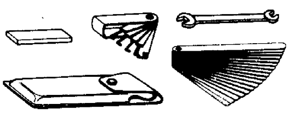
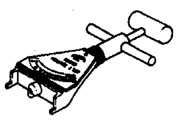
PREPARATION

023W8–01

SST

	09023–12900	Union Nut Wrench 19mm	PARTIAL ENGINE ASSY(N04C–TF)
	09032–00100	Oil Pan Seal Cutter	CAMSHAFT(N04C–TF)
	09223–78010	Crankshaft Oil Seal Replacer	CAMSHAFT(N04C–TF) OIL PUMP SEAL(N04C–TF) ENGINE REAR OIL SEAL(N04C–TF)
	09992–00025	Cylinder Compression Check Gauge Set	ENGINE(N04C–TF)
	(09992–00211)	Gauge Assy	ENGINE(N04C–TF)
	S0955–21060	Compression Gauge Adaptor	ENGINE(N04C–TF)
	S0955–21090	Compression Gauge Adaptor	ENGINE(N04C–TF)

Recomended Tools

	09090–04020	Engine Sling Device	PARTIAL ENGINE ASSY(N04C–TF)
	09200–00010	Engine Adjust Kit	VALVE CLEARANCE(N04C–TF)
	09216–00021	Belt Tension Gauge	ENGINE(N04C–TF)

Equipment

Dial indicator	
Hand–held tester	
Torque wrench	
Vernier calipers	

SSM

08826–00080	Seal Packing Black or equivalent (FIPG)	PARTIAL ENGINE ASSY(N04C–TF) CAMSHAFT(N04C–TF) ENGINE REAR OIL SEAL(N04C–TF)
08833–00080	Adhesive 1344 THREE BOND 1344 LOCTITE 242 or equivalent	PARTIAL ENGINE ASSY(N04C–TF)

EXHAUST

PREPARATION

023W3–01

Equipment

Torque wrench	

COOLING

023W4–01

PREPARATION

Equipment

Radiator cap tester	
Torque wrench	

SSM

08826–00080	Seal Packing Black or equivalent (FIPG)	THERMOSTAT(N04C–TF) WATER PUMP ASSY(N04C–TF)

Coolant

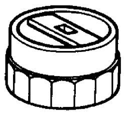
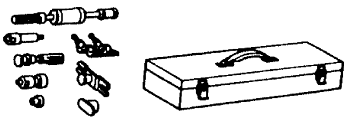
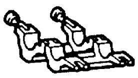
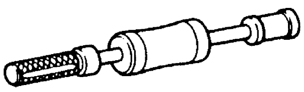
Item	Capacity	Classification
Engine coolant	14.4 liters (15.2 US qts, 13.3 Imp. qts)	”Hino Long Life Coolant” or equivalent

LUBRICATION

PREPARATION

023W7–01

SST

	09228–78010	Oil Filter Wrench	OIL FILTER SUB–ASSY(N04C–TF)
	09910–00015	Puller Set	OIL PUMP ASSY(N04C–TF)
	(09911–00011)	Puller Clamp	OIL PUMP ASSY(N04C–TF)
	(09912–00010)	Puller Slide Hammer	OIL PUMP ASSY(N04C–TF)
	(09913–00010)	Main Drive Gear Puller Attachment (J)	OIL PUMP ASSY(N04C–TF)

Equipment

Oil pressure gauge	
Torque wrench	

SSM

	08826–00080	Seal Packing Black or equivalent (FIPG)	OIL COOLER ASSY(N04C–TF)
	08833–00080	Adhesive 1344 THREE BOND 1344 LOCTITE 242 or equivalent	LUBRICATION SYSTEM(N04C–TF)

Lubricant

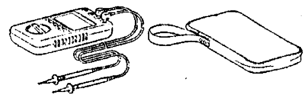
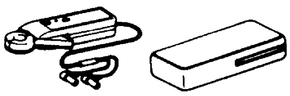
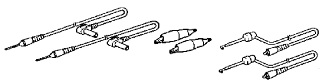
Item	Capacity	Classification
Engine oil (N04C–TF) Drain and refill w/Oil filter change w/o Oil filter change	 8.2 litters (8.6 US qts, 7.2 imp. qts) 7.2 litters (7.6 US qts, 6.3 imp. qts)	API grade CD, CE, CF, CH–4 or CI–4 Energy–Conserving or ILSAC, multigrade engine oil is recommended. SAE 5W–30 is the best choise for your vehicle, for good fuel economy, and good starting in cold weather.

STARTING & CHARGING

023VY–01

PREPARATION

Recomended Tools

	09082–00040	Electrical Tester	STARTING SYSTEM(N04C–TF)
	(09083–00350)	AC/DC 400 A Probe	STARTING SYSTEM(N04C–TF)
	(09083–00150)	Test Lead Set	STARTING SYSTEM(N04C–TF)

Equipment

Ammeter (A)	
Battery (24 V)	
Battery gravity gauge	
Ohmmeter	
Torque wrench	

TIRE & WHEEL

PREPARATION

023WE–01

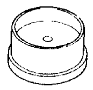
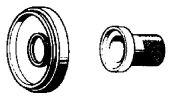
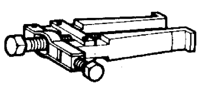
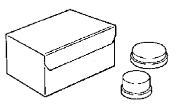
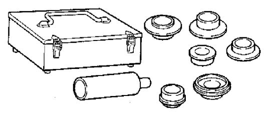
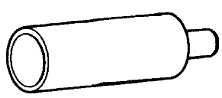
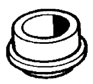
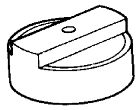
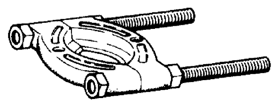
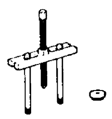
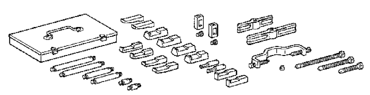
Equipment

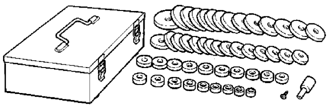
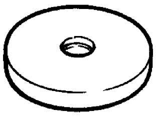
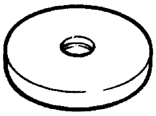
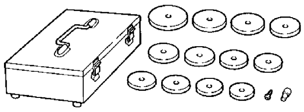
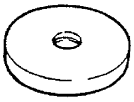
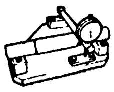
Dial indicator with magnetic base	

DIFFERENTIAL

PREPARATION

SST

	09223–15020	Oil Seal & Bearing Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09223–78010	Crankshaft Oil Seal Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09308–10010	Oil Seal Puller	REAR DIFFERENTIAL CARRIER OIL SEAL(SH12) DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09315–00022	Clutch Release Bearing Remover & Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09316–60011	Transmission & Transfer Bearing Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09316–00011)	Replacer Pipe	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09316–00071)	Replacer "F"	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09504–00011	Differential Side Bearing Adjusting Nut Wrench	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09518–36020	Rear Axle Hub Oil Seal Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–00020	Bearing Remover	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–00030	Bearing Remover Attachment	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–40011	Puller B Set	DIFFERENTIAL CARRIER ASSY REAR(SH12)

	(09957–04010)	Attachment	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–60010	Replacer Set	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09951–00640)	Replacer 64	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09951–00650)	Replacer 65	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–60020	Replacer Set No.2	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09951–00680)	Replacer 68	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09640–1370)	Pinion Depth Gauge	DIFFERENTIAL CARRIER ASSY REAR(SH12)

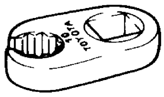
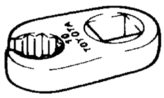
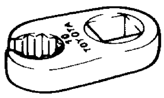
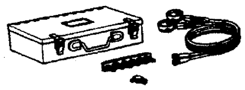
Equipment

Brass bar	
Chisel	
Dial gauge	
Hammer	
Press	
Snap ring expander	
Torque wrench	
Vernier caliper	
Vise	

BRAKE

PREPARATION

023WD–01

	09023–00100	Union Nut Wrench 10 mm	ABS & TRACTION ACTUATOR ASSY
	09023–38200	Union Nut Wrench 12mm	ABS & TRACTION ACTUATOR ASSY
	09023–12900	Union Nut Wrench 19mm	VACUUM PUMP ASSY
	09709–29018	LSPV Gauge Set	LOAD SENSING PROPORTIONING VALVE (LSPV)

Equipment

Torque wrench	

Lubricant

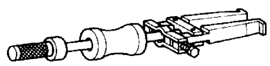
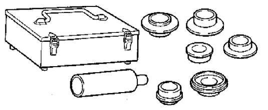
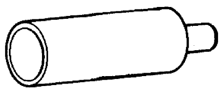
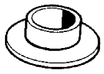
Item	Capacity	Classification
Brake fluid	–	SAE J 1703 or FMVSS No. 116 DOT 3

MANUAL TRANSMISSION/TRANSAXLE

023VS–01

PREPARATION

SST

	09308–00010	Oil Seal Puller	TRANSMISSION REAR BEARING RETAINER OIL SEAL(M550)
	09316–60011	Transmission & Transfer Bearing Replacer	TRANSMISSION REAR BEARING RETAINER OIL SEAL(M550)
	(09316–00011)	Replacer Pipe	TRANSMISSION REAR BEARING RETAINER OIL SEAL(M550)
	(09316–00041)	Replacer "C"	TRANSMISSION REAR BEARING RETAINER OIL SEAL(M550)

Equipment

Torque wrench	

Lubricant

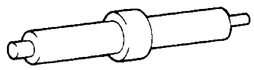
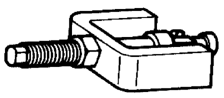
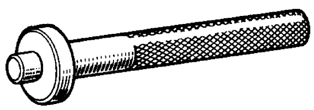
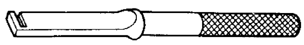
Item		Capacity	Classification
Manual transmission oil	w/o PTO	2.8 liters (2.96 US qts, 2.46 Imp. qts)	API GL–4 or GL–5
	w/ PTO	3.1 liters (3.28 US qts, 2.73 Imp. qts)	SAE 75W–90

CLUTCH

PREPARATION

023VT–01

SST

	09301–00120	Clutch Guide Tool	CLUTCH UNIT(N04C–TF)
	09303–35011	Input Shaft Front Bearing Puller	CLUTCH UNIT(N04C–TF)
	09304–12012	Input Shaft Front Bearing Replacer	CLUTCH UNIT(N04C–TF)
	09333–00013	Universal Joint Bearing Remover & Replacer	CLUTCH UNIT(N04C–TF)

Equipment

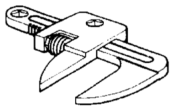
Dial indicator with magnetic base	
Lithium soap base glycol grease	
MP grease	
Snap ring pliers	
Torque wrench	
Vernier calipers	

POWER STEERING

023VV–01

PREPARATION

SST

	09922–10010	Variable Open Wrench	VANE PUMP ASSY(N04C–TF)

Equipment

Torque wrench	

Lubricant

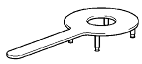
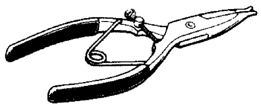
Item	Capacity	Classification
Power steering fluid (Total)	–	ATF DEXRON® II or III

HEATER & AIR CONDITIONER

PREPARATION

023VM–02

SST

	95047–10400	Magnet Clutch Stopper (DENSO part No.)	COOLER COMPRESSOR ASSY(AUSTRALIA)
	95994–10020	Snap Ring Pliers (DENSO Part No.)	COOLER COMPRESSOR ASSY(AUSTRALIA)

Equipment

Belt tension gauge	
Torque wrench	
Dial indicator	
Battery	

Lubricant

Item	Capacity	Classification
Compressor oil	–	ND–OIL 8 or equivalent

SERVICE SPECIFICATIONS

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HOW TO DETERMINE BOLT STRENGTH 03–1
SPECIFIED TORQUE
FOR STANDARD BOLTS 03–2
HOW TO DETERMINE NUT STRENGTH 03–3
ENGINE CONTROL SYSTEM 03–4
SERVICE DATA 03–4
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REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)

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

STANDARD BOLT

HOW TO DETERMINE BOLT STRENGTH

030Y3–05

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

B06431

030Y4–05

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

030Y5–05

HOW TO DETERMINE NUT STRENGTH

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

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

B06432

HINT:
Use the nut with the same number of the nut strength classification or the greater than the bolt strength classification number when tightening parts with a bolt and nut.
Example: Bolt = 4T
Nut = 4N or more

ENGINE CONTROL SYSTEM

SERVICE DATA

03259–01

Venturi assy Standard throttle valve opening percentage		60% or more
MAF meter assy Resistance	4 (THA) – 5 (E2) at –20°C (–4°F) at 20°C (68°F) at 60°C (140°F)	 12.5 to 16.9 kΩ 2.19 to 2.67 kΩ 0.5 to 0.68 kΩ
Venturi assy Resistance	2 (VCR) – 3 (E2R) at 20°C (68°F)	 2.0 to 10 kΩ
Throttle position sensor Resistance	3 (VTA) – 2 (E2) Fully open Fully closed	 0.2 to 5.7 kΩ 2.0 to 10.2 kΩ
ECT sensor Resistance	1 – 2 Approx. 20°C (68°F) Approx. 80°C (176°F) 3 – body ground Approx. 75°C (67°F) Approx. 100°C (212°F)	 2.32 to 2.59 kΩ 0.31 to 0.326 kΩ 79 to 93 kΩ 35.5 to 41.5 kΩ
IAT sensor Resistance	Approx. 20°C (68°F) Approx. 80°C (176°F)	2.21 to 2.65 kΩ 0.55 to 0.61 kΩ
Idle variable resistor switch Resistance	2 – 3 ON MAX ON → MAX	 250 Ω 1.2 kΩ Resistance changes costantly
Crankshaft position sensor Resistance	at cold at hot	1,630 to 2,740 Ω 2,065 to 3,225 Ω
MAIN relay Specified condition	3 – 5 3 – 5	10 kΩ or higher Below 1 Ω (when battery voltage is applied to terminals 1 and 2)
EDU relay Specified condition	3 – 5 3 – 5	10 kΩ or higher Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

0325A–01

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Venturi assy x Intake manifold	28.5	291	21
Clamp x Intake air connector pipe	5.0	51	44 in.·lbf
Clamp x Air hose No. 4	5.0	51	44 in.·lbf
Accelerator link assy x Body	5.5	56	49 in.·lbf

FUEL

SERVICE DATA

0325J–01

Common rail pressure	at idling	25 to 35 MPa (255 to 357 kgf/cm^2, 3,625 to 5,075 psi)
	at 3,000 rpm	80 to 90 MPa (816 to 918 kgf/cm^2, 11,604 to 13,055 psi)
Suction control valve	at 20 °C (68 °F)	7.6 to 8.2 Ω
Fuel temperature sensor	at 20 °C (68 °F)	2.32 to 2.59 kΩ
	at 80 °C (176 °F)	0.310 to 0.326 kΩ
Injector assy	at 20 °C (68 °F)	0.35 to 0.55 Ω
Fuel pressure sensor	F8–2(PFUEL) – F8–3(A–GND)	16.4 kΩ or less
	F8–5(PFUEL) – F8–4(A–GND)	16.4 kΩ or less
	F8–1(A–VCC) – F8–2(PFUEL)	3 kΩ or less
	F8–6(A–VCC) – F8–5(PFUEL)	3 kΩ or less
Level warning switch	Upper end of float	Below 1 Ω
	Lower end of float	10 kΩ or higher

0325K–01

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
Diesel fuel filter assy x Fuel filter support	17.5	175	13
Injection pump drive gear x Supply pump assy	64	652	47
Timer cover x Supply pump assy	28.5	291	21
Timer cover x Engine	28.5	291	21
Holder clip x Supply pump assy	28.5	291	21
Crankshaft position sensor x Timing chain or belt cover sub–assy	12	120	9.0
Fuel filter to injection pump fuel pipe x Common rail	44	449	32
Fuel filter to injection pump fuel pipe x Supply pump assy	44	449	32
Fuel pipe sub–assy x Supply pump assy	24.5	250	18
Fuel return pipe sub–assy x Supply pump assy	24.5	250	18
Fuel pipe No. 4 x Fuel return pipe sub–assy	24.5	250	18
Fuel pipe No. 4 x Common rail	20	204	15
Oil separator assy x Engine	28.5	291	21
Hose clamp x Intake air connector pipe	5.0	51	44 in.·lbf
Intake air connector pipe x Frame	18	185	13
Engine side cover sub–assy LH x Frame	11.5	117	8.0
Ventilation pipe No. 2 x Engine	28.5	290	21
Breather pipe x Engine	28.5	290	21
Bracket x Venturi assy	28.5	290	21
Nozzle holder clamp bolt x Cylinder head	25	255	18
Nozzle leakage pipe No. 1 x Injector assy	13	133	10
Common rail assy x Engine	28.5	291	21
Injection pipe x Injector assy	44	449	32
Cylinder head cover cushion x Cylinder head	28.5	290	21
Cylinder head cover No. 2 x Cylinder head cover	28.5	290	21
Fuel tank stay x Frame	61	622	45
Fuel tank band sub–assy No. 1 x Fuel tank stay	13	133	10
Fuel sender gauge x Fuel tank assy	1.5	15	13 in.·lbf
Fuel tank vent tube sub–assy x Fuel tank assy	1.5	15	13 in.·lbf
Fuel vapor separate valve sub–assy x Fuel tank assy	4.9	50	43 in.·lbf
Side bumper bar x Side bumper stay	21	214	15

INTAKE

SERVICE DATA

0325D–01

Turbo pressure sensor Standard pressure		150 kPa (1.5 kgf/cm^2, 21 psi)
Turbo pressure sensor Standard voltage		4.5 to 5.5 V
Turbo pressure sensor Voltage drop	at 0.25 to 0.4 V at 1.0 to 1.4 V	93.0 kPa (675 mmHg, 27.5 in.Hg) 150 kPa (1,125 mmHg, 44 in.Hg)

0325E–01

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Turbo water pipe No. 1 x Turbocharger sub–assy	24.5	250	18
Bracket x Turbocharger sub–assy	28.5	291	21
Engine side cover RH x Body	11.5	117	8
Front mudguard RH x Body	11.5	117	8
Turbine outlet elbow x Turbocharger sub–assy	36	367	27
Turbocharger sub–assy x Exhaust manifold	69	704	51
Intake pipe x Turbocharger sub–assy	28	286	21
Turbo oil outlet pipe x Turbocharger sub–assy	28.5	291	21
Turbo oil outlet pipe x Cylinder block	28.5	291	21
Turbo water pipe No. 2 x Turbocharger sub–assy	24.5	250	18
Turbo water pipe No. 2 x Cylinder block	28.5	291	21
Turbo oil outlet pipe sub–assy x Turbocharger sub–assy	24.5	250	18
Turbo oil outlet pipe sub–assy x Cylinder block	28.5	291	21
Turbo insulator No. 1 x Turbocharger sub–assy	28.5	291	21
Exhaust pipe assy front x Exhaust manifold	70	714	52
Clamp x Intake pipe	5.0	51	44 in.·lbf
Charge air cooler x Radiator assy	7.5	77	66 in.·lbf
Clamp x Intake air connector pipe	5.0	51	44 in.·lbf
Intake air connector pipe x Body	18	184	13
Intake pipe stay x Body	18	184	13

ENGINE MECHANICAL

0325F–01

SERVICE DATA

New V–belt deflection	Pressing force: 98 N (10 kgf, 22 lbf)	
	For fan and generator	10.5 to 12.5 mm (0.413 to 0.492 in.)
	For A/C compressor	8.5 to 10 mm (0.334 to 0.393 in.)
Used V–belt deflection	Pressing force: 98 N (10 kgf, 22 lbf)	
	For fan and generator	12.5 to 16 mm (0.413 to 0.629 in.)
	For A/C compressor	10 to 12 mm (0.393 to 0.472 in.)
New V–belt tension		
	For fan and generator	370 to 490 N (38 to 50 kgf, 84 to 110 lbf)
	For A/C compressor	345 to 390 N (35 to 40 kgf, 77 to 88 lbf)
Used V–belt tension		
	For fan and generator	245 to 315 N (25 to 32 kgf, 55 to 71 lbf)
	For A/C compressor	225 to 295 N (23 to 30 kgf, 51 to 60 lbf)
Idle speed		600 to 700 rpm
Maximum speed		3,600 to 3,700 rpm
Compression	Compression pressure	3,200 kPa (33 kgf/cm^2, 469 psi)
	Minimum pressure	2,700 kPa (28 kgf/cm^2, 398 psi)
	Difference between each cylinder	290 kPa (3.0 kgf/cm^2, 43 psi)
Diesel Smoke		10% or less
Valve clearance (cold)	Intake	0.30 mm (0.012 in.)
	Exhaust	0.45 mm (0.018 in.)
Cylinder head bolt length	Maximum	129 mm (5.07 in.)
Flywheel	Maximum runout	0.15 mm (0.0059 in.)

0325G–01

TORQUE SPECIFICATION

Part Tightened		N·m	kgf·cm	ft·lbf
A/C compressor V belt tensioner	Nut A	28.5	291	21
A/C compressor V belt tensioner	Bolt B	5.9	60	52 in.·lbf
Fan and generator V belt	Bolt A	28.5	291	21
Fan and generator V belt	Bolt B	55	561	41
Fan and generator V belt	Bolt C	5.9	60	52 in.·lbf
Adjusting screw lock nut		29.5	300	22
Front side cover RH x Body		11.5	119	9
Front side cover LH x Body		11.5	119	9
Mudguard RH x Body		11.5	119	9
Mudguard LH x Body		11.5	119	9
Vacuum reservoir x Body		18	184	13
Rear arch x Frame		18	184	13
Fan x Water pump assy		11	112	8
Exhaust pipe assy front x Exhaust manifold		69	704	51
Ventilation pipe No. 2 x Engine assy		28.5	291	21
Propeller shaft assy x Transmission assy		74.5	760	55
A/C compressor assy x Compressor bracket		24.5	250	18
Radiator support No. 2 x Radiator		7.5	76.5	66 in.·lbf
Radiator assy x Frame		18	184	13
Intake air connector pipe x Body		18	184	13
Charge air cooler assy x Radiator assy		7.5	76.5	66 in.·lbf
Air hose assy x Body		18	184	13
Air hose No. 1 x Body		18	184	13
Floor shift cable transmission control shift x Transmission assy		17.5	178	13
Floor shift cable transmission control select x Transmission assy		17.5	178	13
Starter assy x Flywheel housing		154	1,570	113
Engine mounting x Frame		98	1,000	72
Clutch release cylinder assy x Transmission assy		11.8	120	9
Injection pipe x Injector assy		44	449	32
Injection pipe x Supply pump		44	449	32
Breather pipe x Intake manifold		28.5	291	21
Water by–pass pipe x Cylinder head	for union bolt	24.5	250	18
Water by–pass pipe x Cylinder head	for bolt	28.5	291	21
Venturi assy x Intake manifold		28.5	291	21
Bracket x Venturi assy		28.5	291	21
Turbo water pipe No. 1 x Turbocharger sub–assy		24.5	250	18
Turbine outlet elbow x Turbocharger sub–assy		36	367	27
Turbocharger sub–assy x Exhaust manifold		69	704	51
Intake pipe x Turbocharger sub–assy		28	286	21
Turbo oil outlet pipe x Turbocharger sub–assy		28.5	291	21
Turbo oil outlet pipe x Cylinder block		28.5	291	21
Turbo insulator No. 1 x Turbocharger sub–assy		28.5	291	21
Turbo oil inlet pipe sub–assy x Turbocharger sub–assy		24.5	250	18
Turbo oil inlet pipe sub–assy x Cylinder block		24.5	250	18
Turbo water pipe No. 1 x Cylinder block		24.5	250	18
Exhaust manifold x Cylinder head		59	602	44
Water inlet housing x Water outlet housing		28.5	291	21
ECT sensor x Water outlet housing		29.4	300	22
Oil pressure switch x Oil cooler assy		29.4	300	22
Oil cooler assy x Cylinder block		28.5	291	21

Part Tightened	N·m	kgf·cm	ft·lbf
Generator sub bracket x Cylinder block	125	1,275	92
Generator bracket x Cylinder block	55	561	41
Compressor bracket x Cylinder block	55	561	41
Intake manifold x Cylinder head	28.5	291	21
Water by–pass pipe x Timing chain or belt cover sub–assy	28.5	291	21
Crankshaft position sensor x Timing chain or belt cover sub–assy	12	122	9
Camshaft position sensor x Timing chain or belt cover sub–assy	12	122	9
Radiator pipe x Timing chain or belt cover sub–assy	18	184	13
Idler pulley bracket x Timing chain or belt cover sub–assy	55	561	41
Heater pipe x Timing chain or belt cover sub–assy	28.5	291	21
Water pump assy x Cylinder block	28.5	291	21
Vacuum pipe x Vacuum pump assy	24.5	250	18
Injection pump drive housing shaft oil pipe sub–assy x Vacuum pump assy	12.7	130	9
Vacuum pump assy x Timing chain or belt cover sub–assy	55	561	41
Fuel pipe support x Cylinder block	28.5	291	21
Common rail assy x Fuel pipe support	28.5	291	21
Timer cover x Supply pump assy	28.5	291	21
Supply pump x Timing chain or belt cover sub–assy	28.5	291	21
Supply pump drive gear x Supply pump assy	64	652	47
Fuel pipe No. 4 x Common rail assy	20	204	15
Fuel pipe No. 4 x Feed valve	24.5	250	18
Fuel pipe sub–assy x Supply pump assy	24.5	250	18
Vane pump hose x Vane pump assy	44	449	32
Thrust plate x Cylinder block	28.5	291	21
Timing chain or belt cover sub–assy x Front end plate	28.5	291	21
Crankshaft pulley x Crankshaft	519	5,294	383
Oil pan sub–assy x Cylinder block	28.5	291	21
Cylinder head x Cylinder block (1 to 18 head bolt) 1st 2nd	60 Turn 90°	612 Turn 90°	44 Turn 90°
Cylinder head x Cylinder block (19 to 22 head bolt)	55	561	41
Valve rocker shaft sub–assy No. 1 x Cylinder head	69	704	51
Flywheel housing x Cylinder block (M14) (M8)	132 28.5	1,346 291	97 21
Flywheel sub–assy x Crankshaft	190	1,938	140

EXHAUST

TORQUE SPECIFICATION

03258–01

Part Tightened	N·m	kgf·cm	ft·lbf
Exhaust pipe assy front x Exhaust manifold	70	714	52
Exhaust pipe support bracket No. 1 x Frame	50	510	37
Exhaust pipe support bracket No. 1 clamp x Exhaust pipe support bracket No. 1	25.4	259	19
Exhaust pipe assy center x Exhaust pipe assy front	29.5	301	22
Exhaust pipe support bracket No. 2 x Frame	50	510	37
Exhaust pipe support bracket No. 2 x Exhaust pipe assy center	24.5	245	18
Exhaust pipe No. 1 support bracket lower x Exhaust pipe bracket	24.5	245	18
Exhaust pipe No. 1 support bracket lower x Frame	24.5	245	18

COOLING

SERVICE DATA

03254–01

Radiator cap sub–assy		
Opening pressure	STD	108 kPa (1.1 kgf/cm^2, 15.9 psi)
	Minimum	93.3 kPa (0.951 kgf/cm^2, 13.5 psi)

03255–01

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Cylinder block drain cock plug x Drain cock (Cylinder block)	27	275	20
Water pump assy x Cylinder block	28.5	291	21
Fan x Water pump assy	28.5	291	21
Thermostat x Water outlet housing	28.5	291	21
Aie hose No. 1 x Body	18	184	13
Radiator bracket No. 3 x Frame	18	184	13
Fan shroud x Radiator assy	5.0	51	44 in.·lbf
Radiator support No. 2 x Body	7.5	77	66 in.·lbf
Radiator assy x Body	18	184	13
Heater pipe x Cylinder block	19.5	199	14
Radiator support No. 1 x Body	7.5	77	66 in.·lbf
Condenser assy w/ receiver x Radiator assy	7.5	77	66 in.·lbf
Charge air cooler assy x Radiator assy	7.5	77	66 in.·lbf
Intake air connector pipe x Body	18	184	13

LUBRICATION

03256–01

SERVICE DATA

Oil pressure	at idle speed	190 kPa (1.9 kgf/cm^2, 27 psi) or more
	at 3,000 rpm	245 to 539 kPa (2.5 to 5.5 kgf/cm^2, 36 to 78 psi) or more

03257–01

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Oil pressure switch x Oil cooler assy	29.4	300	22
Oil filter sub–assy x Oil cooler assy	19.6	200	14
Oil drain plug x Oil pan sub–assy	34.5	350	25
Oil pump assy x Cylinder block	28.5	291	21
Idle gear No. 1 x Cylinder block	137	1,397	101
Oil cooler assy x Oil cooler cover	28.5	291	21
Oil w/ bracket cooler assy x Cylinder block	28.5	291	21

STARTING & CHARGING

SERVICE DATA

0325L–01

Starter assy Specified current	STD	Below 120 A
Starter relay Specified condition	L – B L – B	10 kΩ or higher Below 1 Ω (when battery voltage is applied to terminals SW and G)
Battery Specific gravity Voltage	at 20°C (68°F) at 20°C (68°F)	1.25 to 1.29 24 to 25 V
Generator assy Regulating voltage Generated amperage	at 2,000 rpm w/o load w/ load	25 to 26 V 10 A or less 30 A or more

0325M–01

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Lead wire x Terminal M	13.5	138	10
Starter x Transmission	154	1,570	114
Starter wire x Terminal B	13.5	138	10
Starter wire x Terminal C	2.5	25	22 in.·lbf
Stiffener plate LH x Transmission assy	97	989	72
Generator bracket x Engine	62	632	46
Generator bracket x Generator assy	28.5	291	21
Generator bracket No. 1 x Generator assy	55	560	40
Generator wire x Terminal B	10	102	7

TIRE & WHEEL

0325S–01

SERVICE DATA

Cold tire inflation pressure

Cab Type	Countries	Models	Tire Size		Inflation Pressure kPa (kgf/cm^2, psi)	
			Front	Rear	Front	Rear
Standard cab	Australia	XZU305R–TQMMWQ3 XZU305R–HQMMWQ3	195/75R15	195/75R15	600 (6.0, 87)	600 (6.0, 87)
Standard cab	Australia	XZU305R–TKMMWQ3 XZU305R–HKMMWQ3	185/85R16	185/85R16	600 (6.0, 87)	600 (6.0, 87)
Standard cab	Australia	XZU345R–TKMMWQ3 XZU345R–HKMMWQ3	185/85R16	185/85R16	600 (6.0, 87)	600 (6.0, 87)

DIFFERENTIAL

SERVICE DATA

0325B–01

Differential oil	Oil type Recommended oil viscosity Capacity Capacity		Hypoid oil API GL–5 SAE 90 5.2 liters (5.5 US qts, 4.8 Imp.qts)
Differential carrier assy rear	Ring gear runout	Maximum	0.10 mm (0.0039 in.)
	Ring gear backlash	Gear Ratio 5.571	0.20 to 0.28 mm (0.0079 to 0.0110 in.)
		5.833	0.25 to 0.33 mm (0.0098 to 0.0130 in.)
	Side gear backlash	Standard	0.2 to 0.6 mm (0.0079 to 0.0236 in.)
		Maximum	0.9 mm (0.0035 in.)
	Drive pinion preload (Reused bearing)		0.98 to 1.47 N·m (10 to 15 kgf·cm, 9 to 13 in.·lbf)
	Drive pinion preload (New bearing)		1.47 to 1.96 N·m (15 to 20 kgf·cm, 13 to 17 in.·lbf)
	Side bearing preload (Reused bearing)	Gear Ratio 4.875	0.21 to 0.30 N·m (2.1 to 3.0 kgf·cm, 1.8 to 2.6 in.·lbf)
		5.125	0.20 to 0.28 N·m (2.0 to 2.9 kgf·cm, 1.7 to 2.5 in.·lbf)
		5.375	0.19 to 0.27 N·m (1.9 to 2.7 kgf·cm, 1.7 to 2.4 in.·lbf)
		5.571	0.18 to 0.26 N·m (1.8 to 2.6 kgf·cm, 1.6 to 2.3 in.·lbf)
		5.833	0.17 to 0.25 N·m (1.8 to 2.5 kgf·cm, 1.5 to 2.2 in.·lbf)
		6.167	0.16 to 0.23 N·m (1.7 to 2.4 kgf·cm, 1.5 to 2.1 in.·lbf)
		6.500	0.16 to 0.22 N·m (1.6 to 2.3 kgf·cm, 1.4 to 2.0 in.·lbf)
	Side bearing preload (New bearing)	Gear Ratio 4.875	0.31 to 0.40 N·m (3.1 to 4.1 kgf·cm, 2.7 to 3.5 in.·lbf)
		5.125	0.29 to 0.38 N·m (3.0 to 3.9 kgf·cm, 2.6 to 3.3 in.·lbf)
		5.375	0.28 to 0.36 N·m (2.8 to 3.7 kgf·cm, 2.5 to 3.2 in.·lbf)
		5.571	0.27 to 0.35 N·m (2.7 to 3.5 kgf·cm, 2.4 to 3.1 in.·lbf)
		5.833	0.26 to 0.33 N·m (2.6 to 3.4 kgf·cm, 2.3 to 2.9 in.·lbf)
		6.167	0.24 to 0.31 N·m (2.5 to 3.2 kgf·cm, 2.2 to 2.8 in.·lbf)
		6.500	0.23 to 0.30 N·m (2.4 to 3.0 kgf·cm, 2.1 to 2.6 in.·lbf)
	Conical distance		27.0 mm (1.063 in.)
	Inner diameter of the pinion – Outer diameter of the spider	Standard	0.140 to 0.261 mm (0.0055 to 0.0103 in.)
		Maximum	0.4 mm (0.016 in.)
	Side gear thrust washer thickness	Standard	1.9 to 2.1 mm (0.075 to 0.083 in.)
		Minimum	1.7 mm (0.070 in.)
	Pinion gear thrust washer thickness	Standard	1.5 to 1.7 mm (0.059 to 0.070 in.)
		Minimum	1.3 mm (0.051 in.)
Drive pinion preload adjustment	Spacer		14.400 mm (0.5669 in.) 14.425 mm (0.5679 in.) 14.450 mm (0.5689 in.) 14.475 mm (0.5699 in.) 14.500 mm (0.5709 in.) 14.525 mm (0.5719 in.) 14.550 mm (0.5728 in.) 14.575 mm (0.5738 in.) 14.600 mm (0.5748 in.) 14.625 mm (0.5758 in.) 14.650 mm (0.5768 in.) 14.675 mm (0.5778 in.) 14.700 mm (0.5787 in.) 14.725 mm (0.5797 in.) 14.750 mm (0.5807 in.) 14.775 mm (0.5817 in.) 14.800 mm (0.5827 in.) 14.825 mm (0.5837 in.) 14.850 mm (0.5846 in.) 14.875 mm (0.5856 in.)
Tooth contact adjustment	Shim		0.30 mm (0.0118 in.) 0.40 mm (0.0157 in.) 0.45 mm (0.0177 in.) 0.50 mm ((0.0197 in.)

0325C–01

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Drain plug	50	510	37
Filler plug	50	510	37
Rear drive pinion companion flange sub–assy rear x Differential carrier	435	4,440	321
Differential case LH x Differential case RH	190	1,950	141
Differential case x Ring gear	190	1,950	141
Retainer (drive pinion bearing) x Differential carrier	22	225	16
Drive pinion bearing cage x Differential carrier	74	755	55
Bearing cap x Differential carrier	210	2,150	155
Adjusting nut lock x Bearing cap	22	225	16
Differential carrier x Rear axle housing	52	530	38

BRAKE

030YS–02

SERVICE DATA

Rear axle load (including vehicle weight)

Model	Front axle load kg (lb)
XZU305R–TQMMWQ3	1,350 (2,976)
XZU305R–HQMMWQ3	1,350 (2,976)
XZU305R–TKMMWQ3	1,350 (2,976)
XZU305R–HKMMWQ3	1,350 (2,976)
XZU345R–TKMMWQ3	1,400 (3,086)
XZU345R–HKMMWQ3	1,400 (3,086)

Rear brake fluid pressure

Model	Rear brake pressure kPa (kgf/cm^2, psi)
XZU305R–TQMMWQ3	5,600 ± 500 ± (57 ± 5, 810 ± 70)
XZU305R–HQMMWQ3	5,600 ± 500 ± (57 ± 5, 810 ± 70)
XZU305R–TKMMWQ3	5,600 ± 500 ± (57 ± 5, 810 ± 70)
XZU305R–HKMMWQ3	5,600 ± 500 ± (57 ± 5, 810 ± 70)
XZU345R–TKMMWQ3	5,600 ± 500 ± (57 ± 5, 810 ± 70)
XZU345R–HKMMWQ3	5,600 ± 500 ± (57 ± 5, 810 ± 70)

A, B, C point (See page 32–9) data table:

Model	A		B		C	
	kg (lb)	kPa (kg/ cm^2, psi)	kg (lb)	kPa (kg/ cm^2, psi)	kg (lb)	kPa (kg/ cm^2, psi)
XZU305R–TQMMWQ3	991 (2,185)	500 (5.1, 73)	2,179 (4,803)	8,300 (84.9, 1,204)	2,555 (5,633)	12,900 (132, 1,871)
XZU305R–HQMMWQ3	1,121 (2,471)	500 (5.1, 73)	2,152 (4,745)	7,300 (74.4, 1,059)	2,943 (6,488)	13,000 (132.4, 1,885)
XZU305R–TKMMWQ3	1,127 (2,485)	500 (5.1, 73)	2,406 (5,304)	8,700 (89, 1,262)	4,246 (9,361)	16,400 (167.1, 2,379)
XZU305R–HKMMWQ3	875 (1,929)	500 (5.1, 73)	1,908 (4,206)	7,100 (72.9, 1,030)	4,247 (9,363)	16,300 (166, 2,364)
XZU345R–TKMMWQ3	1,095 (2,414)	500 (5.1, 73)	2,012 (4,436)	8,400 (85.6, 1,218)	4,994 (11,010)	17,000 (173.3, 2,466)
XZU345R–HKMMWQ3	1,145 (2,524)	500 (5.1, 73)	2,012 (4,436)	8,000 (81.2, 1,160)	4,815 (10,615)	16,000 (163, 2,321)

030YT–02

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
VACUUM PUMP			
Nozzle leakage pipe No. 3 x Union bolt	13	133	10
Vacuum pump oil pipe x Union bolt	20	204	15
Vacuum pipe x Union Bolt	13	133	10
Vacuum pump x Timing gear case	55	561	41
Vacuum pump x Union tube	14	140	10
Fuel pipe x Fuel pump	13* 14	133* 143	10
Oil separator x Engine assy	55	561	41
ABS & TRACTION ACTUATOR ASSY			
Brake actuator x Brake actuator bracket	5.4	55	48 in.·lbf
Brake actuator bracket x Frame	29	296	21
Brake actuator x Clutch tube No. 2	22* 24	224* 245	16* 18
Brake actuator x Brake line	14* 15	143* 153	10* 11

HINT:
(*): For use with SST

PARKING BRAKE

TORQUE SPECIFICATION

030YY–02

Part Tightened	N·m	kgf·cm	ft·lbf
Control cable clamp No. 2 x Control bracket No. 8	18	184	13
Control bracket No. 5 x Control bracket No. 9	18	184	13
Control bracket No. 6 x Control bracket No. 7	18	184	13
Control cable clamp No. 2 x Body	18	184	13
Control bracket No. 3 x Body	18	184	13
Control bracket No. 4 x Body	18	184	13
Clamp x Backing plate	13	133	10
Parking brake cable No. 2 x Floor	18	184	13
Parking brake lever x Body	5.0	51	44 in.·lbf
Parking brake switch x Parking brake lever	7.0	71	62 in.·lbf
Parking brake cable No. 2 x Parking brake cable No. 3	18	184	13

MANUAL TRANSMISSION / TRANSAXLE

030Z8–09

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Filler and drain plugs	37	377	27
Engine x Transmission	43	439	32
Engine mount bracket x Frame	64	650	47
Engine mount bracket x Transmission	57	581	42
Clutch release cylinder set bolt	12	122	9
Shift and select outer lever x Shift and select transmission control cable	12	122	9
Shift and select transmission control cable clamp x Frame	18	184	13
Shift transmission control cable x Floor shift assy	12	122	9
Speedometer driven gear sub–assy x Transmission	11	112	8

CLUTCH

031CU–02

SERVICE DATA

Disc rivet head depth	Min.	0.3 mm (0.012 in.)
Disc runout	Max.	1.0 mm (0.039 in.)
Flywheel runout	Max.	0.1 mm (0.004 in.)
Diaghargm spring finger wear	depth Max. width Max.	0.6 mm (0.024 in.) 5.0 mm (0.197 in.)
Diaphragm spring tip non–alignment	Max.	0.5 mm (0.020 in.)

031CV–02

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Clutch cover set bolt	43.1	439	32

POWER STEERING

TORQUE SPECIFICATION

030YN–02

Part Tightened	N·m	kgf·cm	ft·lbf
VANE PUMP ASSY			
Radiator pipe x Timing gear case	18	184	13
Oil pump to gear box tube x Timing gear case	18	184	13
Suction port union set bolt x Vane pump assy	29	291	21
Oil pump to gear box tube x Hose support bracket No. 1	44	449	32
Vane pump assy x Transmission	47	480	35
Oil pump to gear box tube x Vane pump assy	49	500	36
Suction port union set bolt	29	291	21

HEATER AND AIR CONDITIONING

0324X–02

SERVICE DATA

V COOLER BELT (N04C–TF)		
V cooler belt Tension	New belt	8.5 to 9.5 mm (0.33 to 0.37 in.)
	Used belt	10.0 to 13.0 mm (0.39 to 0.51 in.)
COOLER COMPRESSOR ASSY (N04C–TF)		
Magnetic clutch clearance	Standard	0.50 ± 0.15 mm (0.020 ± 0.006 in.)
Magnetic clutch shim thickness		0.1 mm (0.004 in.) 0.3 mm (0.012 in.) 0.5 mm (0.020 in.)

0324Y–02

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
V COOLER BELT (N04C–TF)			
Idler pulley bolt (A/C drive belt)	41	420	30
Adjusting bolt	6.0	61	53 in.·lbf
REFRIGERANT LINE (N04C–TF)			
Liquid tube x liquid tube No. 2	14	142	10
Cooler refrigerant discharge hose No. 2 x Cooler compressor assy	5.4	55	48 in.·lbf
Suction hose sub–assy x Cooler compressor assy	5.4	55	48 in.·lbf
COOLER COMPRESSOR ASSY (N04C–TF)			
Cooler refrigerant discharge hose No. 2 x Cooler compressor assy	5.4	55	48 in.·lbf
Suction hose sub–assy x Cooler compressor assy	5.4	55	48 in.·lbf
Magnetic clutch stopper x Cooler compressor assy	18	183	13
COOLER CONDENSOR ASSY (N04C–TF)			
w/ Receiver condensor assy (main condensor) x Condensor bracket	30	306	22
Condensor bracket x Body	80	816	59
Condensor bracket x Condensor holder	19.5	199	14
Liquid tube No. 1 x w/ Receiver condensor assy (main condensor)	5.4	55	48 in.·lbf
w/ Receiver condensor assy (sub condensor)	8.0	82	70 in.·lbf

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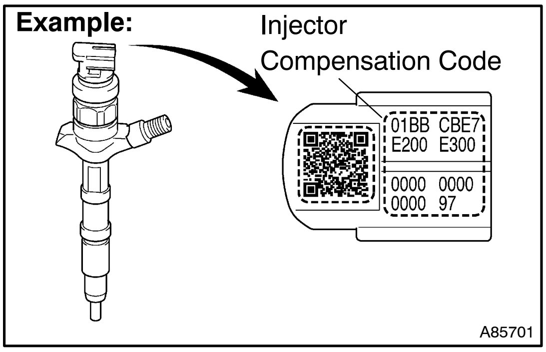
REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)

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

ECD SYSTEM (N04C–TF)

05DVP–03

PRECAUTION



1. INJECTOR COMPENSATION CODE

(a) Since each injector has its own fuel injection characteristic, the ECM compensates this by slightly modifying injection duration in order to optimize fuel injection volume. The compensated data for the optimum injection volume, in the form of a 30–digit–alphanumeric value, has been imprinted on the head portion of each injector as the injector compensation code.

(b) The injector compensation code will be required to register to the ECM when replacing the injectors or the ECM (see page 05–13).

(c) If an incorrect injector compensation code was registered to the ECM, it may rattle the engine assembly or the engine idling may become rough. In addition, it may become a cause of engine failure or shorten the life of the engine.

2. DIFFICULT TO START ENGINE, ENGINE STALL OR BLACK SMOKE

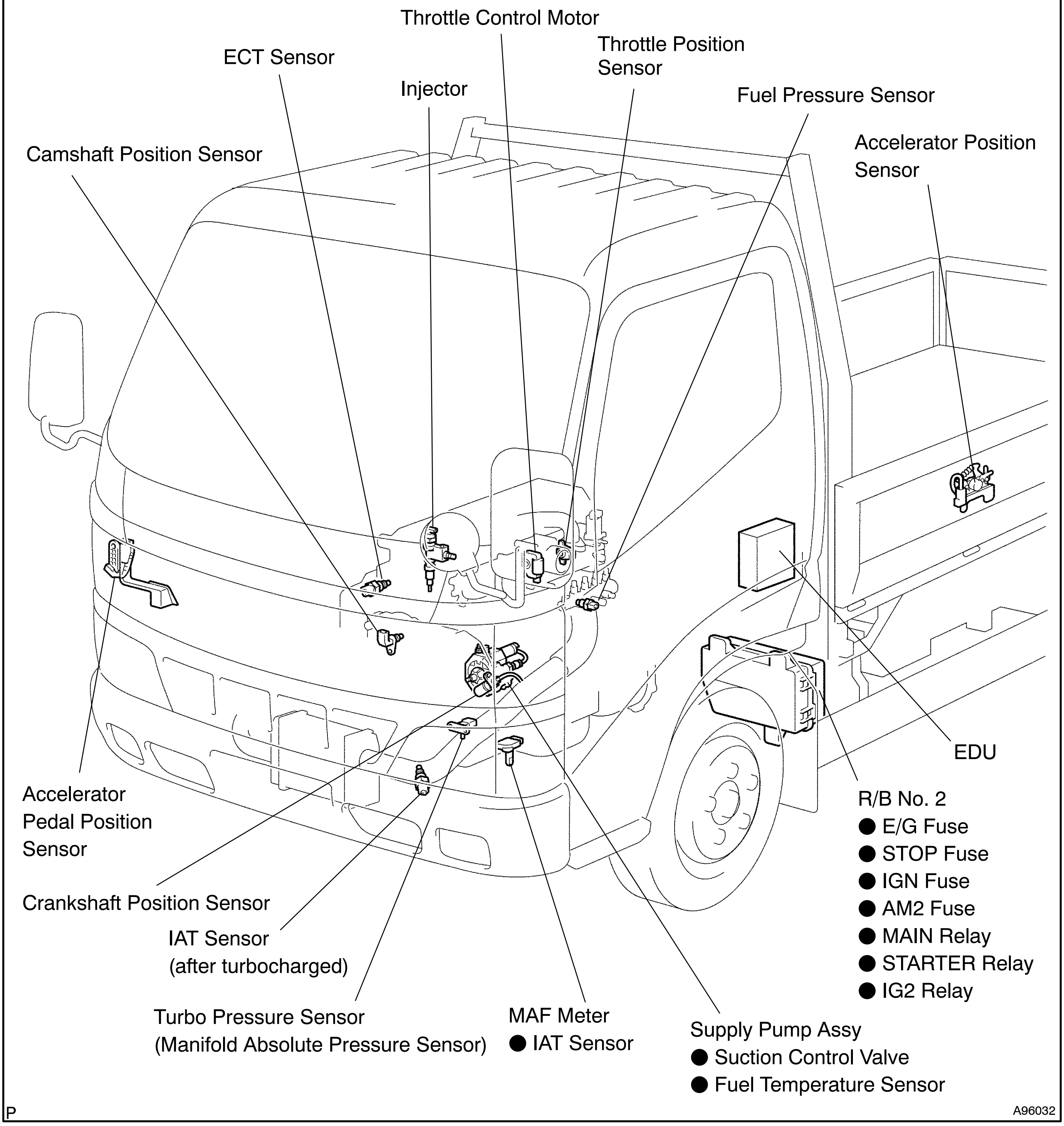
(a) If the customer's complaint description is applicable to one of the following, refer to the troubleshooting on the applicable pages shown below:

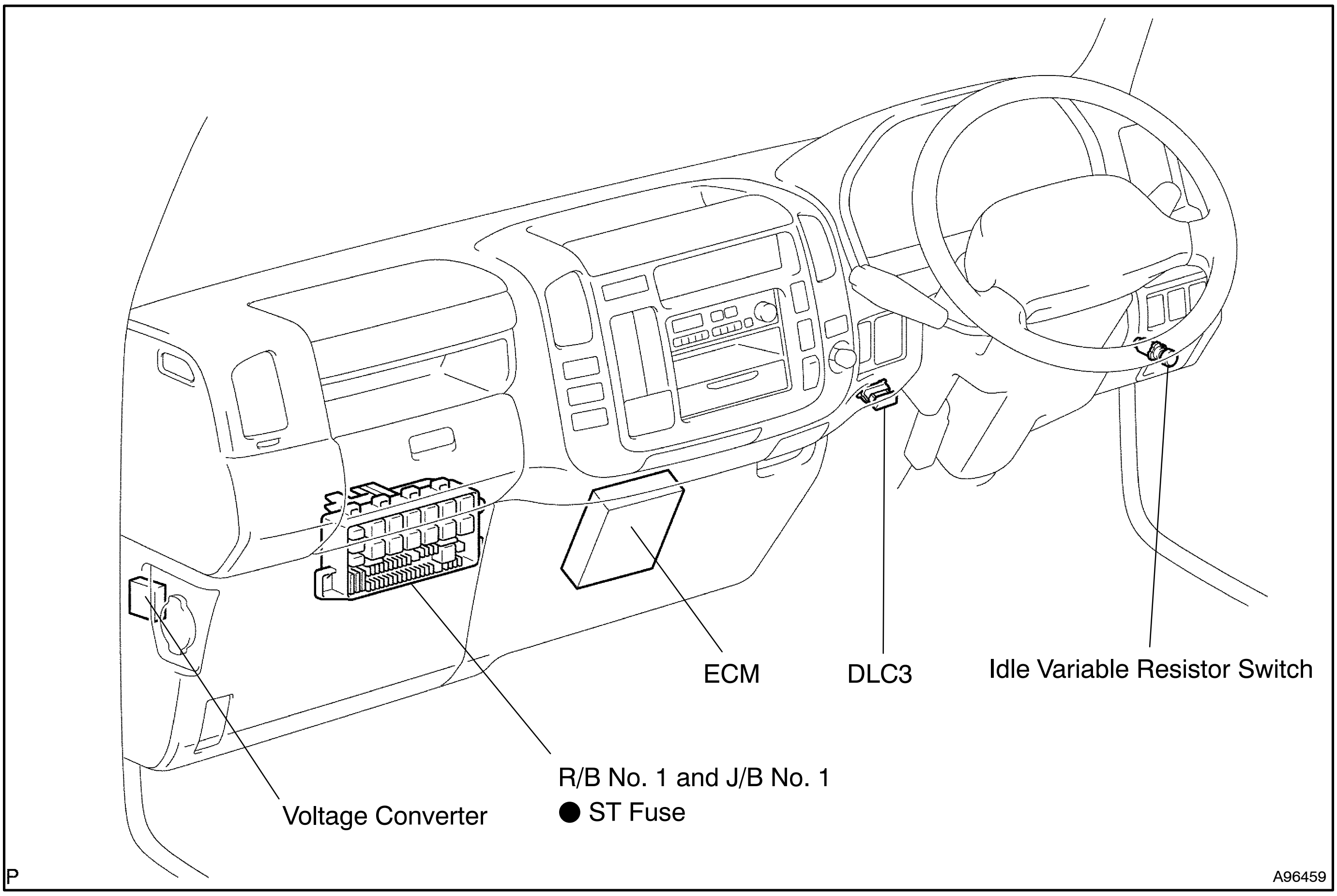
(1) Engine start difficulties, or engine stall (see page 05–22)

(2) Black smoke (see page 05–166)

05L1W–01

LOCATION




ECM
DLC3
Idle Variable Resistor Switch
R/B No. 1 and J/B No. 1
● ST Fuse
Voltage Converter
P
A96459

054JB–22

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:
Use this procedure to troubleshoot the ECD system.

When using hand–held tester:

1 VEHICLE BROUGHT TO WORKSHOP

2 CUSTOMER PROBLEM ANALYSIS (See page 05–9)

3 CONNECT HAND–HELD TESTER TO DLC3

HINT:
If the display indicates a communication fault in the tester, inspect the DLC3.

4 CHECK DTC AND FREEZE FRAME DATA (See page 05–29)

HINT:
Record or print DTC and freeze frame data, if necessary.

5 CLEAR DTC AND FREEZE FRAME DATA (See page 05–29)

6 VISUAL INSPECTION

7 SETTING CHECK MODE DIAGNOSIS (See page 05–31)

8 PROBLEM SYMPTOM CONFIRMATION

HINT:
If the engine does not start, perform steps 10 and 12 first.

Result	Proceed to
Malfunction does not occur	A
Malfunction occurs	B

B → **Go to step 10**

A

9	SYMPTOM SIMULATION

10	DTC CHECK (See page 05–29)

Result	Proceed to
Malfunction code	A
No code	B

B Go to step 12

A

11	DTC CHART (See page 05–38)

Go to step 14

12	BASIC INSPECTION (See page 05–11)

Result	Proceed to
Wrong parts not confirmed	A
Wrong parts confirmed	B

B Go to step 17

A

13	PROBLEM SYMPTOMS TABLE (See page 05–22)

Result	Proceed to
Wrong circuit confirmed	A
Wrong parts confirmed	B

B Go to step 17

A

14	CHECK ECM POWER SOURCE CIRCUIT (See page 05–152)

15 CIRCUIT INSPECTION

Result	Proceed to
Malfunction not confirmed	A
Malfunction confirmed	B

B → Go to step 18

A

16 CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)

Go to step 18

17 PARTS INSPECTION

18 IDENTIFICATION OF PROBLEM

19 ADJUST, REPAIR

20 CONFIRMATION TEST

END

When not using hand–held tester:

1 VEHICLE BROUGHT TO WORKSHOP

2 CUSTOMER PROBLEM ANALYSIS (See page 05–9)

3 CHECK AND CLEAR DTC (See page 05–29)

4 PROBLEM SYMPTOM CONFIRMATION

A	Malfunction occurs
B	Malfunction does not occur

B → **SYMPTOM SIMULATION (See page 05–22)**

5 DTC CHECK (See page 05–29)

A	Malfunction code
B	No code

B → **Go to step 7**

A

6 DTC CHART (See page 05–38)

Go to step 9

7 BASIC INSPECTION (See page 05–11)

A	Wrong parts not confirmed
B	Wrong parts confirmed

B → **Go to step 12**

A

8	PROBLEM SYMPTOMS TABLE (See page 05–22)

A	Wrong circuit confirmed
B	Wrong parts confirmed

B → Go to step 12

A

9	CHECK ECM POWER SOURCE CIRCUIT (See page 05–152)

10	CIRCUIT INSPECTION

A	Malfunction not confirmed
B	Malfunction confirmed

B → Go to step 13

A

11	CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)

Go to step 13

12	PARTS INSPECTION

13	IDENTIFICATION OF PROBLEM

14	ADJUSTMENT, REPAIR

15	CONFIRMATION TEST

END

054JC–23

CUSTOMER PROBLEM ANALYSIS CHECK

ECD SYSTEM Check Sheet

Inspector's Name ______________________

Customer's Name		VIN	
Production Date		Date Vehicle Brought in	
License Plate No.		Odometer Reading	km miles

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

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

Condition of Malfunction Indicator Lamp (MIL)		☐ Remains on ☐ Sometimes turns on ☐ Does not turn on
DTC Inspection	Normal Mode	☐ Normal ☐ Malfunction code(s) (code) ☐ Freeze frame data ( )
	Check Mode	☐ Normal ☐ Malfunction code(s) (code) ☐ Freeze frame data ( )

05DVY–04

CHECK FOR INTERMITTENT PROBLEMS

HINT:

Hand–held tester only:

Inspect the vehicle's ECM using check mode. Intermittent problems are easier to be detected when the ECM is in check mode with the hand–held tester. In check mode, the ECM uses 1 trip detection logic, which has a higher sensitivity to malfunctions than normal mode (default), which uses 2 trip detection logic.

(a) Clear DTCs (see page 05–29).
(b) Change the ECM from normal mode to check mode using the hand–held tester (see page 05–31).
(c) Perform a simulation test (see page 01–17).
(d) Check the connectors and terminals (see page 01–27).
(e) Wiggle the harness and connectors (see page 01–27).

05I7H–03

BASIC INSPECTION

When the malfunction is not confirmed in the DTC check, troubleshooting should be carried out in all the possible circuits considered as possible causes of the problem. In many cases, by carrying out the basic engine check shown in the following flowchart, the problem can be found quickly and efficiently. Therefore, using this check is essential in the engine troubleshooting.

1	CHECK BATTERY VOLTAGE

NOTICE:
Carry out the battery voltage check with the engine stopped and ignition switch OFF.

	OK	NG
Voltage	22 V or more	Less than 22 V

NG → **CHARGE OR REPLACE BATTERY**

OK

2	CHECK IF ENGINE WILL CRANK

NG → **PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–22**

OK

3	CHECK AIR FILTER

(a) Visually check if the air filter is not contaminated with dirt or oil.

NG → **CLEAN OR REPLACE AIR FILTER**

OK

4	CHECK FUEL QUALITY

(a) Check that only diesel fuel is used.
(b) Check that the fuel does not contain any impurity.

NG → **REPLACE FUEL**

OK

5	CHECK ENGINE OIL (See page 17–1)

NG → **ADD OR REPLACE ENGINE OIL**

OK

6	CHECK ENGINE COOLANT (See page 16–1)

NG → REPLACE ENGINE COOLANT (See page 16–3)

OK

7	CHECK IDLE SPEED AND MAXIMUM SPEED (See page 14–1)

NG → REPLACE INJECTION OR SUPPLY PUMP ASSY (See page 11–10)

OK

8	CHECK DIAGNOSTIC CIRCUIT

NG → REPAIR OR REPLACE

OK

9	CHECK VACUUM PUMP

NG → REPAIR OR REPLACE VACUUM PUMP

OK

PROCEED TO PROBLEM SYMPTOMS TABLE (See page 05–22)

05DVV–03

READING REGISTERED DATA

NOTICE:

- **If an injector has been replaced, the injector's compensation code must be registered to the ECM. If an ECM has been replaced, all of the injector's compensation code must be registered to the ECM.**
- **If an incorrect injector compensation code was registered to the ECM, the engine assembly may rattle, engine idling may become rough, the life of the engine may shorten and engine failure may result.**

1. If you replace the ECM with a new one, register all the injector compensation codes to the new ECM as follows:

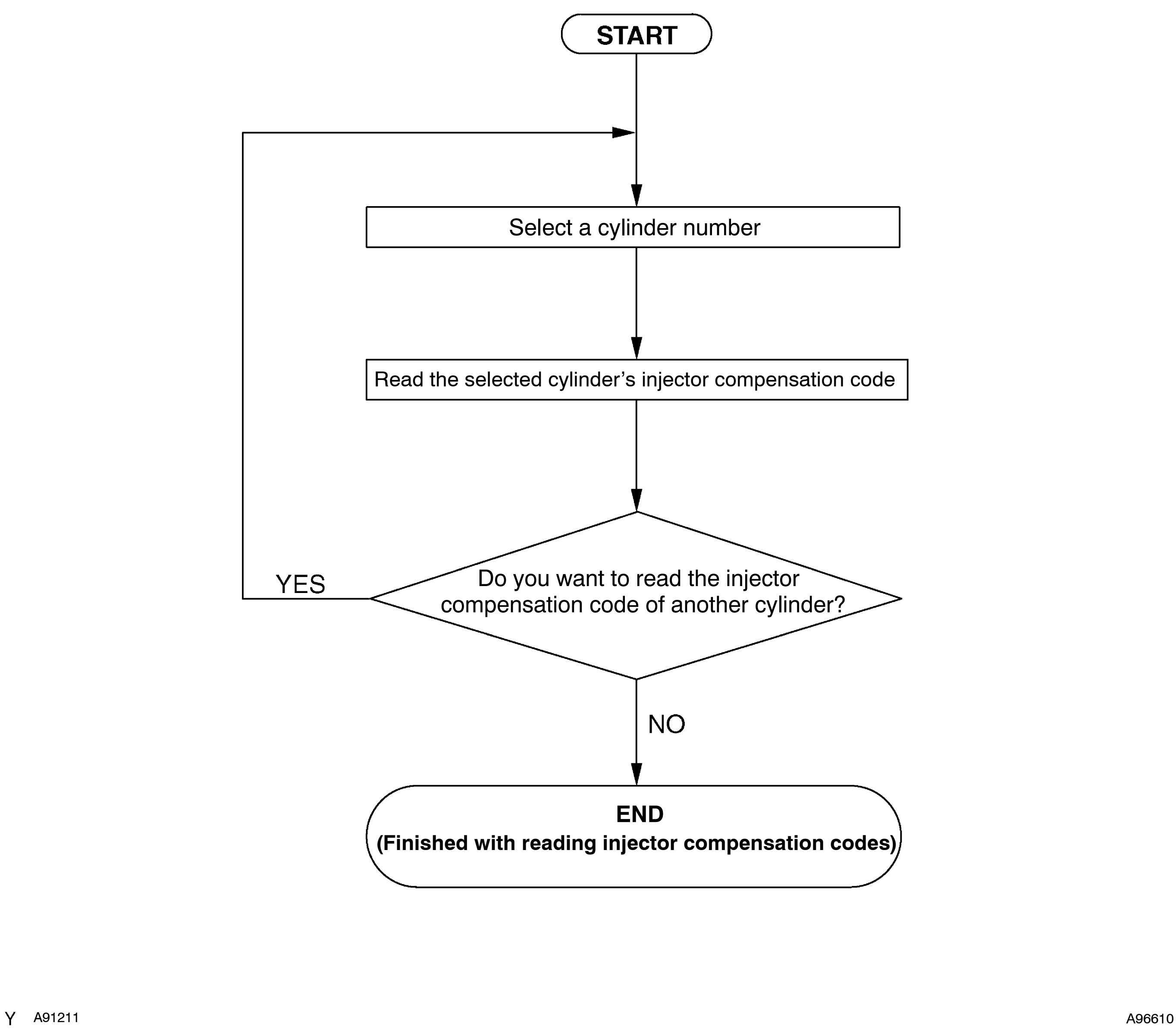
(a) Prior to replacing the ECM, read all the injector compensation codes stored in the existing ECM using the hand–held tester, and then write them down.
(b) After replacing the ECM, register the written injector compensation codes to the ECM using the hand–held tester (see page 05–17).
(c) Turn the ignition switch OFF and turn the hand–held tester OFF. Then wait for 30 seconds or more.
(d) Turn the ignition switch ON and turn the hand–held tester ON. Then clear DTC P1601 using the hand–held tester (see page 05–29).

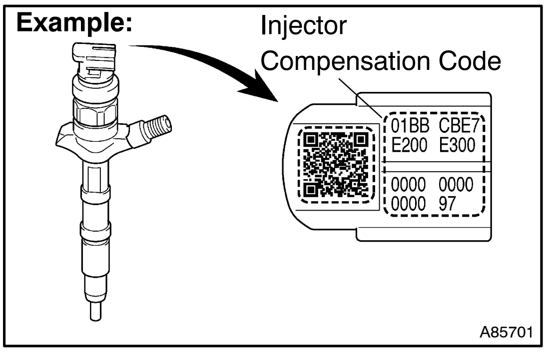
2. If you replace the injector with a new one, register a compensation code to the new injector as follows:

(a) Replace the injector.
(b) Read the new injector's compensation code which is imprinted on the head portion of the injector.
(c) Register the compensation code to the ECM using the hand–held tester (see page 05–17).
(d) Turn the ignition switch OFF and turn the hand–held tester OFF. Then wait for 30 seconds or more.
(e) Turn the ignition switch ON and turn the hand–held tester ON. Then clear DTC P1601/89 using the hand–held tester (see page 05–29).

HINT:
Each injector has different fuel injection characteristics. In order to balance the difference between each injector's fuel injection duration, the ECM uses a 30–digit alphanumeric value that is unique for each injector. The value is written on the head portion of each injector and is known as the injector compensation code.

Reading Injector Compensation Codes





3. READ INJECTOR COMPENSATION CODE

HINT:

The injector compensation code is imprinted on the head portion of the injector.

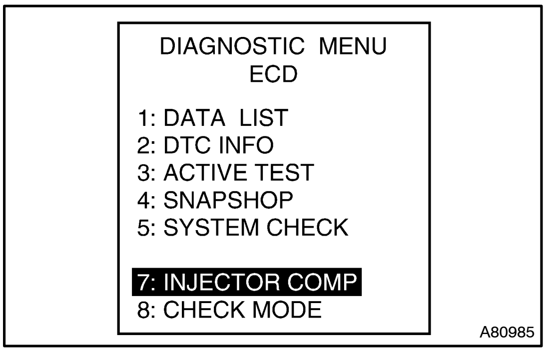
(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.

(b) Turn the ignition switch ON.

(c) Turn the hand–held tester ON.

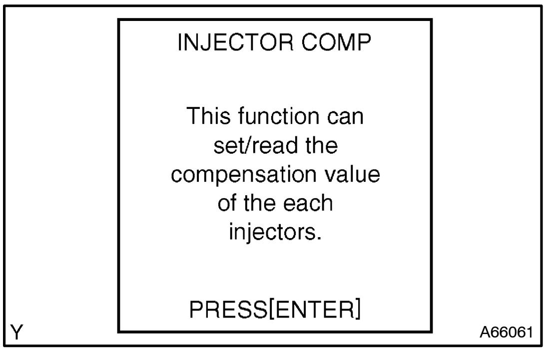
NOTICE:

Do not start the engine.

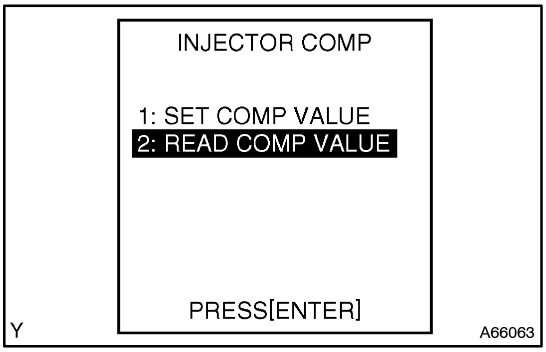


(d) Enter these menu options in this order: ”DIAGNOSIS / OBD/MOBD / DIAGNOSTIC MENU ECD”. Then select ”INJECTOR COMP”.

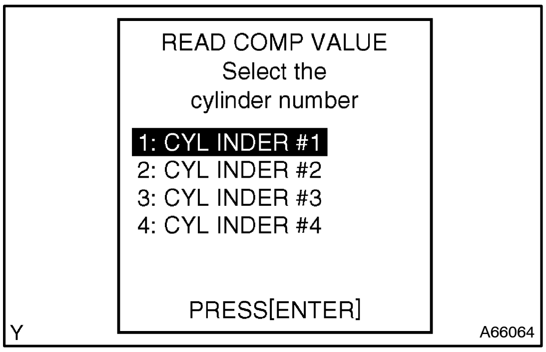
(e) Press ”ENTER”.



(f) Press ”ENTER” again.

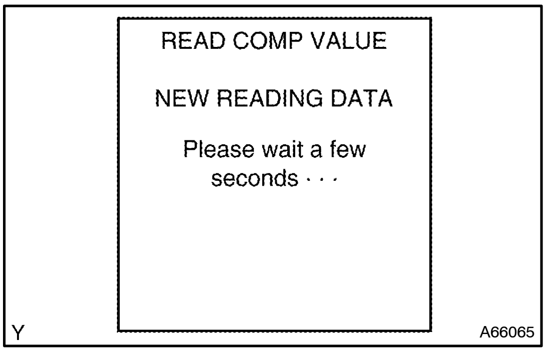


(g) Select ”READ COMP VALUE” and press ”ENTER”.

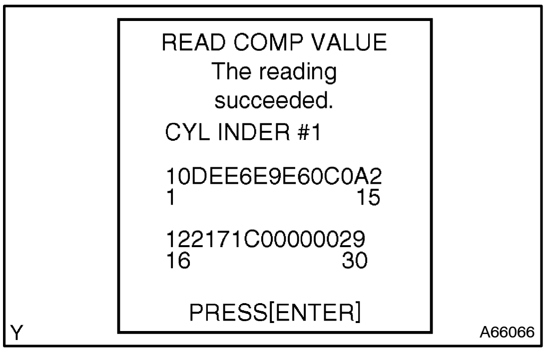


(h) Select a cylinder number for the compensation code you want to read.

(i) Press ”ENTER”.



(j) Wait until the next screen appears.

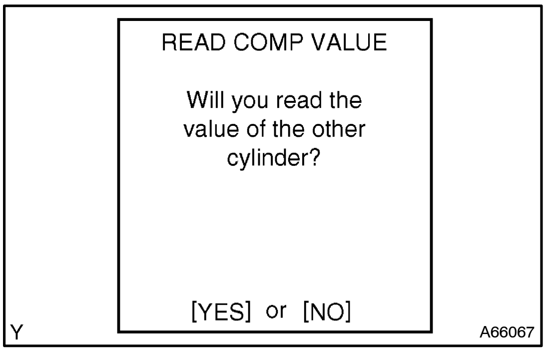


(k) Confirm the 30–digit alphanumeric code which is displayed on the hand–held tester. This is the injection compensation code of the cylinder.

HINT:

The code shown in the illustration is an example of a 30–digit code.

(l) Press ”ENTER” to exit this screen.



(m) Press the ”NO” button to complete the confirmation.

HINT:

- If you want to read other compensation codes for the other cylinders, press ”YES” instead of ”NO”.
- By pressing ”NO”, the hand–held tester returns to the ”DIAGNOSTIC MENU ECD” screen.

05L1X–01

REGISTRATION

NOTICE:

- **If an injector has been replaced, the injector's compensation code must be registered to the ECM. If an ECM has been replaced, all of the injector's compensation code must be registered to the ECM.**
- **If an incorrect injector compensation code was registered to the ECM, the engine assembly may rattle, engine idling may become rough, the life of the engine may shorten and engine failure may result.**

1. If you replace the ECM with a new one, register all the injector compensation codes to the new ECM as follows:

(a) Prior to replacing the ECM, read all the compensation codes stored in the existing ECM using the hand–held tester, and then write them down (see page 05–13).

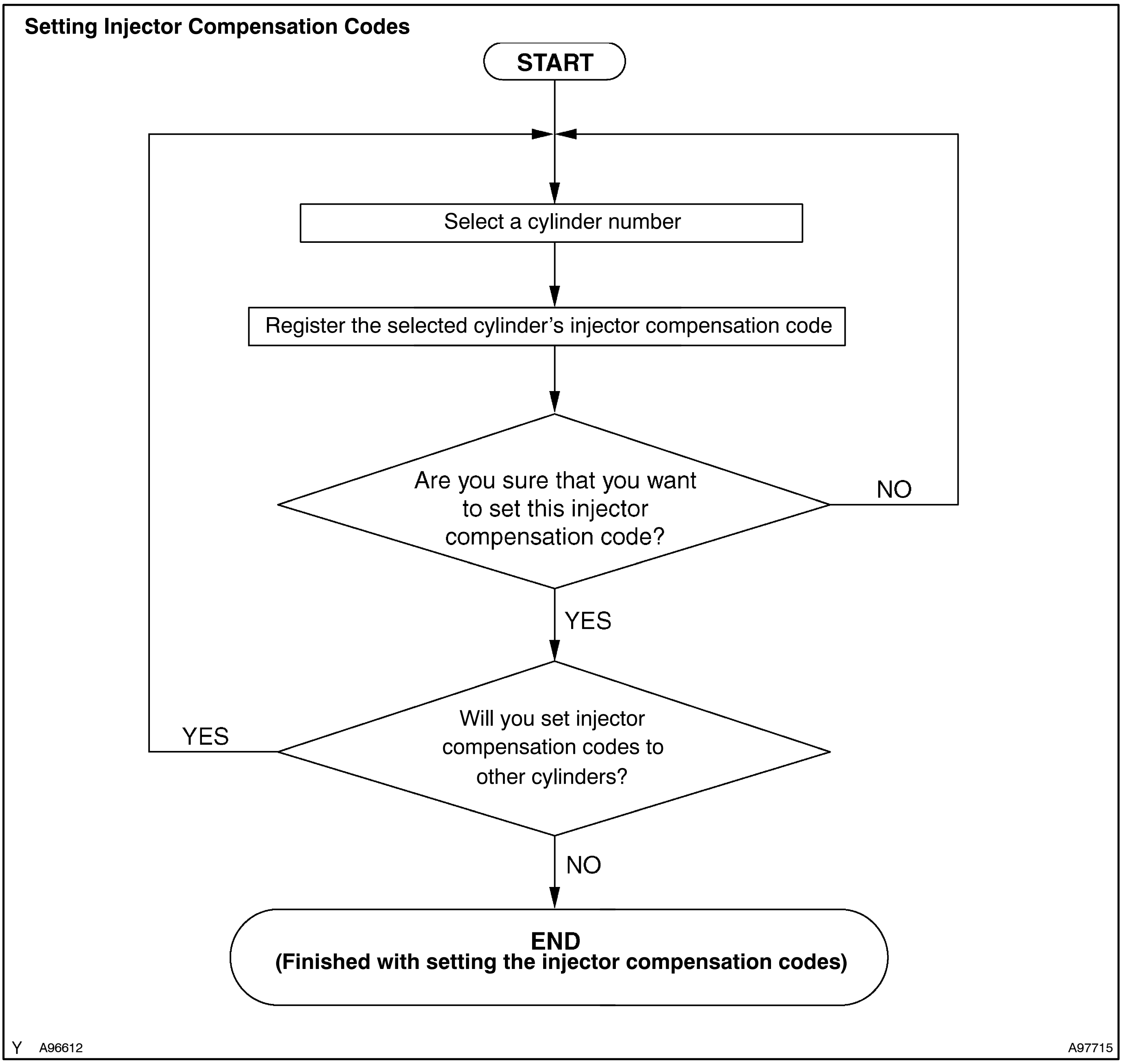
(b) After replacing the ECM, enter the written compensation codes into the ECM using the hand–held tester.

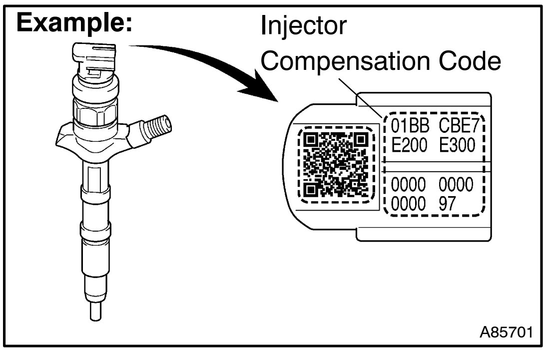
(c) Turn the ignition switch OFF and turn the hand–held tester OFF. Then wait for 30 seconds or more.

(d) Turn the ignition switch ON and turn the hand–held tester ON. Then clear DTC P1601/89 using the hand–held tester (see page 05–29).

HINT:

Each injector has different fuel injection characteristics. In order to balance the difference between each injector's fuel injection duration, the ECM uses a 30–digit alphanumeric value that is unique for each injector. The value is written on the head portion of each injector and is known as the injector compensation code.





2. SET INJECTOR COMPENSATION CODE

HINT:

The injector compensation code is imprinted on the head portion of the injector.

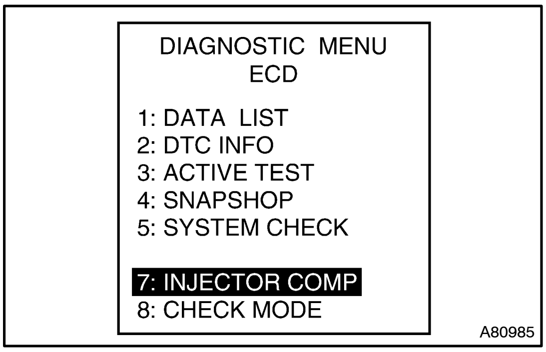
(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.

(b) Turn the ignition switch ON.

(c) Turn the hand–held tester ON.

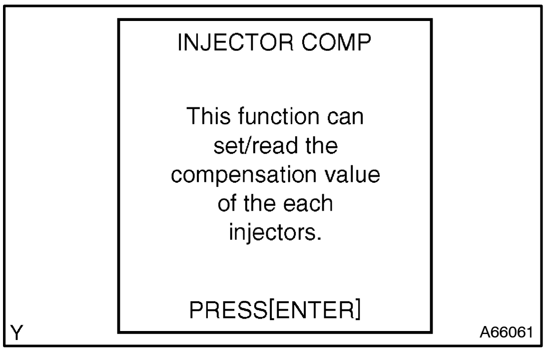
NOTICE:

Do not start the engine.

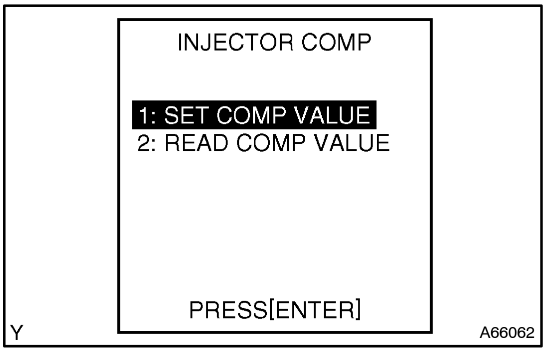


(d) Enter these menu options in this order: ”DIAGNOSIS / OBD/MOBD / DIAGNOSTIC MENU ECD”. Then select ”INJECTOR COMP”.

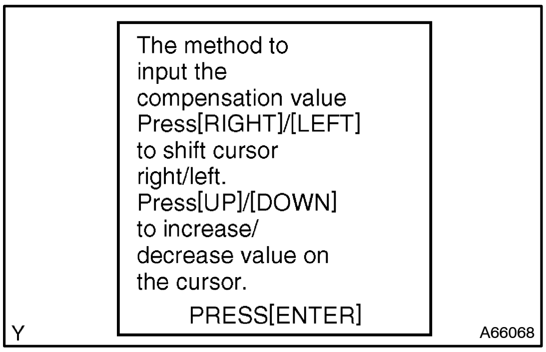
(e) Press ”ENTER”.



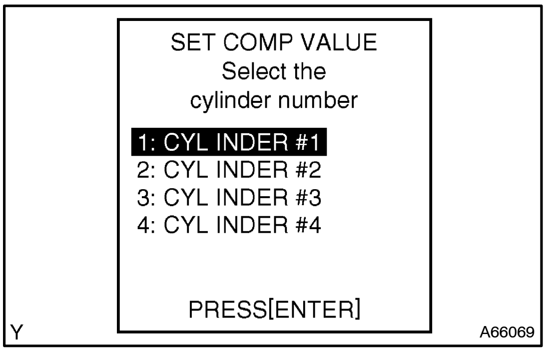
(f) Press ”ENTER” again.



(g) Select ”SET COMP VALUE” and press ”ENTER”.

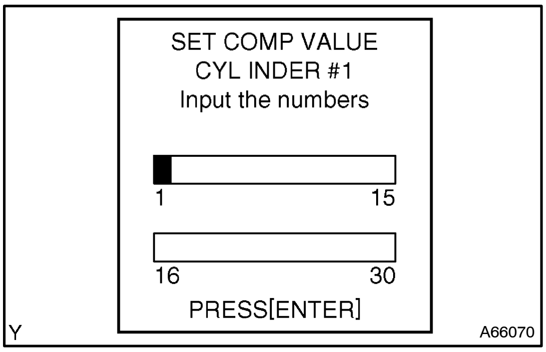


(h) Press ”ENTER”.



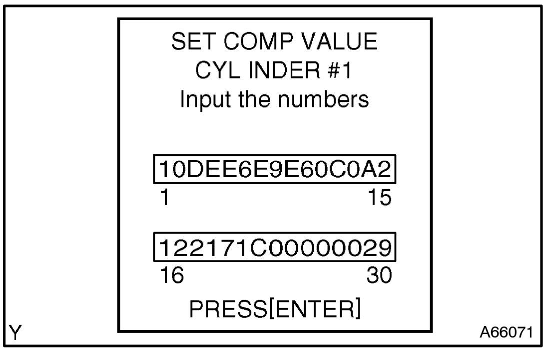
(i) Select a cylinder number for the cylinder in which you want to register the compensation code.

(j) Press ”ENTER”.

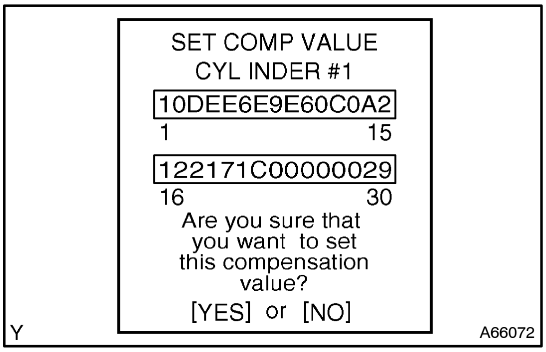


(k) Input the compensation code (30–digit alphanumeric value).

(l) After inputting, press ”ENTER”.



(m) Press ”ENTER” again.



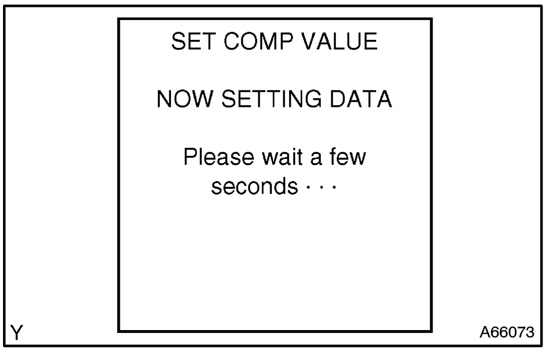
(n) Confirm the injection compensation code displayed on the hand–held tester.

HINT:

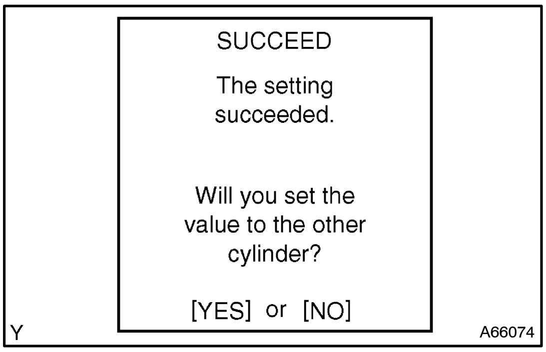
- The code shown in the illustration is an example.
- If a wrong compensation code registered, press ”NO” to correct the error (back to step [g]).

NOTICE:
If an incorrect injector compensation code was registered to the ECM, the engine assembly may rattle, engine idling may become rough, the life of the engine may shorten and engine failure may result.

(o) Press ”YES” to set the code to the ECM.



(p) Wait until the next screen appears.



(q) Press "NO" to complete the registration.

HINT:

- If you want to register compensation codes other cylinders, press "YES" instead of "NO".
- By pressing "NO", the hand–held tester returns to the "DIAGNOSTIC MENU ECD" screen.

(r) Turn the ignition switch OFF and wait for 30 seconds or more.

054JF–23

PROBLEM SYMPTOMS TABLE

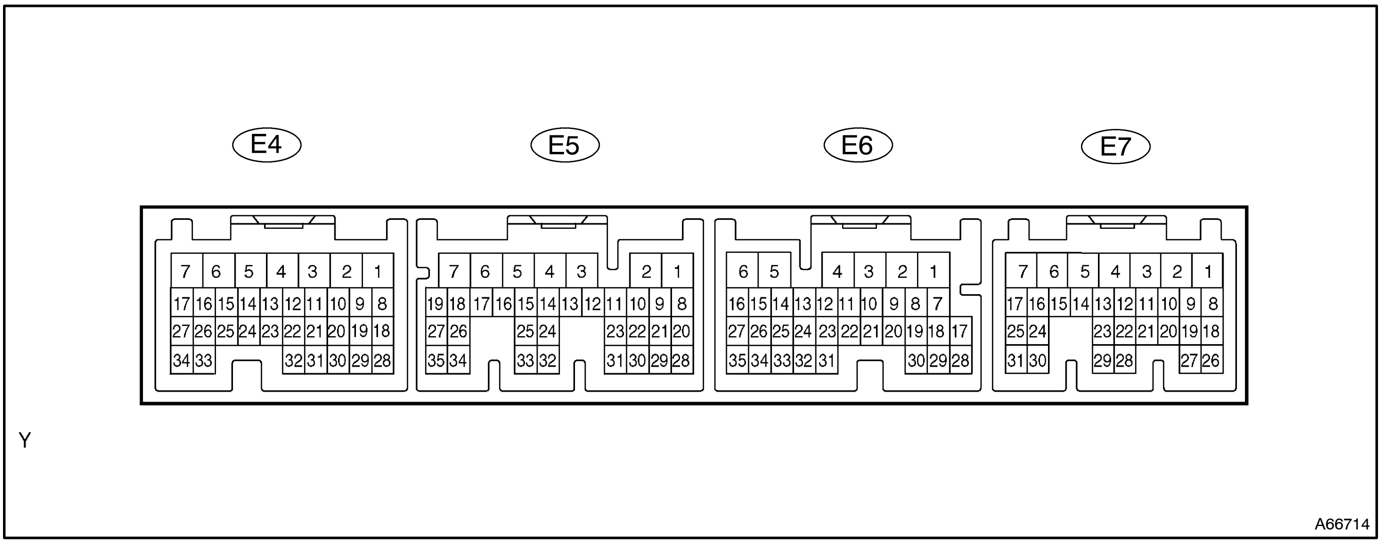
When the malfunction code is not confirmed during the diagnostic trouble code check and no problem can be confirmed in the basic inspection, proceed to this problem symptoms tables and troubleshoot according to the numbered order given below.

Symptoms	Suspected Area	See Page
Engine not crank (difficult to start)	1. Starter 2. STARTER relay 3. ECT sensor	19–1 19–1 10–1
Cold engine (difficult to start)	1. STA signal circuit 2. Injector 3. Fuel filter 4. Compression 5. ECM 6. Supply pump 7. Fuel pressure sensor 8. Diesel throttle	05–159 11–2 – 14–1 10–3 11–3 11–3 11–3
Hot engine (difficult to start)	1. STA signal circuit 2. Injector 3. Fuel filter 4. Compression 5. ECM 6. Supply pump 7. Fuel pressure sensor 8. Diesel throttle	05–159 11–2 – 14–1 10–3 11–3 11–3 11–3
Soon after starting (engine stall)	1. Fuel filter 2. Injector 3. ECM power source circuit 4. ECM 5. Supply pump 6. Fuel pressure sensor 7. Diesel throttle	– 11–2 05–152 10–3 11–3 11–3 11–3
Others (engine stall)	1. ECM power source circuit 2. Injector 3. ECM 4. Supply pump 5. Fuel pressure sensor 6. Diesel throttle	05–152 11–2 10–3 11–3 11–3 11–3
Incorrect first idle (poor idling)	1. Fuel filter 2. Injector 3. ECM 4. Supply pump 5. Fuel pressure sensor	– 11–2 10–3 10–3 11–3
High engine idle speed (poor idling)	1. Injector 2. STA signal circuit 3. ECM 4. Supply pump 5. Fuel pressure sensor	11–2 05–159 10–3 10–3 11–3
Lower engine idle speed (poor idling)	1. Injector 2. Compression 3. Valve clearance 4. Fuel line (Air bleed) 5. ECM 6. Supply pump 7. Fuel pressure sensor 8. Diesel throttle	11–2 14–1 14–5 11–3 10–3 10–3 11–3 11–3

Rough idling (poor idling)	1. Injector 2. Fuel line (Air bleed) 3. Compression 4. Valve clearance 5. ECM 6. Supply pump 7. Fuel pressure sensor 8. Diesel throttle	11–2 – 14–1 14–5 10–3 11–3 11–3 11–3
Hunting at hot engine (poor idling)	1. Injector 2. ECM power source circuit 3. Compression 4. Fuel line (Air bleed) 5. Valve clearance 6. ECM 7. Supply pump 8. Fuel pressure sensor 9. Diesel throttle	11–2 05–152 14–1 – 14–5 10–3 11–3 11–3 11–3
Hunting at cold engine (poor idling)	1. Injector 2. ECM power source circuit 3. Compression 4. Fuel line (Air bleed) 5. Valve clearance 6. ECM 7. Supply pump 8. Fuel pressure sensor 9. Diesel throttle	11–2 05–152 14–1 – 14–5 10–3 11–3 11–3 11–3
Hesitation/Poor acceleration (poor driveability)	1. Injector 2. Fuel filter 3. Compression 4. ECM 5. Supply pump 6. Fuel pressure sensor 7. Diesel throttle	11–2 – 14–1 10–3 11–3 11–3 11–3
Knocking (poor driveability)	1. Injector 2. ECM 3. Supply pump 4. Fuel pressure sensor	11–2 10–3 11–3 11–3
Black smoke (poor driveability)	1. Injector 2. ECM 3. Supply pump 4. Fuel pressure sensor 5. Diesel throttle	11–2 10–3 11–3 11–3 11–3
White smoke (poor driveability)	1. Injector 2. Fuel filter 3. ECM 4. Supply pump 5. Fuel pressure sensor 6. Diesel throttle	11–2 – 10–3 11–3 11–3 11–3
Surging/Hunting (poor driveability)	1. Injector 2. ECM 3. Supply pump 4. Fuel pressure sensor	11–2 10–3 11–3 11–3

054KK–22

TERMINALS OF ECM



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

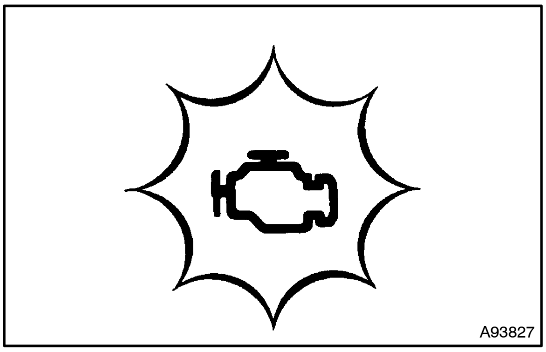
Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
BATT (E6–2) – E1 (E5–7)	L–O – BR	Battery (for measuring battery voltage and for ECM memory)	Constant	18 to 27 V
IGSW (E7–16) – E1 (E5–7)	GR – BR	Ignition switch	Ignition switch ON	18 to 27 V
+B (E7–1) – E1 (E5–7)	B–R – BR	Power source of ECM	Ignition switch ON	18 to 27 V
MREL (E7–13) – E1 (E5–7)	GR–G – BR	MAIN relay	Ignition switch ON	18 to 27 V
MREL (E7–13) – E1 (E5–7)	GR–G – BR	MAIN relay	5 seconds pass after ignition switch OFF	0 to 2 V
VC (E4–18) – E1 (E5–7)	L–R – BR	Power source of sensor (a specific voltage)	Ignition switch ON	4.5 to 5.5 V
VPA (E7–22) – EPA (E7–28)	BR–R – LG–B	Accelerator pedal position sensor (for engine control)	Ignition switch ON, accelerator pedal fully released	0.5 to 1.1 V
VPA (E7–22) – EPA (E7–28)	BR–R – LG–B	Accelerator pedal position sensor (for engine control)	Ignition switch ON, accelerator pedal fully depressed	3.0 to 4.6 V
VPA2 (E7–23) – EPA2 (E7–29)	R–W – GR–G	Accelerator pedal position sensor (for sensor malfunction detection)	Ignition switch ON, accelerator pedal fully released	0.9 to 2.3 V
VPA2 (E7–23) – EPA2 (E7–29)	R–W – GR–G	Accelerator pedal position sensor (for sensor malfunction detection)	Ignition switch ON, accelerator pedal fully depressed	3.4 to 5.0 V
VCPA (E7–20) – EPA (E7–28)	B–O – LG–B	Power source of accelerator pedal position sensor (for VPA)	Ignition switch ON	4.5 to 5.5 V
VCP2 (E7–21) – EPA2 (E7–29)	G–W – GR–G	Power source of accelerator pedal position sensor (for VPA2)	Ignition switch ON	4.5 to 5.5 V
VG (E5–24) – EVG (E5–32)	G – V–R	MAF meter	Engine is warmed up: Idling	1.8 to 2.6 V
THA (E4–31) – E2 (E4–28)	V–G – R–Y	IAT sensor (built in MAF meter)	Engine is warmed up: Idling, IAT at 0 to 80°C (32 to 176°F)	0.5 to 3.4 V

THIA (E4–20) – E2 (E4–28)	Y–R – R–Y	IAT sensor (after turbo-charged)	Engine is warmed up: Idling, IAT at 0 to 80°C (32 to 176°F)	0.5 to 3.4 V
THW (E4–19) – E2 (E4–28)	G–R – R–Y	ECT sensor	Idling, ECT at 80 to 120°C (176 to 248°F)	0.4 to 1.0 V
STA (E5–18) – E1 (E5–7)	B–W – BR	Starter signal	Cranking	6.0 V or more
#1 (E4–24) – E1 (E5–7) #2 (E4–23) – E1 (E5–7) #3 (E4–22) – E1 (E5–7) #4 (E4–21) – E1 (E5–7)	P–L – BR LG – BR LG–B – BR GR – BR	Injector	Engine is warmed up: Idling	Pulse generation (see page 05–98)
G+ (E5–23) – G– (E5–31)	R – G	Camshaft position sensor	Engine is warmed up: Idling	Pulse generation (see page 05–111)
NE+ (E4–27) – NE– (E4–34)	B – W	Crankshaft position sensor	Engine is warmed up: Idling	Pulse generation (see page 05–107)
STP (E7–18) – E1 (E5–7)	V – BR	Stop lamp switch	Ignition switch ON, brake pedal depressed	18 to 27 V
STP (E7–18) – E1 (E5–7)	V – BR	Stop lamp switch	Ignition switch ON, brake pedal released	0 to 2 V
ST1– (E7–8) – E1 (E5–7)	V–Y – BR	Stop lamp switch (opposite to STP)	Brake pedal depressed	0 to 2 V
ST1– (E7–8) – E1 (E5–7)	V–Y – BR	Stop lamp switch (opposite to STP)	Brake pedal released	18 to 27 V
TC (E7–17) – E1 (E5–7)	R–L – BR	Terminal TC of DLC3	Ignition switch ON	18 to 27 V
W (E7–9) – E1 (E5–7)	Y–R – BR	MIL	MIL illuminated	0 to 2 V
W (E7–9) – E1 (E5–7)	Y–R – BR	MIL	MIL not illuminated	18 to 27 V
SPD (E7–19) – E1 (E5–7)	R – BR	Speed signal from combination meter	Ignition switch ON, rotate driving wheel slowly	Pulse generation (see page 05–118)
SIL (E7–26) – E1 (E5–7)	W – BR	Terminal SIL of DLC3	Connect the hand–held tester to DLC3	Pulse generation
PIM (E5–28) – E2 (E4–28)	P–G – R–Y	Turbo pressure sensor (manifold absolute pressure sensor)	Applied negative pressure of 93 kPa (697 mmHg, 27.5 in.Hg)	0.25 to 0.4 V
PIM (E5–28) – E2 (E4–28)	P–G – R–Y	Turbo pressure sensor (manifold absolute pressure sensor)	Applied positive pressure of 150 kPa (1,128 mmHg, 44.2 in.Hg)	1.0 to 1.4 V
IREL (E7–14) – E1 (E5–7)	R – BR	EDU relay	Ignition switch OFF	18 to 27 V
IREL (E7–14) – E1 (E5–7)	R – BR	EDU relay	Idling	0 to 2 V
PCR1 (E4–26) – E2 (E4–28)	L–W – R–Y	Fuel pressure sensor	Idling (Approximately 30 MPa (306 kgf/cm^2, 4,351 psi))	1.7 to 2.2 V
PCR2 (E4–33) – E2 (E4–28)	L–B – R–Y	Fuel pressure sensor	Idling (Approximately 30 MPa (306 kgf/cm^2, 4,351 psi))	1.2 to 1.6 V
THF (E4–29) – E2 (E4–28)	Y – R–Y	Fuel temperature sensor	Ignition switch ON	1.2 to 1.6 V
PCV+ (E4–2) – PCV– (E4–1)	L – L–Y	Suction control valve	Idling	Pulse generation (see page 05–46)
INJF (E4–25) – E1 (E5–7)	B – BR	EDU	Idling	Pulse generation (see page 05–98)
VLU (E5–20) – E2 (E4–28)	Y–B – R–Y	Throttle position sensor	Accelerator pedal depressed	0.5 to 0.8 V
VLU (E5–20) – E2 (E4–28)	Y–B – R–Y	Throttle position sensor	Accelerator pedal released	2.5 to 3.0 V
VICM (E6–12) – E2 (E4–28)	W – R–Y	Throttle position switch	Ignition switch ON, throttle position switch ON	0.5 to 0.9 V
VICM (E6–12) – E2 (E4–28)	W – R–Y	Throttle position switch	Ignition switch ON, throttle position switch OFF	0 to 0.4 V
VICM (E6–12) – E2 (E4–28)	W – R–Y	Throttle position switch	Ignition switch ON, throttle position switch MAX	4.0 to 4.5 V
LUSL (E5–4) – E1 (E5–7)	W – BR	Throttle control motor duty signal	Accelerator pedal released → Accelerator pedal depressed (when throttle motor is operating)	Pulse generation (see page 05–115)

NUSW (E6–16) – E1 (E5–7)	B–W – BR	Neutral position switch	Ignition switch ON, shift position is neutral	18 to 27 V
NUSW (E6–16) – E1 (E5–7)	B–W – BR	Neutral position switch	Ignition switch ON, shift position is not neutral	0 to 2 V
CLSW (E6–9) – E1 (E5–7)	O – BR	Exhaust brake clutch switch	Clutch pedal depressed	0 to 2 V
CLSW (E6–9) – E1 (E5–7)	O – BR	Exhaust brake clutch switch	Clutch pedal released	18 to 27 V
EXSW (E6–13) – E1 (E5–7)	L – BR	Combination switch	Exhaust brake switch ON	18 to 27 V
EXSW (E6–13) – E1 (E5–7)	L – BR	Combination switch	Exhaust brake switch OFF	0 to 2 V
HSW (E6–11) – E1 (E5–7)	BR–W – BR	Warm up switch	Warm up switch ON	18 to 27 V
HSW (E6–11) – E1 (E5–7)	BR–W – BR	Warm up switch	Warm up switch OFF	0 to 2 V
VAP (E5–26) – E2P (E5–34)	B – R–Y	Accelerator position sensor	PTO Accelerator full close	0.7 to 1.0 V
VAP (E5–26) – E2P (E5–34)	B – R–Y	Accelerator position sensor	PTO Accelerator full open	3.3 to 3.9 V
VCP (E5–35) – E2P (E5–34)	L–R – R–Y	Accelerator position sensor	Ignition switch ON	4.5 to 5.5 V

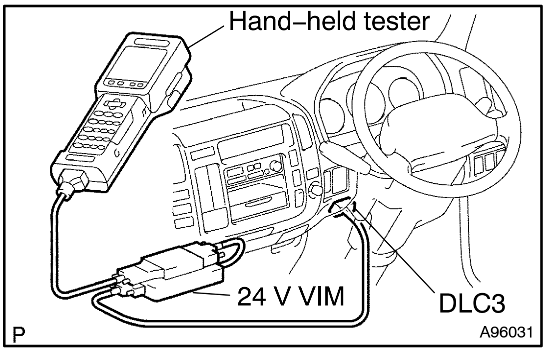
05I7I–02

DIAGNOSIS SYSTEM



1. DESCRIPTION

- When troubleshooting Multiplex OBD (M–OBD) vehicles, the vehicle must be connected to the hand–held tester. Various data output from the vehicle's Engine Control Module (ECM) can then be read.
- The vehicle's on–board computer illuminates the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition, the applicable Diagnostic Trouble Codes (DTCs) are recorded in the ECM memory (see page 05–38). If the malfunction does not reoccur, the MIL turns on until the ignition switch is turned OFF, and then the MIL turns off when the ignition switch is turned ON but the DTCs remain recorded in the ECM memory.



NOTICE:
Be sure to use the 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

- To check DTCs, connect the hand–held tester to the Data Link Connector 3 (DLC3) on the vehicle or read the DTC which is indicated on the multi–information display when TC and CG terminals on the DLC3 are connected. The hand–held tester also enables you to erase the DTCs and check the freeze frame data and various forms of engine data (see the instruction manual for the hand–held tester).

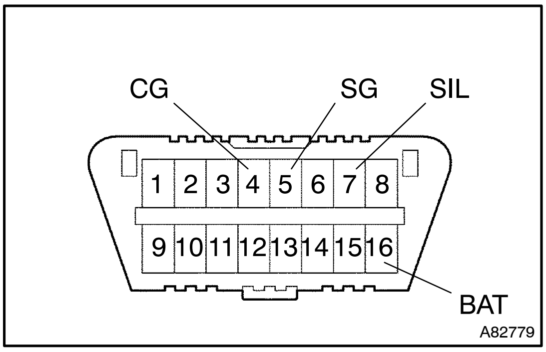
The diagnosis system operates in "normal mode" during normal vehicle use. In normal mode, "2 trip detection logic" is used to ensure accurate detection of malfunctions. A "check mode" is also available to technicians as an option. In check mode, "1–trip detection logic" is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent malfunctions (hand–held tester only).

2–TRIP DETECTION LOGIC

When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the ignition switch is turned OFF and then ON again, and the same malfunction is detected again, the MIL will illuminate (2nd trip).

FREEZE FRAME DATA

Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.



2. CHECK DLC3

The vehicle's ECM uses the ISO 9141–2 (Euro–OBD) communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031–03 and matches the ISO 9141–2 format.

HINT:

Connect the cable of the hand–held tester (with 24 V VIM) to the DLC3, turn the ignition switch ON and attempt to use the hand–held tester. If the screen displays "UNABLE TO CONNECT TO VEHICLE", a problem exists in the vehicle side or the tester side.

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

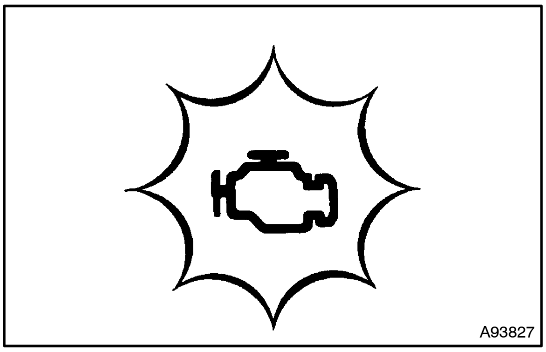
If communication is still impossible when the tester is connected to another vehicle, the problem is probably in the tester itself. Consult the Service Department listed in the tester's instruction manual.

Symbols (Terminals No.)	Terminal Description	Condition	Specified Condition
SIL (7) – SG (5)	Bus "+" line	During transmission	Pulse generation
CG (4) – Body ground	Chassis ground	Constant	Below 1 Ω
SG (5) – Body ground	Signal ground	Constant	Below 1 Ω
BAT (16) – Body ground	Battery positive	Constant	18 to 27 V

3. INSPECT BATTERY VOLTAGE

Battery voltage: 18 to 27 V

If voltage is below 18 V, recharge the battery before proceeding.



4. CHECK MIL

(a) The MIL illuminates when the ignition switch is turned ON and the engine is not running.

HINT:

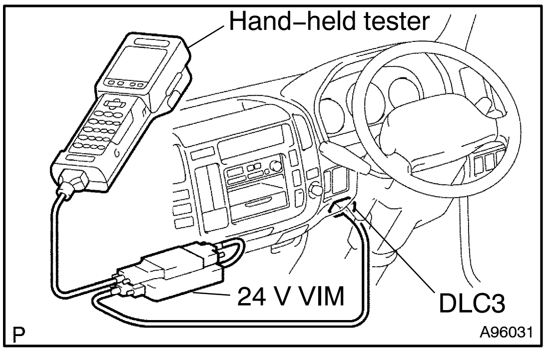
If the MIL does not illuminate, troubleshoot the MIL circuit (see page 05–163).

(b) When the engine is started, the MIL should turn off. If the lamp remains on, the diagnosis system has detected a malfunction or abnormality in the system.

05L1Y–01

DTC CHECK/CLEAR

NOTICE:
Hand–held tester only:
When the diagnosis system is changed from normal mode to check mode, all DTCs and freeze frame data recorded in normal mode will be erased. Before changing, always check and a note of DTCs and freeze frame data and make a note of them.



1. Using the hand–held tester: CHECK DTC

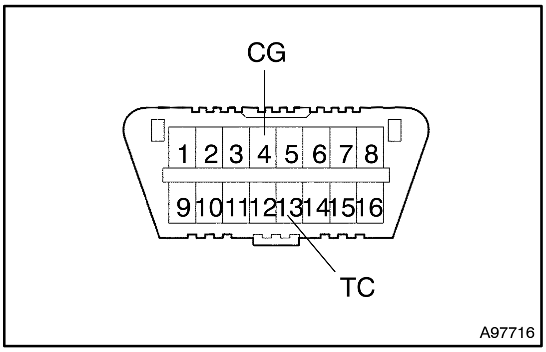
(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.

NOTICE:
Be sure to use the 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

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

(c) Use the hand–held tester to check the DTCs and freeze frame data and then write them down (see the instruction manual for the hand–held tester).

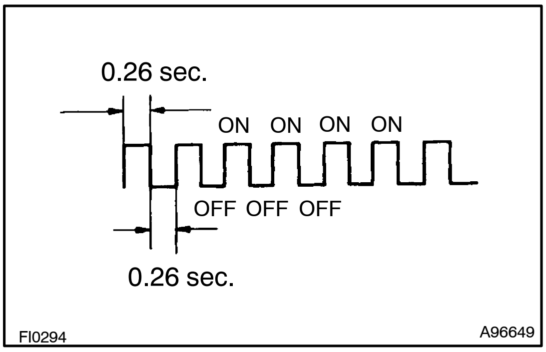
(d) See page 05–38 to confirm the details of the DTCs.



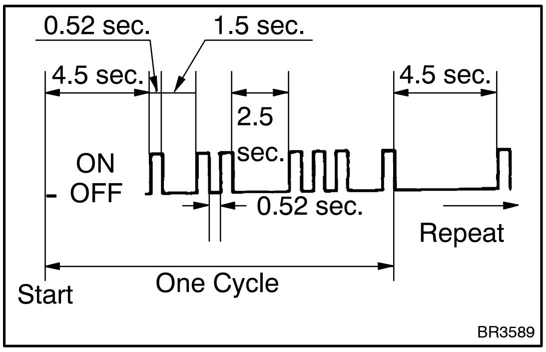
2. Not using the hand–held tester: CHECK DTC

(a) Turn the ignition switch ON.

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



(c) Read DTC by observing the MIL. If any DTC is not detected, the MIL blinks as shown in the illustration.



(d) Example
If DTCs 12 and 31 are detected, the MIL flashes once (for 0.52 seconds) and flashes twice after the 1.5 seconds interval, then flashes 3 times after a 2.5 seconds interval from the previous DTC and flashes once.
If the interval between the previous DTC and the next DTC is 4.5 seconds, it means the previous DTC is the last one of the multiple string DTCs. The MIL repeats the indication of DTCs from the initial cycle (refer to the illustration on the left).

(e) Check the details of the malfunction using the DTC chart on page 05–38.

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

HINT:
If 2 or more DTCs are detected, the MIL will illuminate the smaller number DTC first.

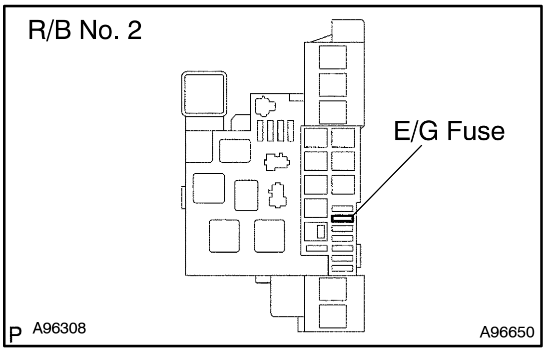
3. Using the hand–held tester: CLEAR DTC

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.

(b) Turn the ignition switch ON.

(c) Erase DTCs and freeze frame data with the hand–held tester (see the hand–held tester instruction manual for operating procedures).

4. Not using the hand–held tester: CLEAR DTC



(a) Disconnect the battery terminal or remove the E/G fuse from the R/B No. 2 for more than 60 seconds.

05L1Z–01

CHECK MODE PROCEDURE

HINT:

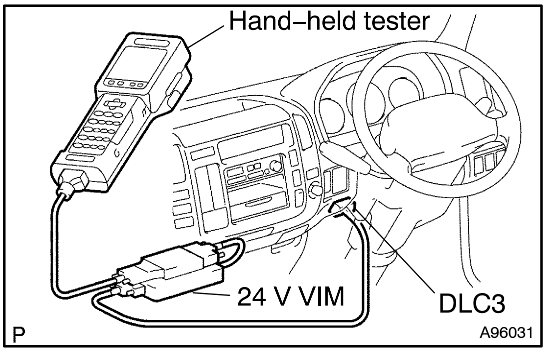
Hand–held tester only:

Check mode has a higher sensitivity to malfunctions and can detect malfunction that normal mode cannot detect. Check mode can also detect all the malfunctions that normal mode can detect.

1. **Using the hand–held tester: CHECK MODE PROCEDURE**

(a) Make sure that the items below are true:
- Battery positive voltage 18 V or more.
- Throttle valve (intake shutter) fully closed.
- Transmission in neutral.
- A/C switched OFF.

(b) Turn the ignition switch OFF.

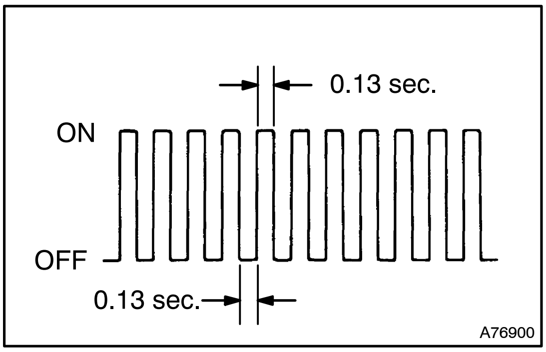


(c) Connect the hand–held tester (with 24 V VIM) to the DLC3.

NOTICE:

Be sure to use the 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

(d) Turn the ignition switch ON and turn the hand–held tester ON.



(e) Change the ECM to check mode with the hand–held tester. Make sure the MIL blinks at 0.13 second intervals as shown in the illustration.

NOTICE:

All DTCs and freeze frame data recorded will be erased if: 1) the hand–held tester is used to change the ECM from normal mode to check mode or vice–versa; or 2) during check mode, the ignition switch is turned from ON to ACC or OFF.

(f) Start the engine. The MIL should turn off after the engine starts.

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

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

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

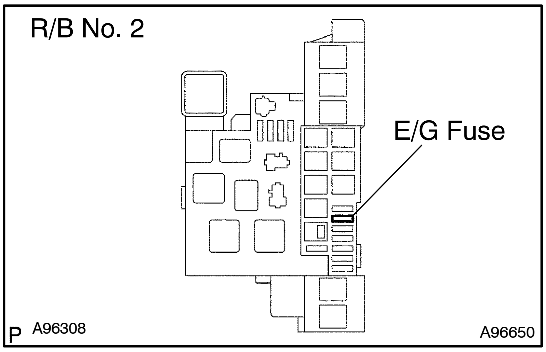
2. Using the hand–held tester: CLEAR DTC

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.

(b) Turn the ignition switch ON.

(c) Erase DTCs and freeze frame data with the hand–held tester (see the hand–held tester instruction manual for operating procedures).

3. Not using the hand–held tester: CLEAR DTC



(a) Disconnect the battery terminal or remove the E/G fuse from the R/B No. 2 for more than 60 seconds.

05DVX–04

FAIL–SAFE CHART

1. FAIL–SAFE CHART

If any of the following codes is recorded, the ECM enters fail–safe mode.

DTC No.	Detection Item	Fail–safe Operation	Fail–safe Deactivation Conditions
P0087/49	Fuel Rail/System Pressure – Too Low	Limits engine power	Ignition switch OFF
P0088/78	Fuel Rail/System Pressure – Too High	Limits engine power	Ignition switch OFF
P0093/78	Fuel System Leak Detected – Large Leak	Limits engine power	Ignition switch OFF
P0095/23	Intake Air Temperature Sensor 2 Circuit	Intake air (intake manifold) temperature is fixed at 90°C (194°F)	”Pass” condition detected
P0097/23	Intake Air Temperature Sensor 2 Circuit Low	Intake air (intake manifold) temperature is fixed at 90°C (194°F)	”Pass” condition detected
P0098/23	Intake Air Temperature Sensor 2 Circuit High	Intake air (intake manifold) temperature is fixed at 90°C (194°F)	”Pass” condition detected
P0100/31	Mass or Volume Air Flow Circuit	Limits engine power	”Pass” condition detected
P0102/31	Mass or Volume Air Flow Meter Circuit Low Input	Limits engine power	”Pass” condition detected
P0103/31	Mass or Volume Air Flow Meter Circuit High Input	Limits engine power	”Pass” condition detected
P0105/31	Manifold Absolute Pressure/Barometric Pressure Circuit	Intake air manifold pressure is fixed at 101.3 kPa (760 mmHg, 29.9 in.Hg)	”Pass” condition detected
P0107/31	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	Intake air manifold pressure is fixed at 101.3 kPa (760 mmHg, 29.9 in. Hg)	”Pass” condition detected
P0108/31	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	Intake air manifold pressure is fixed at 101.3 kPa (760 mmHg, 29.9 in.Hg)	”Pass” condition detected
P0110/24	Intake Air Temperature Circuit	Intake air temperature is fixed at 60°C (140°F) (built in MAF meter)	”Pass” condition detected
P0112/24	Intake Air Temperature Circuit Low Input	Intake air temperature is fixed at 60°C (140°F) (built in MAF meter)	”Pass” condition detected
P0113/24	Intake Air Temperature Circuit High Input	Intake air temperature is fixed at 60°C (140°F) (built in MAF meter)	”Pass” condition detected
P0115/22	Engine Coolant Temperature Circuit	• Fuel temperature is 15°C (59°F) or more: Value from fuel temperature sensor is substituted. • Fuel temperature is 15°C (59°F) or less: ECT is fixed at 80°C (176°F)	”Pass” condition detected
P0117/22	Engine Coolant Temperature Circuit Low Input	• Fuel temperature is 15°C (59°F) or more: Value from fuel temperature sensor is substituted. • Fuel temperature is 15°C (59°F) or less: ECT is fixed at 80°C (176°F)	”Pass” condition detected
P0118/22	Engine Coolant Temperature Circuit High Input	• Fuel temperature is 15°C (59°F) or more: Value from fuel temperature sensor is substituted. • Fuel temperature is 15°C (59°F) or less: ECT is fixed at 80°C (176°F)	”Pass” condition detected
P0120/41	Throttle/Pedal Position Sensor/Switch ”A” Circuit	Limits engine power	Ignition switch OFF
P0122/41	Throttle/Pedal Position Sensor/Switch ”A” Circuit Low Input	Limits engine power	Ignition switch OFF
P0123/41	Throttle/Pedal Position Sensor/Switch ”A” Circuit High Input	Limits engine power	Ignition switch OFF
P0168/39	Fuel Temperature Too High	Limits engine power	”Pass” condition detected
P0180/39	Fuel Temperature Sensor ”A” Circuit	Fuel temperature is fixed at 40°C (104°F)	”Pass” condition detected
P0182/39	Fuel Temperature Sensor ”A” Circuit Low Input	Fuel temperature is fixed at 40°C (104°F)	”Pass” condition detected
P0183/39	Fuel Temperature Sensor ”A” Circuit High Input	Fuel temperature is fixed at 40°C (104°F)	”Pass” condition detected

DTC No.	Detection Item	Fail–safe Operation	Fail–safe Deactivation Conditions
P0190/49	Fuel Rail Pressure Sensor Circuit	Limits engine power	”Pass” condition detected
P0191/49	Fuel Rail Pressure Sensor Circuit Range/Performance	Limits engine power	”Pass” condition detected
P0192/49	Fuel Rail Pressure Sensor Circuit Low Input	Limits engine power	”Pass” condition detected
P0193/49	Fuel Rail Pressure Sensor Circuit High Input	Limits engine power	”Pass” condition detected
P0200/97	Injector Circuit/Open	Limits engine power	Ignition switch OFF
P0335/13	Crankshaft Position Sensor ”A” Circuit	Limits engine power	”Pass” condition detected
P0488/15	Exhaust Gas Recirculation Throttle Position Control Range/Performance	Limits engine power	Ignition switch OFF
P0627/78	Fuel Pump Control Circuit / Open	Limits engine power	Ignition switch OFF
P1229/78	Fuel Pump System	Limits engine power	Ignition switch OFF
P1611/17	IC Circuit Malfunction	Limits engine power	Ignition switch OFF
P1674/17	Solenoid for Exhaust Brake Circuit Malfunction	Exhaust brake stop operation	”Pass” condition detected
P2120/19	Throttle/Pedal Position Sensor/Switch ”D” Circuit	Limits engine power	”Pass” condition detected
P2121/19	Throttle/Pedal Position Sensor/Switch ”D” Circuit Range/Performance	Limits engine power	”Pass” condition detected
P2122/19	Throttle/Pedal Position Sensor/Switch ”D” Circuit Low Input	Limits engine power	”Pass” condition detected
P2123/19	Throttle/Pedal Position Sensor/Switch ”D” Circuit High Input	Limits engine power	”Pass” condition detected
P2125/19	Throttle/Pedal Position Sensor/Switch ”E” Circuit	Limits engine power	”Pass” condition detected
P2127/19	Throttle/Pedal Position Sensor/Switch ”E” Circuit Low Input	Limits engine power	”Pass” condition detected
P2128/19	Throttle/Pedal Position Sensor/Switch ”E” Circuit High Input	Limits engine power	”Pass” condition detected
P2138/19	Throttle/Pedal Position Sensor/Switch ”D”/”E” Voltage Correlation	Limits engine power	”Pass” condition detected
P2226/A5	Barometric Pressure Circuit	Atmospheric pressure is fixed at 101.3 kPa (760 mmHg, 29.9 in.Hg)	”Pass” condition detected
P2228/A5	Barometric Pressure Circuit Low Input	Atmospheric pressure is fixed at 101.3 kPa (760 mmHg, 29.9 in.Hg)	”Pass” condition detected
P2229/A5	Barometric Pressure Circuit High Input	Atmospheric pressure is fixed at 101.3 kPa (760 mmHg, 29.9 in.Hg)	”Pass” condition detected

05DVU–04

DATA LIST/ACTIVE TEST

1. DATA LIST

HINT:

Using the hand–held tester is DATA LIST allows switch, sensor, actuator and other item values to be read without removing any parts. Reading DATA LIST early in troubleshooting is one way to save time.

NOTICE:

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

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(d) Turn the ignition switch ON.
(e) Turn the hand–held tester ON.
(f) Enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST.
(g) Read the DATA LIST on the tester's screen.

Hand–held Tester Display	Measurement Item/Range (Display)	Normal Condition *	Diagnostic Note
INJ VOLUME	Injection volume/ Min.: 0 mm^3, Max.: 1280 mm^3	Idling: 5 to 15 mm^3	—
INJ TIMING	Injection timing/ Min.: – 90°CA , Max.: 90°CA	• Idling: 0°CA • Running without load (3,000 rpm): – 8 to – 6°CA	—
ENGINE SPD	Engine speed/ Min.: 0 rpm, Max.: 16383.75 rpm	Idling: 600 to 700 rpm	—
MAF	Air flow rate from MAF meter status/ Min.: 0 gm/s, Max.: 655.35 gm/s	• Idling: 5 to 20 gm/s • Running without load (3,000 rpm): 50 to 70 gm/s	If value is approximately 0.0 gm/s: • Mass air flow meter power source circuit open • VG circuit open or short If value is 160 gm/s or more: • E2G circuit open
PIM	Absolute pressure inside intake manifold/ Min.: 0 kPa, Max.: 255 kPa	Ignition switch ON: Same as atmospheric pressure	Engine is not running
COOLANT TEMP	Engine coolant temperature/ Min.: – 40°C, Max.: 215°C	After warming up: 80 to 100°C (176 to 212°F)	If value is "– 40°C (– 40°F)" or "140°C (284°F) or more", sensor circuit is open or shorted
FUEL TEMP	Fuel temperature status/ Min.: – 40°C, Max.: 215°C	Actual fuel temperature	If value is "– 40°C (– 40°F)" or "140°C (284°F) or more", sensor circuit is open or shorted
ACCEL POSITION	Accel position status/ Min.: 0 %, Max.: 100 %	• Accelerator pedal released: 15 to 17 % • Accelerator pedal depressed: 68 to 74 %	Read value with ignition switch ON (do not start engine)
VEHICLE SPD	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Actual vehicle speed	Speed indicated on speedometer
THROTTLE POS	Throttle position sensor status/ Min.: – 20 %, Max.: 120 %	• Idling: 60 to 80 % • Running without load (2,000 rpm): 0 to 5 %	—
PTO SW	Throttle position switch assy/ Min.: 0 V, Max.: 5 V	When operating PTO: 0.6 to 3.7 V	VAP voltage (throttle position switch assy)

Hand–held Tester Display	Measurement Item/Range (Display)	Normal Condition *	Diagnostic Note
COMN RAIL PRESS	Common rail pressure status/ Min.: 0 MPa, Max.: 255 MPa	• Idling: 25 to 35 MPa (255 kgf/cm^2 (3,625 psi) to 357 kgf/cm^2 (5,076 psi)) • Engine running at 3,000 rpm: 80 to 90 MPa (816 kgf/cm^2 (11,602 psi) to 918 kgf/cm^2 (13,053 psi))	—
COMN RAIL PRESS 2	Common rail pressure status/ Min.: 0 MPa, Max.: 255 MPa	• Idling: 25 to 35 MPa (255 kgf/cm^2 (3,625 psi) to 357 kgf/cm^2 (5,076 psi)) • Engine running at 3,000 rpm: 80 to 90 MPa (816 kgf/cm^2 (11,602 psi) to 918 kgf/cm^2 (13,053 psi))	—
AMBI TEMP SENS	Ambient temperature sensor status/ Min.: –40°C, Max.: 215°C	Actual atmospheric air temperature	If value is ”– 40°C (– 40°F)” or ”140°C (284°F) or more”, sensor circuit is open or shorted
INJ VOL FB #1	Injection volume correction for cylinder 1/ Min.: – 20 mm^3, Max.: 20 mm^3	Idling: – 2.0 to 2.0 mm^3	—
INJ VOL FB #2	Injection volume correction for cylinder 2/ Min.: – 20 mm^3, Max.: 20 mm^3	Idling: – 2.0 to 2.0 mm^3	—
INJ VOL FB #3	Injection volume correction for cylinder 3/ Min.: – 20 mm^3, Max.: 20 mm^3	Idling: – 2.0 to 2.0 mm^3	—
INJ VOL FB #4	Injection volume correction for cylinder 4/ Min.: – 20 mm^3, Max.: 20 mm^3	Idling: – 2.0 to 2.0 mm^3	—
M–INJ/PILOT ON	Main injection time at pilot–injection ON/ Min.: 0 µs Max.: 65,535 µs	Idling: 750 to 850 µs	—
M–INJ/PILOT OFF	Injection time at pilot–injection OFF/ Min.: 0 µs Max.: 65,535 µs	Running without load (3,000 rpm): 650 to 750 µs	—
PILOT–INJ	Sub–Injection time at pilot–injection ON/ Min.: 0 µs, Max.: 65,535 µs	Idling: 500 to 600 µs	—
STOP LIGHT SW	Stop lamp switch/ ON or OFF	• Brake pedal depressed: ON • Brake pedal released: OFF	—
STARTER SIG	Starter signal/ ON or OFF	Cranking: ON	—
CHECK MODE	Check mode/ ON or OFF	Check mode ON: ON	—
A/C SIG	A/C switch/ ON or OFF	A/C switch ON: ON	—
THROTTLE KNOB	Throttle knob voltage/ Min.: 0 V, Max.: 5 V	• Switch angle 20°: 0.5 to 0.9 V • Switch angle 300°: 4.0 to 4.5 V	—
E/G OVER RUN FLAG	Engine overrun history/ ON or OFF	Status: OFF	—
WATER IN FLAG	Water sucked in malfunction history/ ON or OFF	Status: OFF	—

HINT:
*: If no conditions are specifically stated for ”Idling”, the A/C switch is OFF and all accessory switches are OFF.

2. ACTIVE TEST

HINT:

Performing the hand–held tester's ACTIVE TEST allows relay, VSV, actuator and other items to be operated without removing any parts. Performing the ACTIVE TEST early in trouble shooting is one way to save time. The DATA LIST can be displayed during the ACTIVE TEST.

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the hand–held tester ON.
(d) Enter the following menus: DIAGNOSIS / OBD/MOBD / ACTIVE TEST.
(e) According to the display on the tester, perform the ACTIVE TEST.

Hand–held Tester Display	Test Details	Diagnostic Note
TC/TE1	Same condition as the connection of TC and TE1 ON or OFF	—
INJECTION VOLUME	Injection Volume – 25 to 24.8 %	—
FUEL LEAK TEST	Maintain the engine speed at 2,000 rpm, and pressurize the common rail internal fuel pressure to 175 MPa (1,784.5 kgf/cm^2, 25,380 psi) ON or OFF	Confirm that there is no leak in the fuel system when the common rail internal fuel pressure is pressurized high
INJECTOR CUT #1	Stop injection of Injector No. 1 ON or OFF	—
INJECTOR CUT #2	Stop injection of Injector No. 2 ON or OFF	—
INJECTOR CUT #3	Stop injection of Injector No. 3 ON or OFF	—
INJECTOR CUT #4	Stop injection of Injector No. 4 ON or OFF	—

DIAGNOSTIC TROUBLE CODE CHART

HINT:
Parameters listed in the chart may be different from your readings depending on the type of instrument used and other factors.
During the DTC check, refer to the table below if a malfunction code is displayed. For details about each code, refer to the page number in the DTC chart's left column.

DTC No. (See Page)	Detection Item	Trouble Area	*1 MIL	Memory
P0087/49 (05–42)	Fuel Rail/System Pressure – Too Low	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM	○	○
P0088/78 (05–46)	Fuel Rail/System Pressure – Too High	• Supply pump (suction control valve) • Open or short in supply pump (suction control valve) circuit • Common rail • ECM	○	○
P0093/78 (05–50)	Fuel System Leak Detected – Large Leak	• Fuel leak (supply pump – common rail – injector) • Injector	○	○
P0095/23 (05–52)	Intake Air Temperature Sensor 2 Circuit	• Open or short in IAT sensor circuit • IAT sensor (after turbocharged) • ECM	○	○
P0097/23 (05–52)	Intake Air Temperature Sensor 2 Circuit Low	• Open or short in IAT sensor circuit • IAT sensor (after turbocharged) • ECM	○	○
P0098/23 (05–52)	Intake Air Temperature Sensor 2 Circuit High	• Open or short in IAT sensor circuit • IAT sensor (after turbocharged) • ECM	○	○
P0100/31 (05–59)	Mass or Volume Air Flow Circuit	• Open or short in MAF meter circuit • MAF meter • Voltage converter • ECM	○	○
P0102/31 (05–59)	Mass or Volume Air Flow Meter Circuit Low Input	• Open or short in MAF meter circuit • MAF meter • Voltage converter • ECM	○	○
P0103/31 (05–59)	Mass or Volume Air Flow Meter Circuit High Input	• Open or short in MAF meter circuit • MAF meter • Voltage converter • ECM	○	○
P0105/31 (05–68)	Manifold Absolute Pressure/ Barometric Pressure Circuit	• Open or short in turbo pressure sensor (manifold absolute pressure sensor) circuit • Turbo pressure sensor (manifold absolute pressure sensor) • ECM	○	○
P0107/31 (05–68)	Manifold Absolute Pressure/ Barometric Pressure Circuit Low Input	• Open or short in turbo pressure sensor (manifold absolute pressure sensor) circuit • Turbo pressure sensor (manifold turbo pressure sensor) • ECM	○	○
P0108/31 (05–68)	Manifold Absolute Pressure/ Barometric Pressure Circuit High Input	• Open or short in turbo pressure sensor (manifold absolute pressure sensor) circuit • Turbo pressure sensor (manifold absolute pressure sensor) • ECM	○	○
P0110/24 (05–74)	Intake Air Temperature Circuit	• Open or short in IAT sensor circuit • IAT sensor (built in MAF meter) • ECM	○	○
P0112/24 (05–74)	Intake Air Temperature Circuit Low Input	• Open or short in IAT sensor circuit • IAT sensor (built in MAF meter) • ECM	○	○

P0113/24 (05–74)	Intake Air Temperature Circuit High Input	• Open or short in IAT sensor circuit • IAT sensor (built in MAF meter) • ECM	○	○
P0115/22 (05–80)	Engine Coolant Temperature Circuit	• Open or short in ECT sensor circuit • ECT sensor • ECM	○	○
P0117/22 (05–80)	Engine Coolant Temperature Circuit Low Input	• Open or short in ECT sensor circuit • ECT sensor • ECM	○	○
P0118/22 (05–80)	Engine Coolant Temperature Circuit High Input	• Open or short in ECT sensor circuit • ECT sensor • ECM	○	○
P0120/41 (05–86)	Throttle/Pedal Position Sensor/ Switch "A" Circuit	• Open or short in throttle position sensor circuit • Throttle position sensor • ECM	○	○
P0122/41 (05–86)	Throttle/Pedal Position Sensor/ Switch "A" Circuit Low Input	• Open or short in throttle position sensor circuit • Throttle position sensor • ECM	○	○
P0123/41 (05–86)	Throttle/Pedal Position Sensor/ Switch "A" Circuit High Input	• Open or short in throttle position sensor circuit • Throttle position sensor • ECM	○	○
P0168/39 (05–92)	Fuel Temperature Too High	• Open or short in fuel temperature sensor circuit • Fuel temperature sensor • ECM	○	○
P0180/39 (05–92)	Fuel Temperature Sensor "A" Circuit	• Open or short or short in fuel temperature sensor circuit • Fuel temperature sensor • ECM	○	○
P0182/39 (05–92)	Fuel Temperature Sensor "A" Circuit Low Input	• Open or short in fuel temperature sensor circuit • Fuel temperature sensor • ECM	○	○
P0183/39 (05–92)	Fuel Temperature Sensor "A" Circuit High Input	• Open or short in fuel temperature sensor circuit • Fuel temperature sensor • ECM	○	○
P0190/49 (05–42)	Fuel Rail Pressure Sensor Circuit	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM	○	○
P0191/49 (05–42)	Fuel Rail Pressure Sensor Circuit Range/Performance	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM	○	○
P0192/49 (05–42)	Fuel Rail Pressure Sensor Circuit Low Input	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM	○	○
P0193/49 (05–42)	Fuel Rail Pressure Sensor Circuit High Input	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM	○	○
P0200/97 (05–98)	Injector Circuit / Open	• Open or short in EDU circuit • Injector • EDU • ECM	○	○
P0263/78 (05–103)	Cylinder 1 Contribution/Balance	• Open or short in EDU circuit • Injector • EDU	—	○
P0266/78 (05–103)	Cylinder 2 Contribution/Balance	• Open or short in EDU circuit • Injector • EDU	—	○
P0269/78 (05–103)	Cylinder 3 Contribution/Balance	• Open or short in EDU circuit • Injector • EDU	—	○

P0272/78 (05–103)	Cylinder 4 Contribution/Balance	• Open or short in EDU circuit • Injector • EDU	—	○
P0335/12 (05–107)	Crankshaft Position Sensor ”A” Circuit	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Crankshaft position sensor plate • ECM	○	○
P0339/13 (05–107)	Crankshaft Position Sensor ”A” Circuit Intermittent	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Crankshaft position sensor plate • ECM	—	○
P0340/12 (05–111)	Camshaft Position Sensor ”A” Circuit (Bank 1 or Single Sensor)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft drive gear • ECM	○	○
P0488/15 (05–115)	Exhaust Gas Recirculation Throttle Position Control Range/ Performance	• Open or short in throttle control motor circuit • Throttle control motor • ECM	○	○
P0500/42 (05–118)	Vehicle Speed Sensor ”A”	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • Combination meter • ECM	○	○
P0504/51 (05–121)	Brake Switch ”A”/”B” Correlation	• Open or short in stop lamp switch signal circuit • Stop lamp switch • ECM	—	○
P0627/78 (05–46)	Fuel Pump Control Circuit / Open	• Supply pump (suction control valve) • Open or short in supply pump (suction control valve) circuit • Common rail • ECM	○	○
P1133 (05–127)	Accelerator Position Sensor Circuit High	• Short in accelerator position sensor circuit • Accelerator position sensor • ECM	—	○
P1143/19 (05–132)	Idle Variable Resistor Switch Circuit Malfunction (Short)	• Short in idle variable resistor switch circuit • Idle variable resistor switch • ECM	—	○
P1229/78 (05–46)	Fuel Pump System	• Supply pump (suction control valve) • Open or short in supply pump (suction control valve) circuit • Common rail • ECM	○	○
P1601/89 (05–138)	Injector Correction Circuit Malfunction (EEPROM)	• Injector compensation code • ECM	○	○
P1611/17 (05–139)	Run Pulse Malfunction	• ECM	○	○
P1674/36 (05–140)	Solenoid for Exhaust Brake Circuit Malfunction	• Open or short exhaust brake solenoid circuit • Exhaust brake solenoid • ECM	○	○
P2120/19 (05–143)	Throttle/Pedal Position Sensor/ Switch ”D” Circuit	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM	○	○
P2121/19 (05–143)	Throttle/Pedal Position Sensor/ Switch ”D” Circuit Range/Performance	• Accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM	○	○
P2122/19 (05–143)	Throttle/Pedal Position Sensor/ Switch ”D” Circuit Low Input	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM	○	○
P2123/19 (05–143)	Throttle/Pedal Position Sensor/ Switch ”D” Circuit High Input	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM	○	○

P2125/19 (05–143)	Throttle/Pedal Position Sensor/ Switch ”E” Circuit	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM	○	○
P2127/19 (05–143)	Throttle/Pedal Position Sensor/ Switch ”E” Circuit Low Input	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM	○	○
P2128/19 (05–143)	Throttle/Pedal Position Sensor/ Switch ”E” Circuit High Input	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM	○	○
P2138/19 (05–143)	Throttle/Pedal Position Sensor/ Switch ”D”/”E” Voltage Correlation	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM	○	○
P2226/A5*2 (05–151)	Barometric Pressure Circuit	• ECM	○	○
P2228/A5*2 (05–151)	Barometric Pressure Circuit Low Input	• ECM	○	○
P2229/A5*2 (05–151)	Barometric Pressure Circuit High Input	• ECM	○	○

HINT:
*1: Check that the MIL is illuminated.
*2: ”A” in the above table indicates that the MIL flashes 10 times.

DTC	P0087/49	FUEL RAIL/SYSTEM PRESSURE – TOO LOW

DTC	P0190/49	FUEL RAIL PRESSURE SENSOR CIRCUIT

DTC	P0191/49	FUEL RAIL PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE

DTC	P0192/49	FUEL RAIL PRESSURE SENSOR CIRCUIT LOW INPUT

DTC	P0193/49	FUEL RAIL PRESSURE SENSOR CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

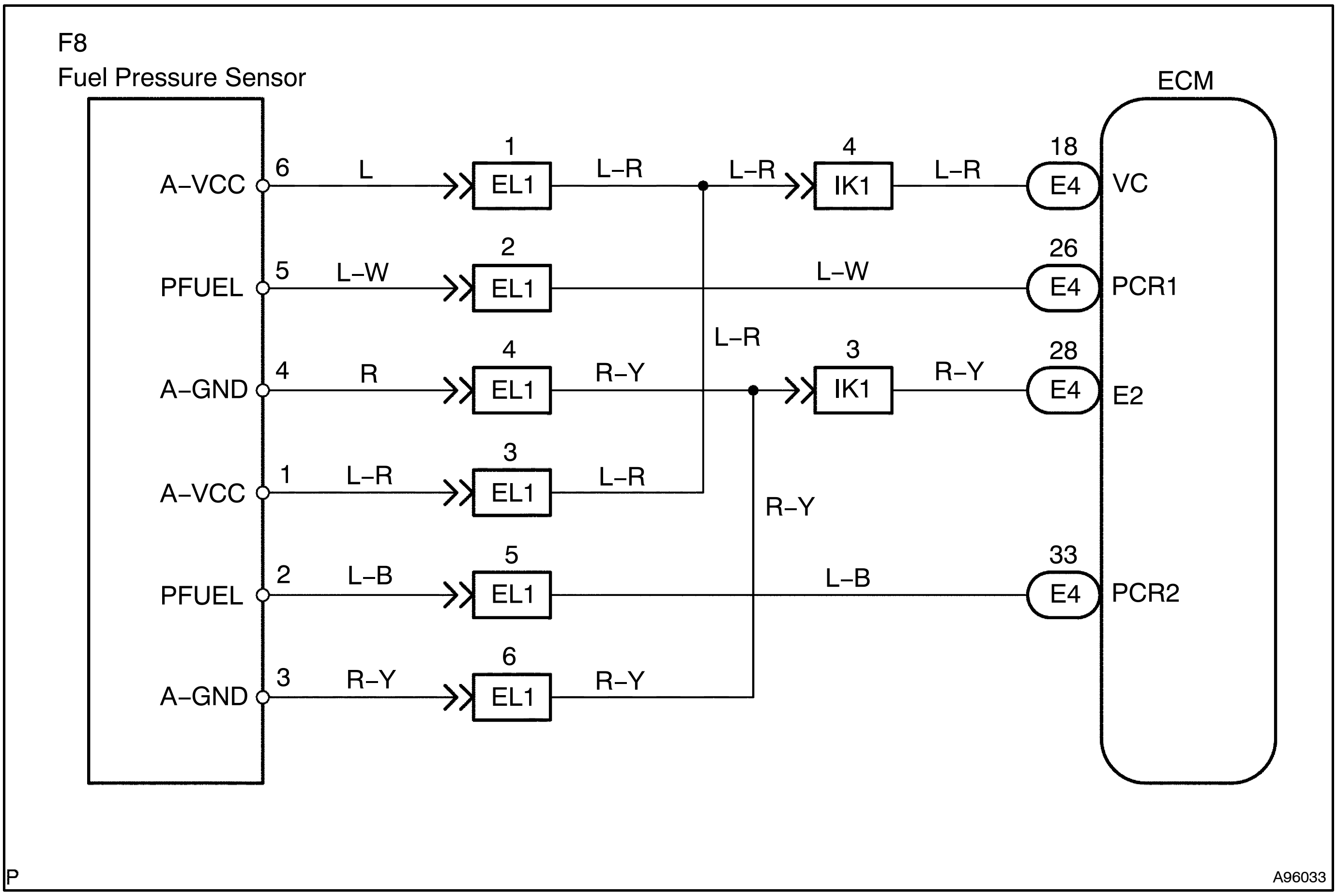
The fuel pressure sensor, mounted on the common rail, converts the fuel pressure into an electric signal and outputs the signal to the ECM.
Based on the signal from the fuel pressure sensor, the ECM controls the injection (supply) pump (suction control valve) and keeps the internal fuel pressure of the common rail at the target fuel pressure.

DTC No.	DTC Detection Condition	Trouble Area
P0087/49	Conditions (a), (b)and (c) continue 10 times with engine speed 600 rpm or more: (a) Battery voltage: 16 V or more (b) Fuel quantify: 5 mm^3/st or more (c) Amount of change in fuel pressure applied to common rail: 0.1MPa or less	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM
P0190/49	Conditions (a) and (b) continue for 1 second or more: (a) Ignition switch ON (b) Open or short in fuel pressure sensor circuit	Same as DTC No. P0087/49
P0191/49	Conditions (a) and (b) continue for 1 second or more: (a) Ignition switch ON (b) Fuel pressure sensor out of range	Same as DTC No. P0087/49
P0192/49	Condition (a) continues for 1 second: (a) Fuel pressure sensor output voltage is 0.55 V or less	Same as DTC No. P0087/49
P0193/49	Condition (a) continues for 1 second: (a) Fuel pressure sensor output voltage is 4.9 V or more	Same as DTC No. P0087/49

HINT:
- If the vehicle runs out of fuel, the ECM determines the fuel pressure has decreased, and DTC P0192/49 may be output.
- After confirming DTC P0087/49, P0190/49, P0191/49, P0192/49 and P0193/49, use the hand–held tester to confirm the internal fuel pressure of the common rail from the COMMON RAIL menu (to reach the COMMON RAIL menu: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / COMN RAIL).

Fuel Pressure	Malfunction
Approx. 0 MPa (0 kg/cm^2, 0 psi) or more	• Short in PCR and E2 circuit • Open in VC circuit
Approx. 190 MPa (1,937 kg/cm^2, 27,556 psi) or more	• Short in PCR and VC circuit • Open in PCR circuit • Open in E2 circuit

WIRING DIAGRAM

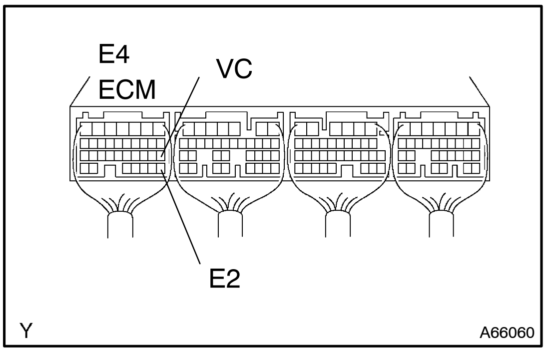


INSPECTION PROCEDURE

HINT:

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

1 CHECK ECM (VC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.

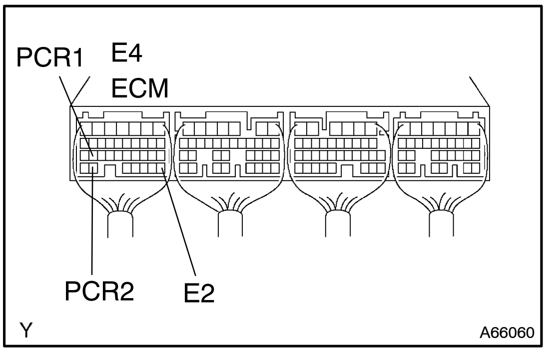
Standard:

Tester Connection	Specified Condition
E4–18 (VC) – E4–28 (E2)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–10)**

OK

2 CHECK ECM (PCR VOLTAGE)



(a) Start the engine.
(b) Measure the voltage of the ECM connector.

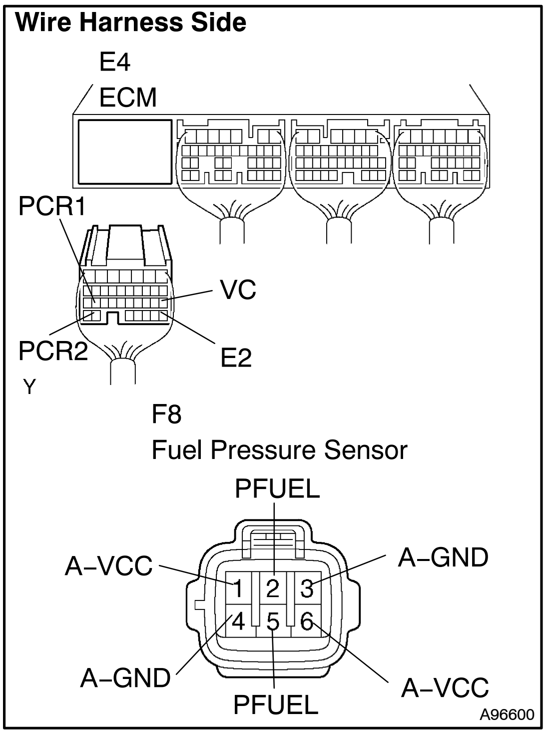
Standard:

Tester Connection	Condition	Specified Condition
E4–26 (PCR1) – E4–28 (E2)	Engine is idling	1.7 to 2.2 V
E4–33 (PCR2) – E4–28 (E2)	Engine is idling	1.2 to 1.6 V

OK → **REPLACE ECM (See page 10–10)**

NG

3 CHECK WIRE HARNESS (FUEL PRESSURE SENSOR – ECM)



(a) Disconnect the E4 ECM connector.
(b) Disconnect the F8 fuel pressure sensor connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
E4–26 (PCR1) – F8–5 (PFUEL) E4–33 (PCR2) – F8–2 (PFUEL) E4–18 (VC) – F8–6 (A–VCC) E4–18 (VC) – F8–1 (A–VCC) E4–28 (E2) – F8–4 (A–GND) E4–28 (E2) – F8–3 (A–GND)	Below 1 Ω
E4–26 (PCR1) or F8–5 (RFUEL) – Body ground E4–33 (PCR2) or F8–2 (PFUEL) – Body ground E4–18 (VC) or F8–6 (A–VCC) – Body ground E4–18 (VC) or F8–1 (A–VCC) – Body ground E4–28 (E2) or F8–4 (A–GND) – Body ground E4–28 (E2) or F8–3 (A–GND) – Body ground	10 kΩ or higher

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

OK

REPLACE COMMON RAIL ASSY (FUEL PRESSURE SENSOR) (See page 11–15)

DTC	P0088/78	FUEL RAIL/SYSTEM PRESSURE – TOO HIGH

DTC	P0627/78	FUEL PUMP CONTROL CIRCUIT / OPEN

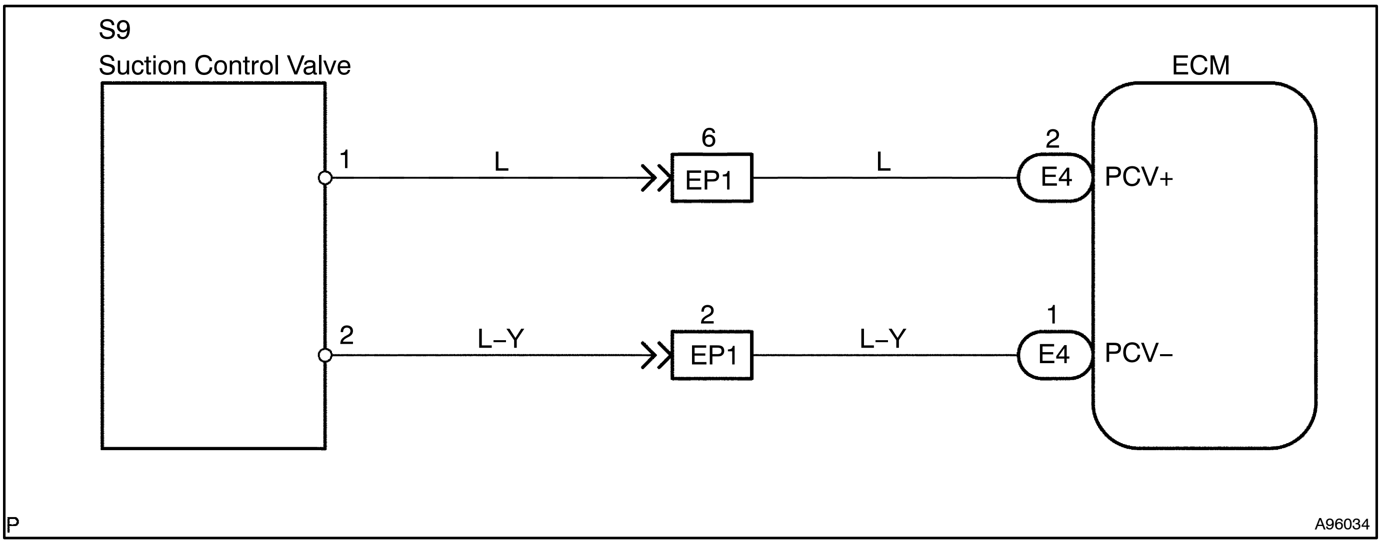
DTC	P1229/78	FUEL PUMP SYSTEM

CIRCUIT DESCRIPTION

The injection (supply) pump is single–type pump and has a circuit for fuel suction that achieves high pressure force feed and reduction of driving torque, and for force feed process. The ECM controls the suction control valve, which operates fuel suction by the plunger in the process of suction.
When the internal fuel pressure of the common rail exceeds the target pressure, the pressure limiter on the common rail starts operating to control the internal fuel pressure of the common rail.

DTC No.	DTC Detection Condition	Trouble Area
P0088/78	Conditions (a) and (b) continue 2 times or more: (a) Ignition switch ON (b) Internal fuel pressure of the common rail: 180 MPa (1,835 kg/cm^2, 25,106 psi) or more	• Supply pump (suction control valve) • Open or short in supply pump (suction control valve) circuit • Common rail • ECM
P0627/78	Open or short in suction control valve circuit for more than 0.5 seconds	Same as DTC No. P0088/78
P1229/78	Fuel over–feed: Internal fuel pressure is beyond target fuel pressure despite ECM closing suction control valve	Same as DTC No. P0088/78

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK OTHER DTC OUTPUT

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DTC INFO / CURRENT CODES.
(d) Read DTCs.

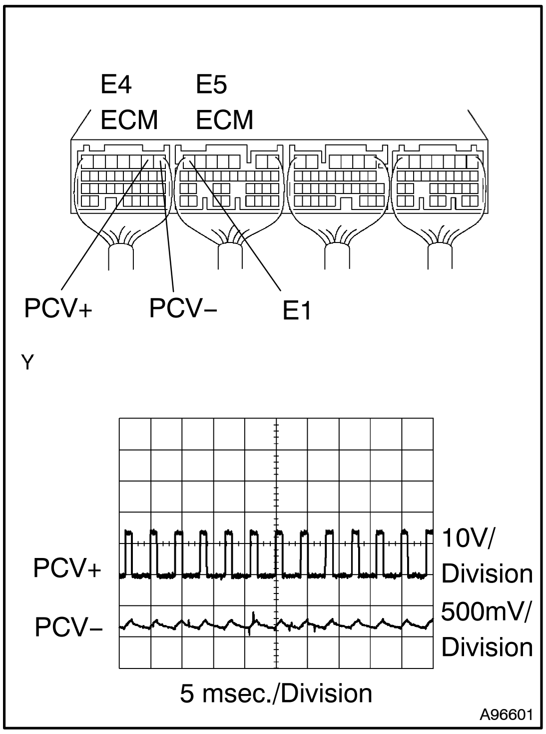
Result:

Display (DTC output)	Proceed to
P0180/39, P0182/39, P0183/39, P190/49, P191/49, P192/49, P193/49 or P0200/97 is not output	A
P0180/39, P0182/39, P0183/39, P190/49, P191/49, P192/49, P193/49 or P0200/97 is output	B

B → **Go to RELEVANT DTC CHART (See page 05–38)**

A

2 CHECK ECM



(a) Inspect using an oscilloscope.
(1) While the engine is cranking or idling, check the waveforms between the specified terminals of the E4 and E5 ECM connectors.

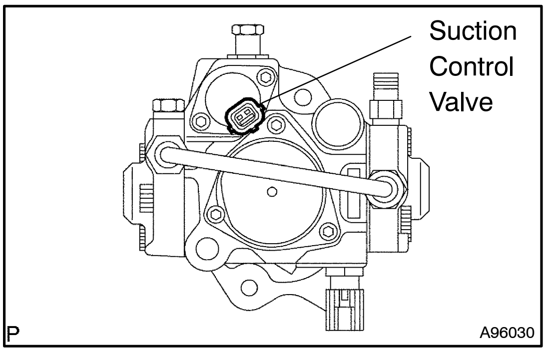
Standard:

Tester Connection	Specified Condition
E4–2 (PCV+) – E5–7 (E1) E4–1 (PCV–) – E5–7 (E1)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10–10)**

OK

3 INSPECT SUPPLY PUMP ASSY (SUCTION CONTROL VALVE)

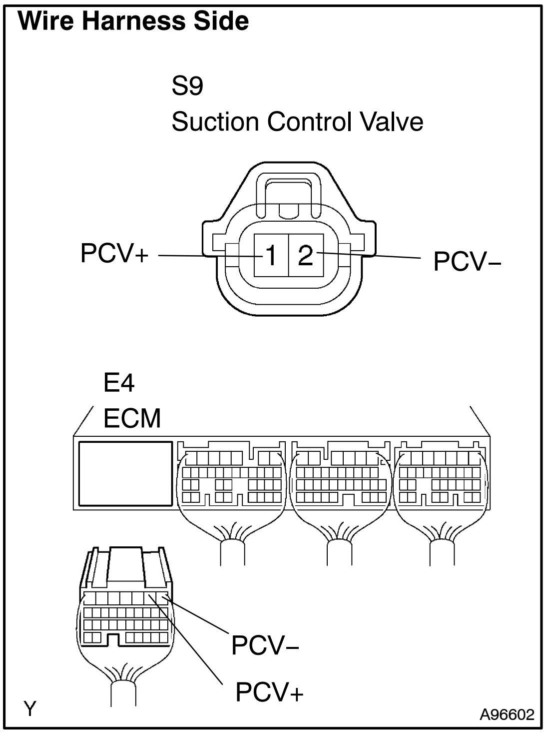


(a) Measure the resistance of the suction control valve.
Standard: 7.5 to 8.1 Ω at 20°C (68°F)

NG → **REPLACE SUPPLY PUMP ASSY (SUCTION CONTROL VALVE) (See page 11–10)**

OK

4 CHECK WIRE HARNESS (SUCTION CONTROL VALVE – ECM)



(a) Disconnect the S9 suction control valve connector.
(b) Disconnect the E4 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
S9–1 (PCV+) – E4–2 (PCV+) S9–2 (PCV–) – E4–1 (PCV–)	Below 1 Ω
S9–1 (PCV+) or E4–2 (PCV+) – Body ground S9–2 (PCV–) or E4–1 (PCV–) – Body ground	10 kΩ or higher

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

OK

5 REPLACE COMMON RAIL ASSY (See page 11–15)

GO

6 CHECK DTC OUTPUT

(a) Read the DTCs using the hand–held tester.

Result:

Display (DTC output)	Proceed to
P0088/87, P0627/78 or P1229/78 is output	A
P0088/87, P0627/78 or P1229/78 is not output	B

B → **SYSTEM IS OK**

A ↓

REPLACE SUPPLY PUMP ASSY (See page 11–10)

DTC	P0093/78	FUEL SYSTEM LEAK DETECTED – LARGE LEAK

CIRCUIT DESCRIPTION

Refer to DTC P0087/48 on page 05–42.
Refer to DTC P0088/78 on page 05–46.

DTC No.	DTC Detection Condition	Trouble Area
P0093/78	DTC is output when following conditions (a), (b) and (c) are all met and if difference of common rail pressure that fuel pressure sensor detects before and after fuel injection varies greatly from difference of value that ECM calculates before and after fuel injection, ECM determines that there may be fuel leaks. (a) Engine RPM is 1,500 rpm or higher. (b) Fuel pressure sensor is normal (P0190/49, P0191/49, P0192/49, and P0193/49 are not detected) (c) Suction control valve is normal (P0088/78, P0627/78 and P1229/78 are not detected)	• Fuel leak (supply pump to common rail to injector) • Injector

WIRING DIAGRAM

Refer to DTC P0087/48 on page 05–42.
Refer to DTC P0088/78 on page 05–46.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK DTC OUTPUT

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result:

Display (DTC output)	Proceed to
P0093/78 only	A
P0093/78 and other DTC are output	B

B → **Go to RELEVANT DTC CHART (See page 05–38)**

A

2	CHECK FUEL LEAKAGE

(a) Visually check the supply pump, injector and fuel line located between the supply pump and common rail for fuel leaks or fuel pressure leaks. Also, perform the same on the fuel line between the common rail and the injector (see pages 11–15 and 11–20).

HINT:

There is possibility that fuel leaks inside the components (supply pump, etc.) have occurred.

NG → **REPAIR OR REPLACE**

OK

REPLACE INJECTOR ASSY (See page 11–20)

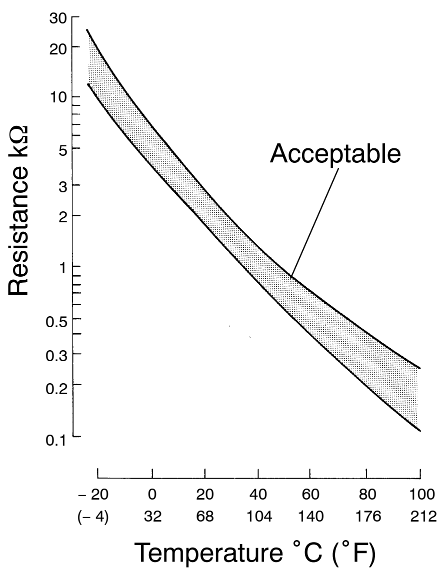
DTC P0095/23 INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT

DTC P0097/23 INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT LOW

DTC P0098/23 INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT HIGH

CIRCUIT DESCRIPTION

(Fig. 1)



A56991

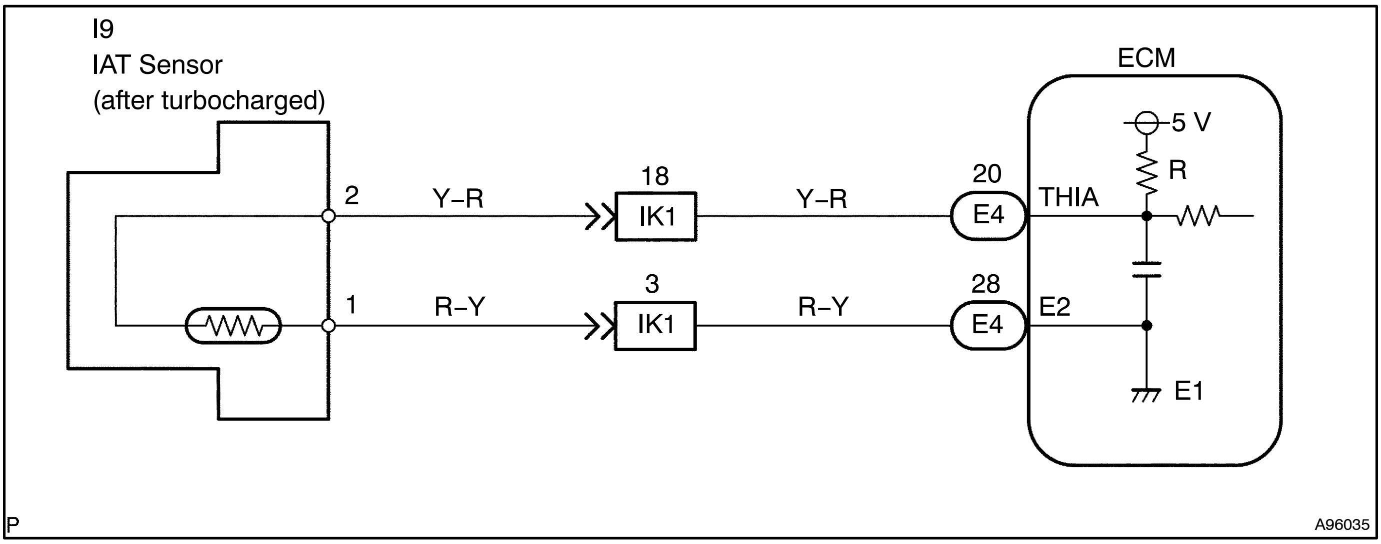
The intake air temperature (IAT) sensor (after turbocharged), built into the intake pipe, senses the turbocharged air temperature. A thermistor built in the sensor changes the resistance value according to the IAT. The lower the IAT, the greater the thermistor resistance value, and the higher the IAT, the lower the thermistor resistance value (see Fig. 1).
The IAT sensor is connected to the ECM. The 5 V power source voltage in the ECM is applied to the IAT sensor from terminal THIA via a resistor R. The resistor R and IAT sensor are connected in series. When the resistance value of the IAT sensor changes in accordance with changes in the IAT, the voltage at the terminal THIA also changes. Based on this signal, the ECM increases the fuel injection volume to improve driveability during cold engine operation.

DTC No.	Proceed to	DTC Detection Condition	Trouble Area
P0095/23	Step 1	Open or short in IAT sensor (after turbocharged) circuit for 0.5 seconds (1 trip detection logic)	• Open or short in IAT sensor (after turbocharged) circuit • IAT sensor (after turbocharged) • ECM
P0097/23	Step 4	Short in IAT sensor (after turbocharged) circuit for 0.5 seconds	Same as DTC No. P0095/23
P0098/23	Step 2	Open in IAT sensor (after turbocharged) circuit for 0.5 seconds	Same as DTC No. P0095/23

HINT:
After confirming DTC P0095/23, P0097/23 or P0098/23, use the hand–held tester to confirm the IAT from the AMBI TEMP SENS menu (to reach the AMBI TEMP SENS menu: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / AMBI TEMP SENS).

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

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

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

When using hand–held tester:

1	READ VALUE OF DATA LIST (INTAKE AIR TEMPERATURE)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / AMBI TEMP SENS. Read the values.
Standard: Same as actual inlet air temperature
Result:

Temperature Display	Proceed to
– 40°C (– 40°F)	A
140°C (284°F) or more	B
OK (same as air temperature near intake manifold)	C

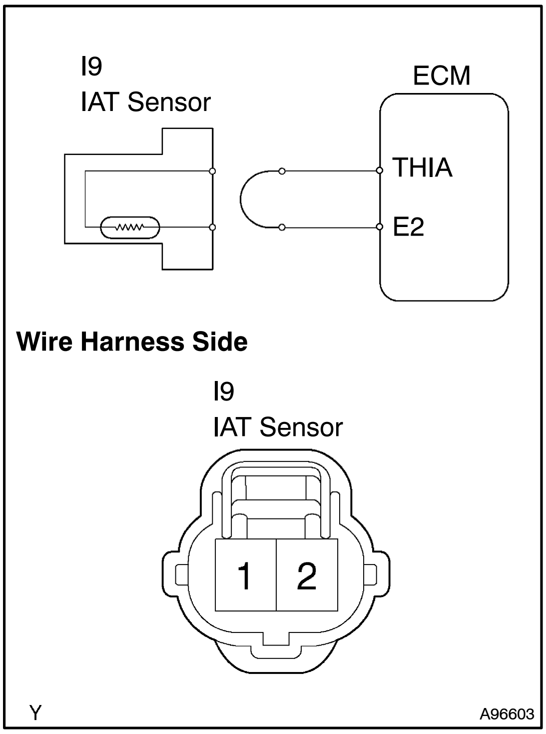
HINT:
- If there is an open circuit, the hand–held tester indicates – 40°C (– 40°F).
- If there is a short circuit, the hand–held tester indicates 140°C (284°F) or more.

B → **Go to step 4**

C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

A

2	READ VALUE OF DATA LIST (CHECK FOR OPEN IN WIRE HARNESS)

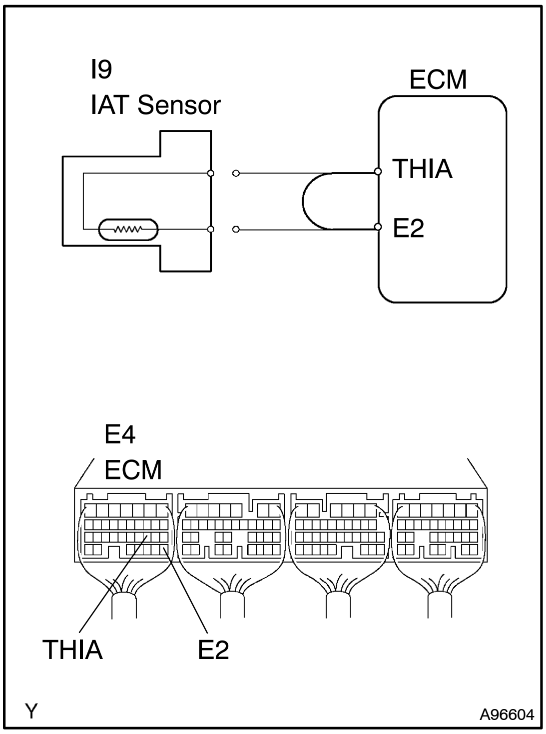


(a) Disconnect the I9 IAT sensor connector.
(b) Connect the terminals 1 and 2 of the IAT sensor harness side connector.
(c) Turn the ignition switch ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / AMBI TEMP SENS. Read the values.
Standard: 140°C (284°F) or more

OK → **REPLACE INTAKE AIR TEMPERATURE SENSOR**

NG

3 READ VALUE OF DATA LIST (CHECK FOR OPEN IN ECM)



(a) Disconnect the I9 IAT sensor connector.
(b) Connect terminals THIA and E2 of the E4 ECM connector.

HINT:
Before checking, do a visual and contact pressure check for the ECM connector.

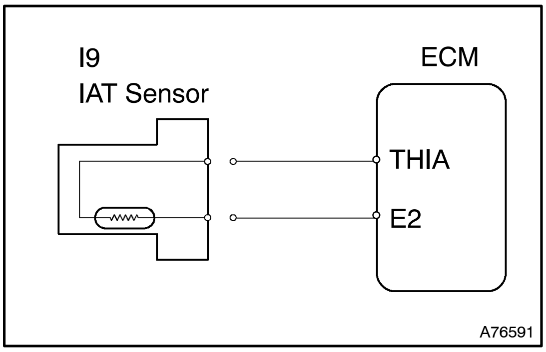
(c) Turn the ignition switch ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / AMBI TEMP SENS. Read the values.
Standard: 140°C (284°F) or more

NG → **REPLACE ECM (See page 10–10)**

OK ↓

REPAIR OR REPLACE HARNESS AND CONNECTOR

4 READ VALUE OF DATA LIST (CHECK FOR SHORT IN WIRE HARNESS)

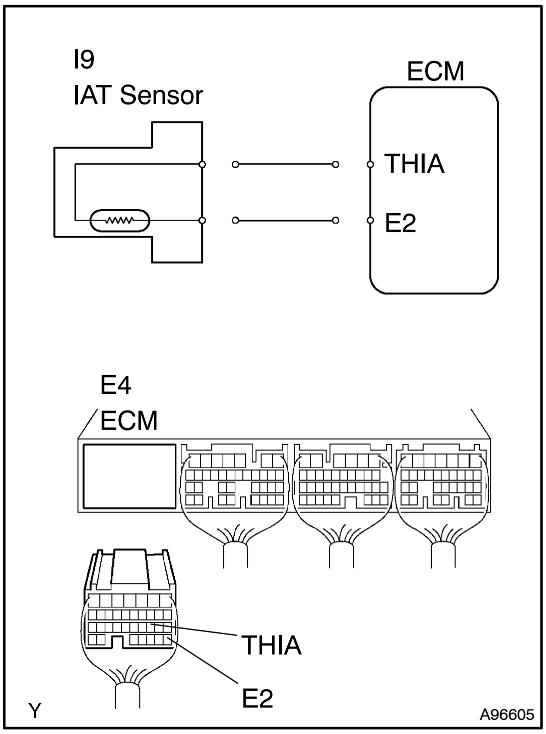


(a) Disconnect the I9 IAT sensor connector.
(b) Turn the ignition switch ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / AMBI TEMP SENS. Read the values.
Standard: – 40°C (– 40°F)

OK → **REPLACE INTAKE AIR TEMPERATURE SENSOR**

NG ↓

5 READ VALUE OF DATA LIST (CHECK FOR SHORT IN ECM)



(a) Disconnect the E4 ECM connector.
(b) Turn the ignition switch ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / AMBI TEMP SENS. Read the values.
Standard: – 40°C (– 40°F)

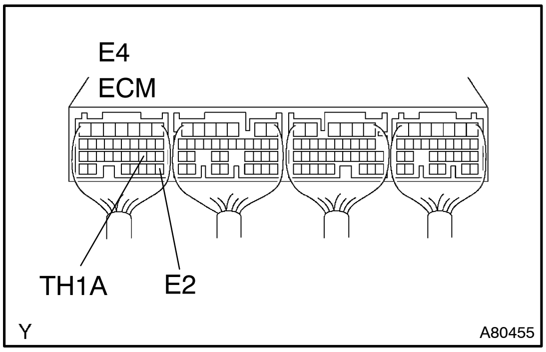
NG → **REPLACE ECM (See page 10–10)**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

When not using hand–held tester:

1	CHECK ECM (TH1A VLTAGE)



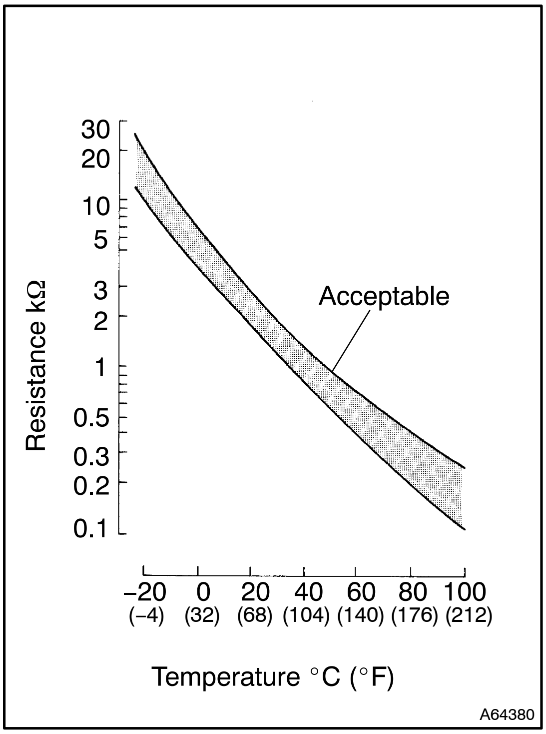
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Condition	Specified Condition
E4–20 (THIA) – E4–28 (E2)	20°C (68°F)	0.2 to 3.8 V
E4–20 (THIA) – E4–28 (E2)	80°C (176°F)	0.1 to 1.5 V

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

NG

2	CHECK INTAKE AIR TEMPERATURE SENSOR



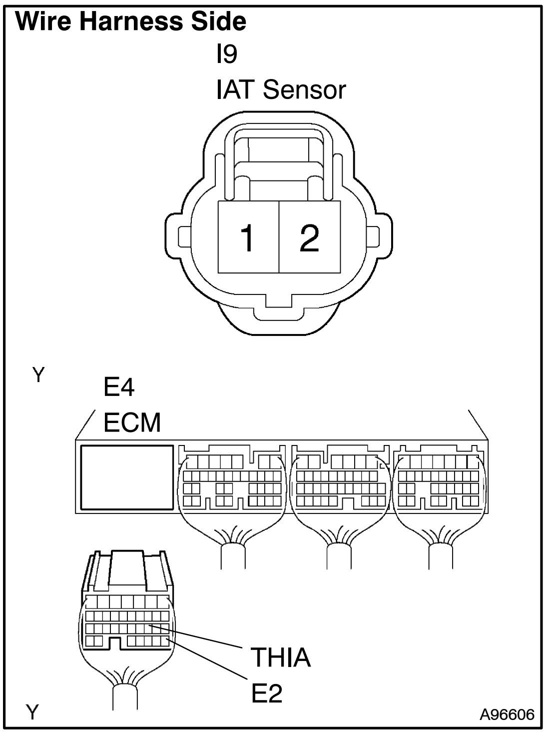
(a) Remove the IAT sensor.
(b) Measure the resistance between the terminals.
Standard:
2.21 to 2.65 kΩ at approximately 20°C (68°F)

NOTICE:
If checking the ECT sensor in water, be careful not to allow water to go into the terminals, and after checking, wipe out the sensor.

NG → **REPLACE INTAKE AIR TEMPERATURE SENSOR**

OK

3 CHECK WIRE HARNESS (ECM – IAT SENSOR)



(a) Disconnect the I9 IAT sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
I9–2 (THIA) – E4–20 (THIA) I9–1 (E2) – E4–28 (E2)	Below 1 Ω
I9–2 (THIA) or E4–20 (THIA) – Body ground I9–1 (E2) or E4–28 (E2) – Body ground	10 kΩ or higher

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

OK

REPLACE ECM (See page 10–10)

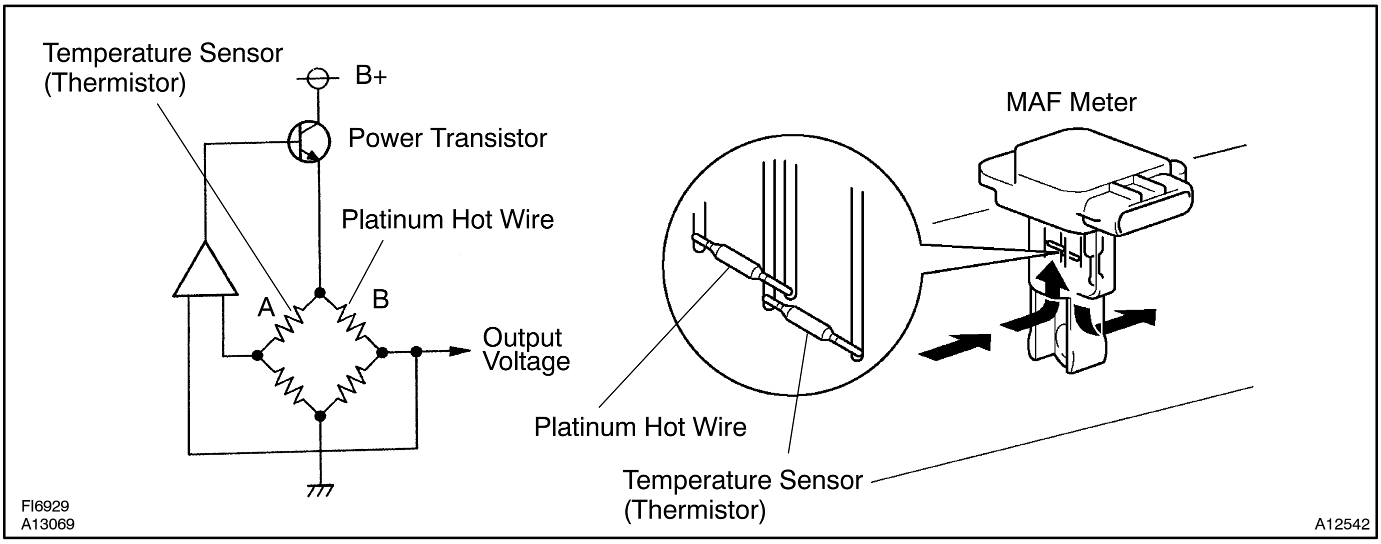
DTC	P0100/31	MASS OR VOLUME AIR FLOW CIRCUIT

DTC	P0102/31	MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

DTC	P0103/31	MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

The Mass Air Flow (MAF) meter uses a platinum hot wire. The hot wire MAF meter consists of a platinum hot wire, thermistor and a control circuit installed in a plastic housing. The hot wire MAF 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 IAT.
The hot wire is maintained at the set temperature by controlling the current flow through the hot wire. This current flow is then measured as the output voltage of the MAF meter.
The circuit is constructed so that the platinum hot wire and thermistor provide a bridge circuit with the power transistor controlled so that the potential of A and B remains equal to maintain the set temperature.

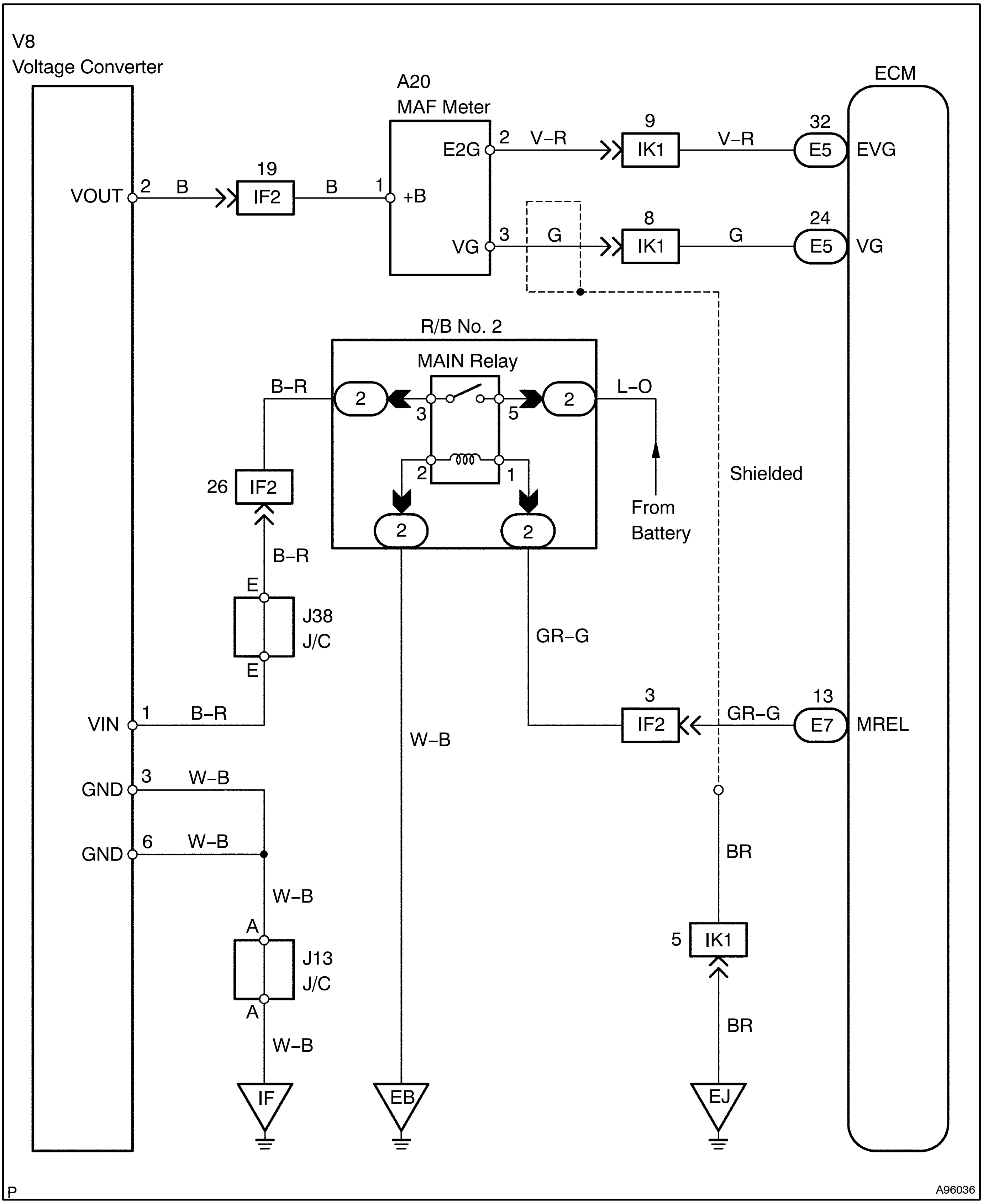


DTC No.	DTC Detection Condition	Trouble Area
P0100/31	Open or short in MAF meter circuit for more than 3 seconds with engine speed at 4,000 rpm or less	• Open or short in MAF meter circuit • MAF meter • Voltage converter • ECM
P0102/31	Open in MAF meter circuit for more than 3 seconds with engine speed at 4,000 rpm or less	Same as DTC No. P0100/31
P0103/31	Short in MAF meter circuit for more than 3 seconds with engine speed at 4,000 rpm or less	Same as DTC No. P0100/31

HINT:
After confirming DTC P0100/31, P0102/31 or P0103/31, use the hand–held tester to confirm the MAF ratio from the MAF menu (to reach the MAF menu: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / MAF).

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

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

When using hand–held tester:

1	READ VALUE OF DATA LIST (MAF RATE)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Start the engine.
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / MAF. Read the values.
Result:

Air Flow Rate (gm/s)	Proceed to
0.0	A
170.1 or more	B
Between 1.6 and 170.0 *	C

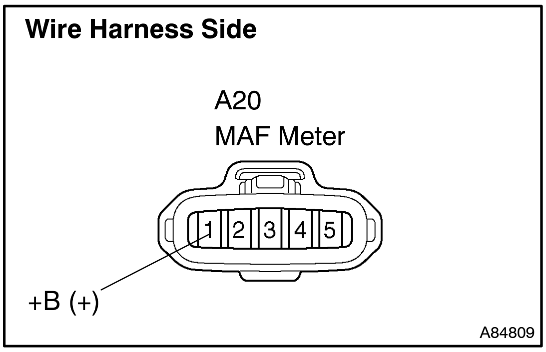
HINT:
*: The value must change when the throttle valve is opened or closed.

B → **Go to step 4**

C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

A

2	CHECK MASS AIR FLOW METER (POWER SOURCE)



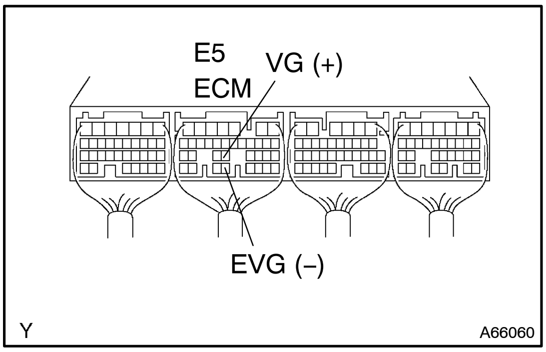
(a) Turn the ignition switch ON.
(b) Disconnect the A20 MAF meter connector.
(c) Measure the voltage of the wire harness side connector.
Standard:

Tester Connection	Specified Condition
A20–1 (+B) – Body ground	13 to 17 V

NG → **Go to step 5**

OK

3 CHECK ECM (VG VOLTAGE)



(a) Start the engine.
(b) Measure the voltage of the ECM connector.
Standard:

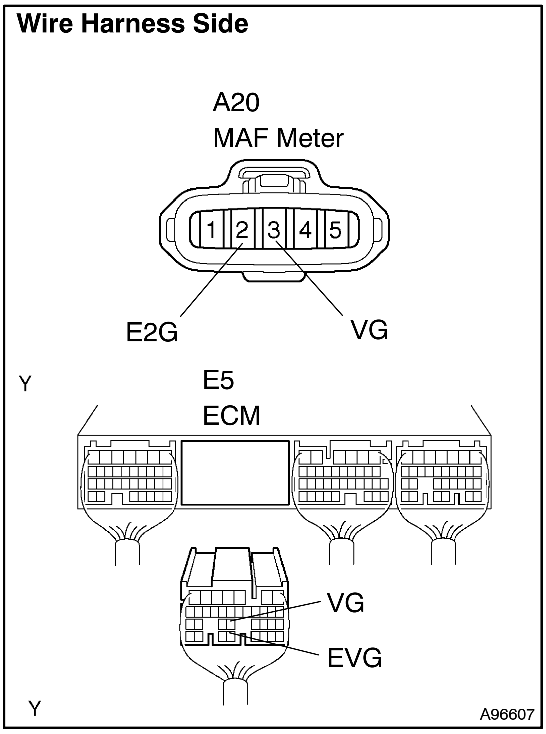
Tester Connection	Condition	Specified Condition
E5–24 (VG) – E5–32 (EVG)	Engine is idling	1.8 to 2.6 V
E5–24 (VG) – E5–32 (EVG)	Engine speed at 3,000 rpm	3.0 to 4.0 V

HINT:
The A/C switch should be turned OFF.

OK → **REPLACE ECM (See page 10–10)**

NG

4 CHECK WIRE HARNESS (MAF METER – ECM)



(a) Disconnect the A20 MAF meter connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

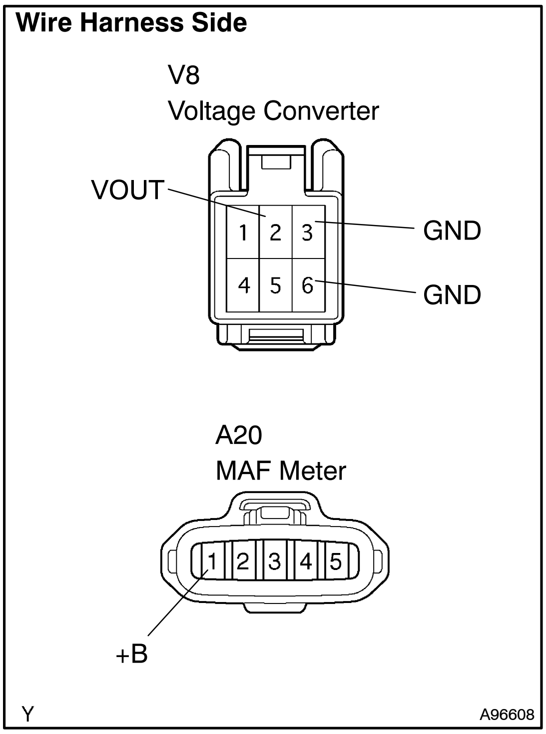
Tester Connection	Specified Condition
A20–3 (VG) – E5–24 (VG) A20–2 (E2G) – E5–32 (EVG)	Below 1 Ω
A20–3 (VG) or E5–24 (VG) – Body ground	10 kΩ or higher

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

OK

REPLACE MASS AIR FLOW METER

5 CHECK WIRE HARNESS (VOLTAGE CONVERTER – MAF METER)



(a) Disconnect the V8 voltage converter connector.
(b) Disconnect the A20 MAF meter connector.
(c) Measure the resistance of the wire harness side connectors.

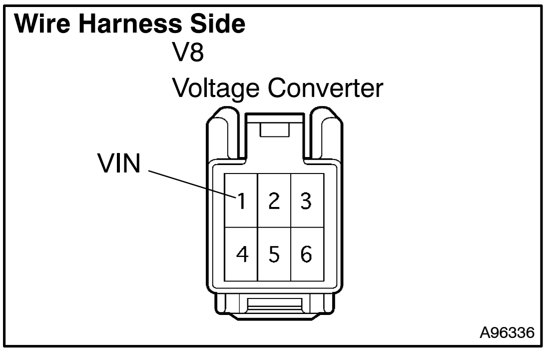
Standard:

Tester Connection	Specified Condition
V8–2 (VOUT) – A20–1 (+B) V8–3 (GND) – Body ground V8–6 (GND) – Body ground	Below 1 Ω
V8–2 (VOUT) or A20–1 (+B) – Body ground	10 kΩ or higher

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

OK

6 CHECK VOLTAGE CONVERTER (VIM VOLTAGE)



(a) Turn the ignition switch ON.
(b) Disconnect the V8 voltage converter connector.
(c) Measure the voltage of the converter connector.

Standard:

Tester Connection	Specified Condition
V8–1 (VIN) – V8 –3 (GND)	18 to 27 V

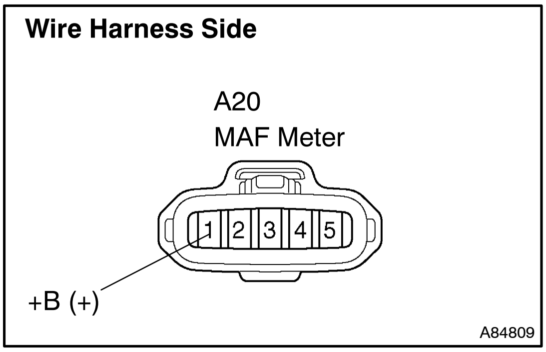
NG → **REPLACE VOLTAGE CONVERTER CHECK**

OK

CHECK AND REPLACE ECM POWER SOURCE CIRCUIT (See page 05–152)

When not using hand–held tester:

1	CHECK MASS AIR FLOW METER (POWER SOURCE)



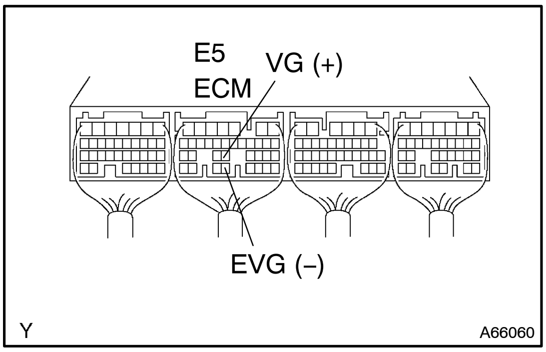
(a) Turn the ignition switch ON.
(b) Disconnect the A20 MAF meter connector.
(c) Measure the voltage of the wire harness side connector.
Standard:

Tester Connection	Specified Condition
A20–1 (+B) – Body ground	13 to 17 V

NG → **Go to step 4**

OK

2	CHECK ECM (VG VOLTAGE)



(a) Start the engine.
(b) Measure the voltage of the ECM connector.
Standard:

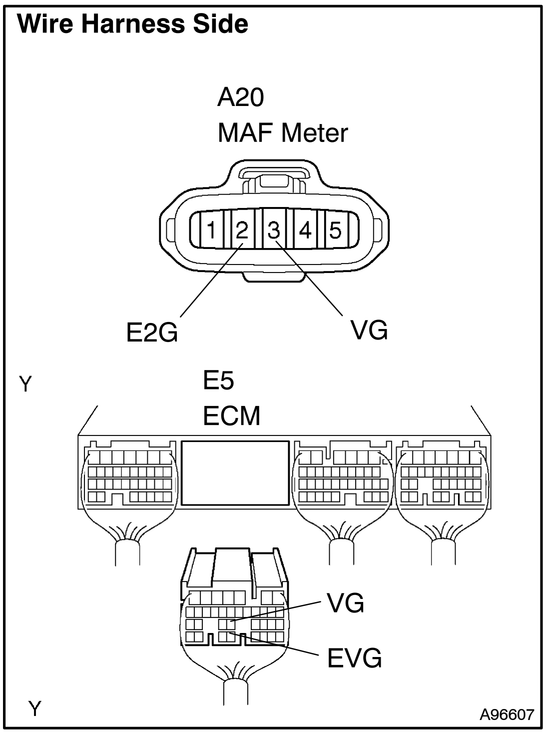
Tester Connection	Condition	Specified Condition
E5–24 (VG) – E5–32 (EVG)	Engine is idling	1.8 to 2.6 V
E5–24 (VG) – E5–32 (EVG)	Engine speed at 3,000 rpm	3.0 to 4.0 V

HINT:
The A/C switch should be turned OFF.

OK → **REPLACE ECM (See page 10–10)**

NG

3	CHECK WIRE HARNESS (MAF METER – ECM)



(a) Disconnect the A20 MAF meter connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

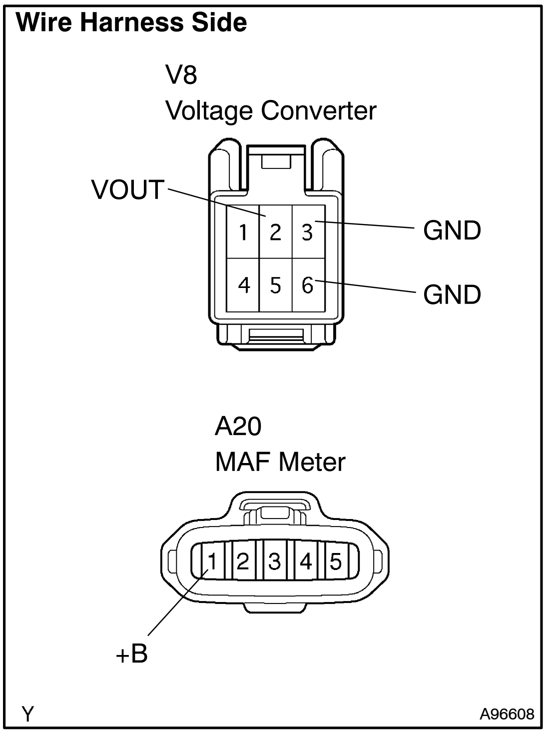
Tester Connection	Specified Condition
A20–3 (VG) – E5–24 (VG) A20–2 (E2G) – E5–32 (EVG)	Below 1 Ω
A20–3 (VG) or E5–24 (VG) – Body ground	10 kΩ or higher

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

OK

REPLACE MASS AIR FLOW METER

4	CHECK WIRE HARNESS (VOLTAGE CONVERTER – MAF METER)



(a) Disconnect the V8 voltage converter connector.
(b) Disconnect the A20 MAF meter connector.
(c) Measure the resistance of the wire harness side connectors.

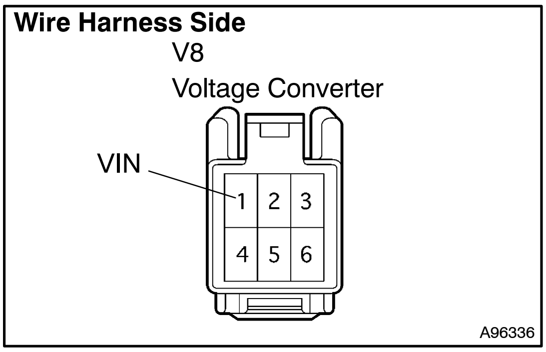
Standard:

Tester Connection	Specified Condition
V8–2 (VOUT) – A20–1 (+B) V8–3 (GND) – Body ground V8–6 (GND) – Body ground	Below 1 Ω
V8–2 (VOUT) or A20–1 (+B) – Body ground	10 kΩ or higher

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

OK

5	CHECK VOLTAGE CONVERTER (VIM VOLTAGE)



(a) Turn the ignition switch ON.
(b) Disconnect the V8 voltage converter connector.
(c) Measure the voltage of the converter connector.

Standard:

Tester Connection	Specified Condition
V8–1 (VIN) – V8 –3 (GND)	18 to 27 V

NG → **REPLACE VOLTAGE CONVERTER**

OK

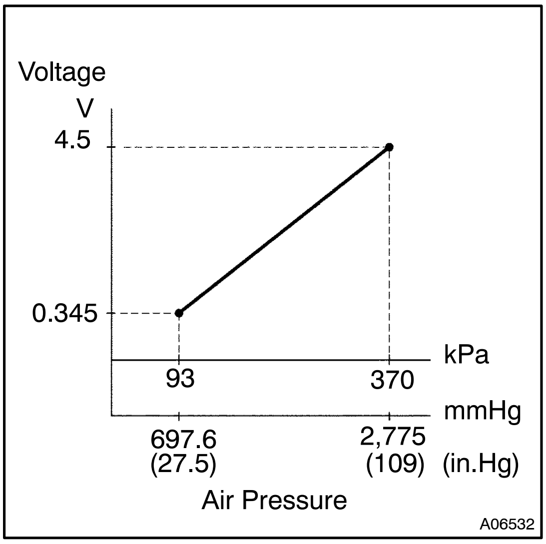
CHECK AND REPLACE ECM POWER SOURCE CIRCUIT (See page 05–152)

DTC	P0105/31	MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT

DTC	P0107/31	MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

DTC	P0108/31	MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION



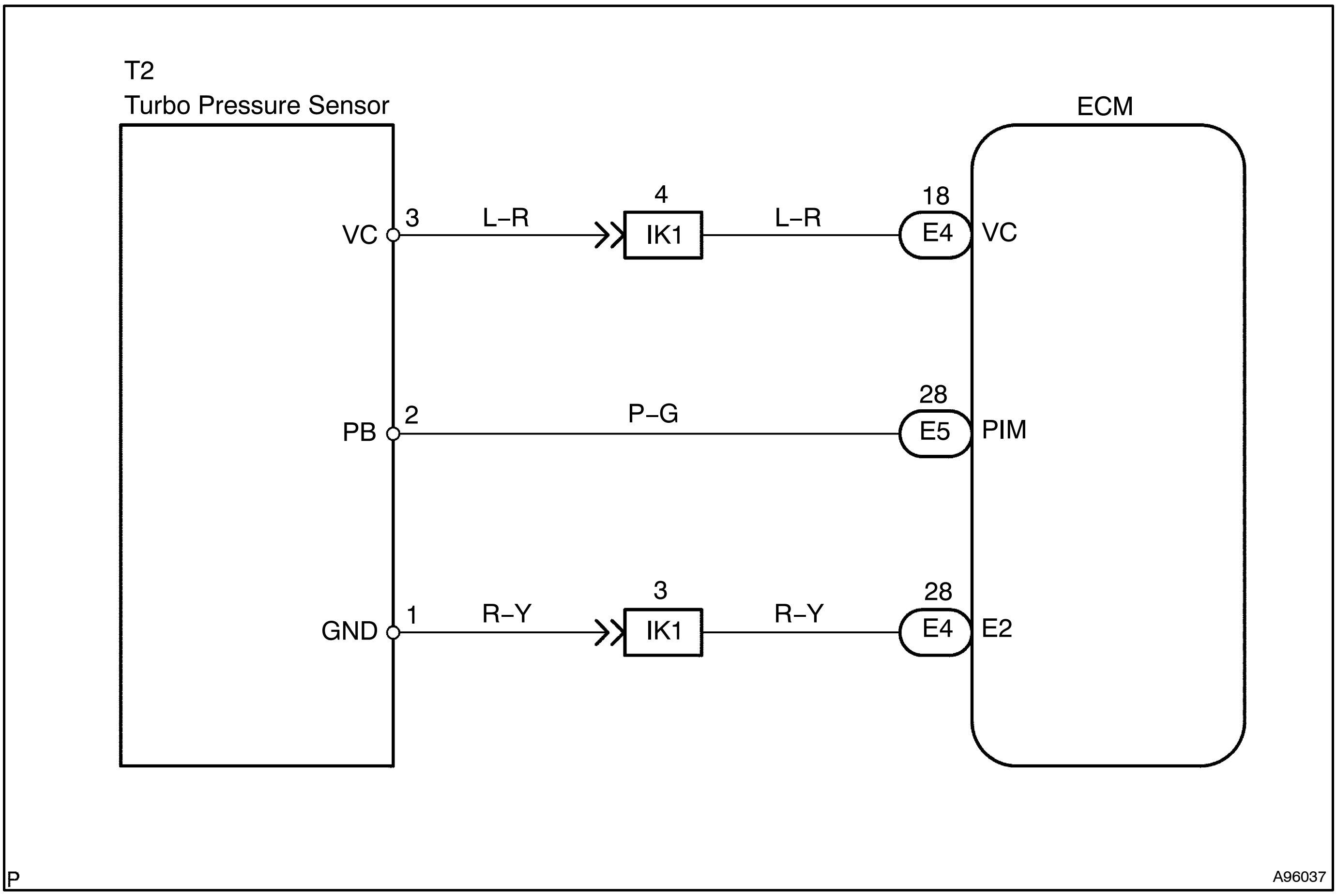
By a built–in sensor unit, the turbo pressure sensor (manifold absolute pressure sensor) detects the intake manifold pressure as a voltage. The ECM then determines the basic injection duration and basic ignition advance angle based on this voltage.
Since the turbo pressure sensor does not use the atmospheric 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.	DTC Detection Condition	Trouble Area
P0105/31	After engine is started, condition (a) continues for more than 2.0 seconds (a) Open or short in turbo pressure sensor circuit for 0.5 seconds or more	• Open or short in turbo pressure sensor circuit • Turbo pressure sensor • ECM
P0107/31	After engine is started, condition (a) continues for more than 2.0 seconds (a) Short in turbo pressure sensor circuit for 0.5 seconds or more	Same as DTC No. P0105/31
P0108/31	After engine is started, condition (a) continues for more than 2.0 seconds (a) Open in turbot pressure sensor circuit for 0.5 seconds or more	Same as DTC No. P0105/31

HINT:
After confirming DTC P0105/31, P0107/31 or P0108/31, use the hand–held tester to confirm the intake manifold pressure from the PIM menu (to reach the PIM menu: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / PIM).

Intake Manifold Pressure (kPa)	Malfunction
Approximately 0	• Short in PIM circuit
370 or more	• Open or short in VC circuit • Open in PIM circuit • Open in E2 circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

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

When using hand–held tester:

1	READ VALUE OF DATA LIST (MANIFOLD ABSOLUTE PRESSURE)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / PIM. Read the values.
Standard: Same value as the actual atmospheric pressure.
Result:

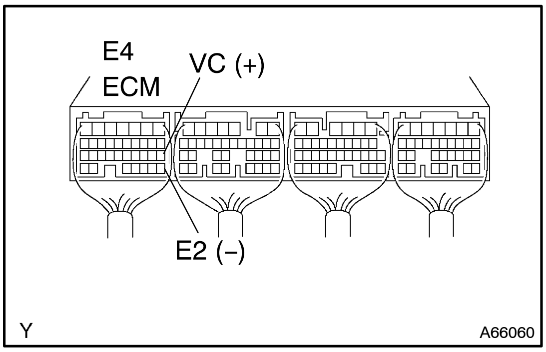
Pressure Displayed	Proceed to
130 kPa	A
0 kPa	B
OK (same as atmospheric pressure near to intake manifold)	C

B → **Go to step 3**

C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

A

2	CHECK ECM (VC VOLTAGE)



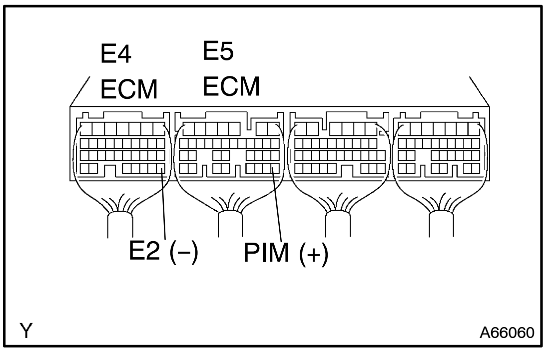
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Specified Condition
E4–18 (VC) – E4–28 (E2)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–10)**

OK

3 CHECK ECM (PIM VOLTAGE)



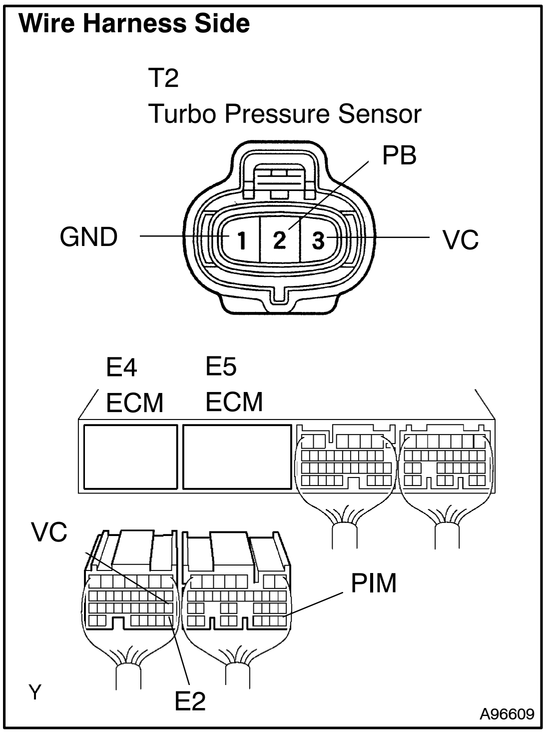
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard:

Tester Connection	Condition	Specified Condition
E5–28 (PIM) – E4–28 (E2)	Negative pressure of 93 kPa (675 mmHg, 27.5 in.Hg) applied	0.25 to 0.4 V
E5–28 (PIM) – E4–28 (E2)	Positive pressure of 150 kPa (1,125 mmHg, 44 in.Hg) applied	1.0 to 1.4 V

NG → **REPLACE ECM (See page 10–10)**

OK

4 CHECK WIRE HARNESS (TURBO PRESSURE SENSOR – ECM)



(a) Disconnect the T2 turbo pressure sensor connector.
(b) Disconnect the E4 and E5 ECM connectors.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
T2–2 (PB) – E5–28 (PIM) T2–3 (VC) – E4–18 (VC) T2–1 (GND) – E4–28 (E2)	Below 1 Ω
T2–2 (PB) or E5–28 (PIM) – Body ground T2–3 (VC) or E4–18 (VC) – Body ground T2–1 (GND) or E4–28 (E2) – Body ground	10 kΩ or higher

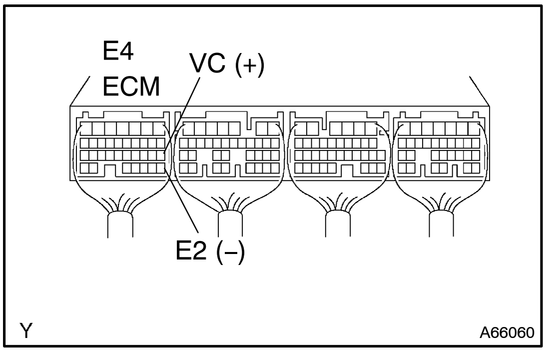
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE TURBO PRESSURE SENSOR

When not using hand–held tester:

1	CHECK ECM (VC VOLTAGE)



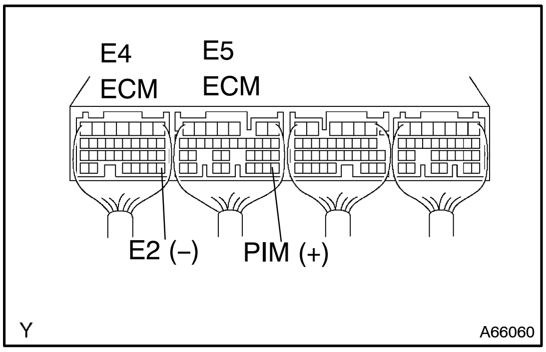
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Specified Condition
E4–18 (VC) – E4–28 (E2)	4.5 to 5.5 V

NG ▷ **REPLACE ECM (See page 10–10)**

OK

2	CHECK ECM (PIM VOLTAGE)



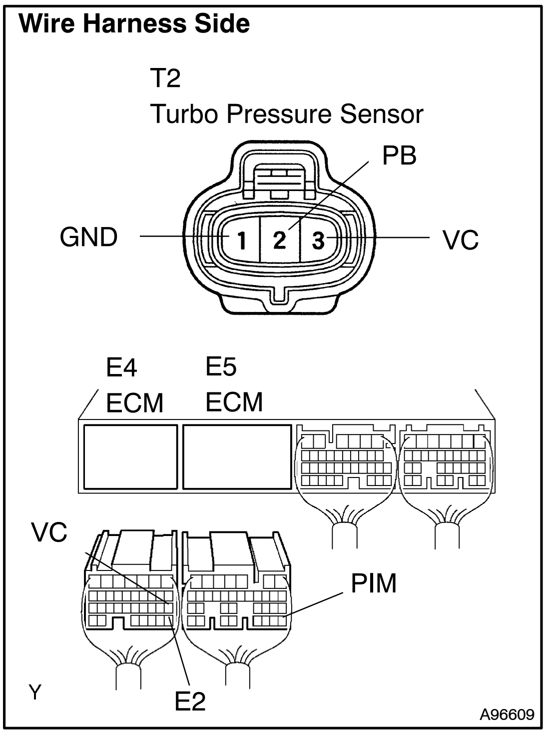
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard:

Tester Connection	Condition	Specified Condition
E5–28 (PIM) – E4–28 (E2)	Negative pressure of 93 kPa (675 mmHg, 27.5 in.Hg) applied	0.25 to 0.4 V
E5–28 (PIM) – E4–28 (E2)	Positive pressure of 150 kPa (1,125 mmHg, 44 in.Hg) applied	1.0 to 1.4 V

NG ▷ **REPLACE ECM (See page 10–10)**

OK

3 CHECK WIRE HARNESS (TURBO PRESSURE SENSOR – ECM)



(a) Disconnect the T2 turbo pressure sensor connector.
(b) Disconnect the E4 and E5 ECM connectors.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
T2–2 (PB) – E5–28 (PIM) T2–3 (VC) – E4–18 (VC) T2–1 (GND) – E4–28 (E2)	Below 1 Ω
T2–2 (PB) or E5–28 (PIM) – Body ground T2–3 (VC) or E4–18 (VC) – Body ground T2–1 (GND) or E4–28 (E2) – Body ground	10 kΩ or higher

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

OK

REPLACE TURBO PRESSURE SENSOR

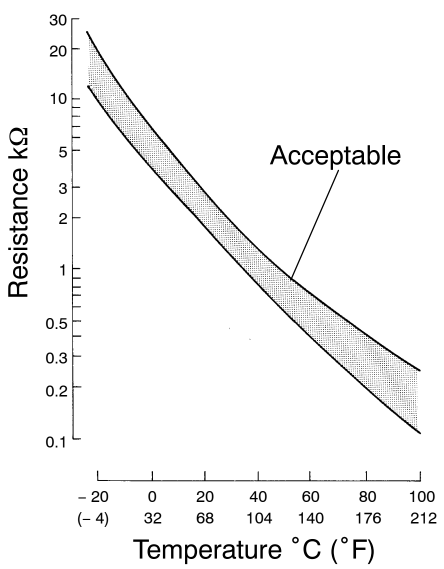
DTC	P0110/24	INTAKE AIR TEMPERATURE CIRCUIT

DTC	P0112/24	INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT

DTC	P0113/24	INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

(Fig. 1)



A56991

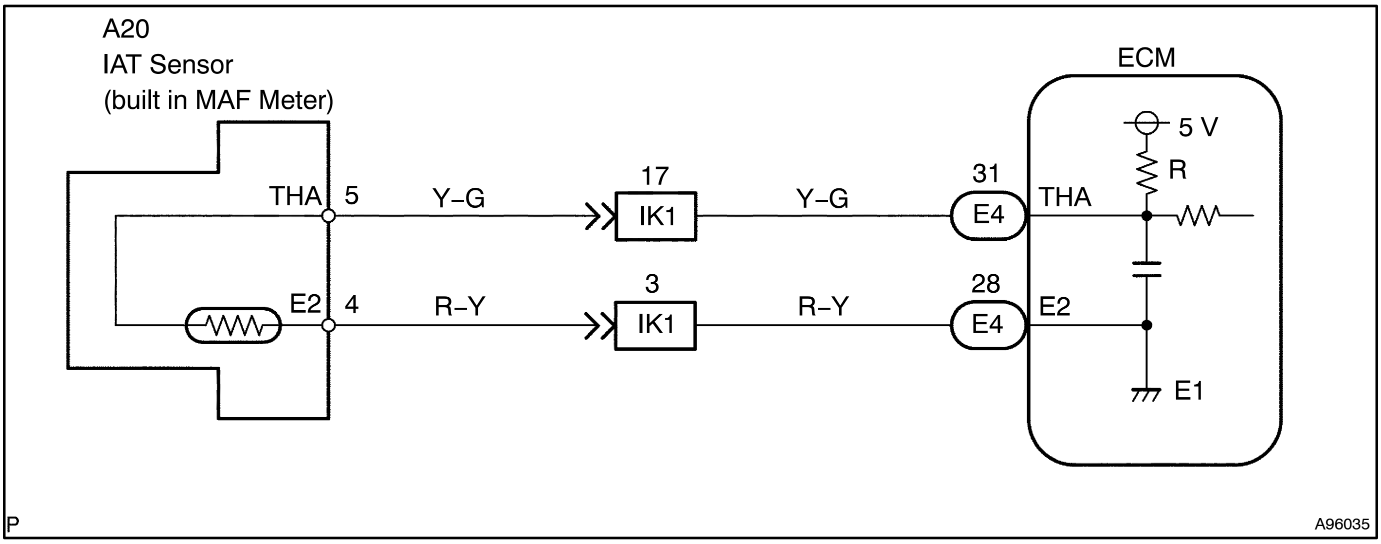
The Intake Air Temperature (IAT) sensor is built into the Mass Air Flow (MAF) meter and senses the atmospheric temperature. A thermistor built in the sensor changes the resistance value according to the intake air temperature. The lower the atmospheric temperature is, the greater the thermistor resistance value is, and the higher the atmospheric temperature is, the lower the thermistor resistance value is (see Fig. 1).
The IAT sensor is connected to the ECM. The 5 V power source voltage in the ECM is applied to the IAT sensor from terminal THA via a resistor R. The resistor R and the IAT sensor are connected in series. When the resistance value of the IAT sensor changes in accordance with changes in the IAT, the voltage at terminal THA also changes. Based on this signal, the ECM increases the fuel injection volume to improve driveability during cold engine operation.

DTC No.	Proceed to	DTC Detection Condition	Trouble Area
P0110/24	Step 1	Open or short in IAT sensor circuit for 0.5 seconds	• Open or short in IAT sensor circuit • IAT sensor (built in MAF meter) • ECM
P0112/24	Step 4	Short in intake IAT sensor circuit for 0.5 secconds	Same as DTC No. P0110/24
P0113/24	Step 2	Open in IAT sensor circuit for 0.5 seconds	Same as DTC No. P0110/24

HINT:
After confirming DTC ”P0110/24, P0112/24 or P0113/24, use the hand–held tester to confirm the IAT from the intake air menu (to reach the INTAKE AIR menu: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / INTAKE AIR).

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

WIRING DIAGRAM



INSPECTION PROCEDURE

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

When using hand–held tester:

1	READ VALUE OF DATA LIST (IAT)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / INTAKE AIR. Read the values.
Standard: Same value as the actual intake air temperature.
Result:

Temperature Displayed	Proceed to
–40°C (–40°F)	A
140°C (284°F) or more	B
OK (same as air temperature near to intake manifold)	C

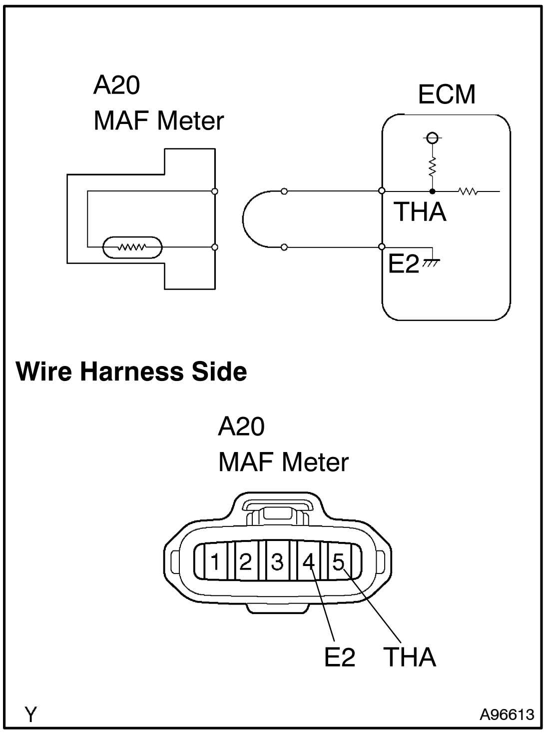
HINT:
- If there is an open circuit, the hand–held tester indicates –40°C (–40°F).
- If there is a short circuit, the hand–held tester indicates 140°C (284°F) or more.

B	Go to step 4

C	CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)

A

2	READ VALUE OF DATA LIST (CHECK FOR OPEN IN WIRE HARNESS)

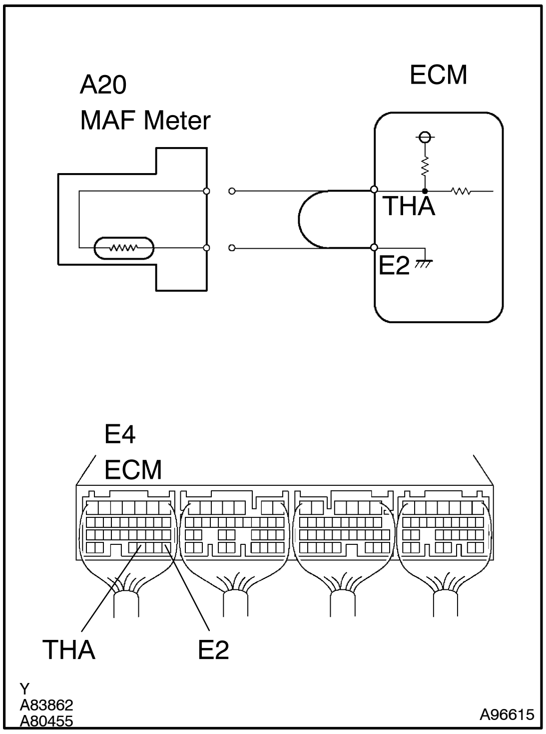


(a) Disconnect the A20 MAF meter connector.
(b) Connect terminals 4 and 5 of the MAF meter wire harness side connector.
(c) Turn the ignition switch ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / INTAKE AIR. Read the values.
Standard: 140°C (284°F) or more

OK → **CONFIRM GOOD CONNECTION AT SENSOR. IF OK, REPLACE MASS AIR FLOW SENSOR**

NG

3	READ VALUE OF DATA LIST (CHECK FOR OPEN IN ECM)



(a) Disconnect the A20 MAF meter connector.
(b) Connect terminals THA and E2 of the E4 ECM connector.

HINT:
Before checking, perform a visual and contact pressure check on the ECM connector.

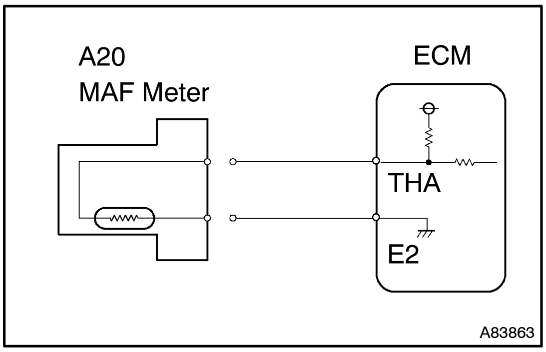
(c) Turn the ignition switch ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / INTAKE AIR. Read the values.
Standard: 140°C (284°F) or more

NG → **CONFIRM GOOD CONNECTION AT ECM. IF OK, REPLACE ECM (See page 10–10)**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

4	READ VALUE OF DATA LIST (CHECK FOR SHORT IN WIRE HARNESS)

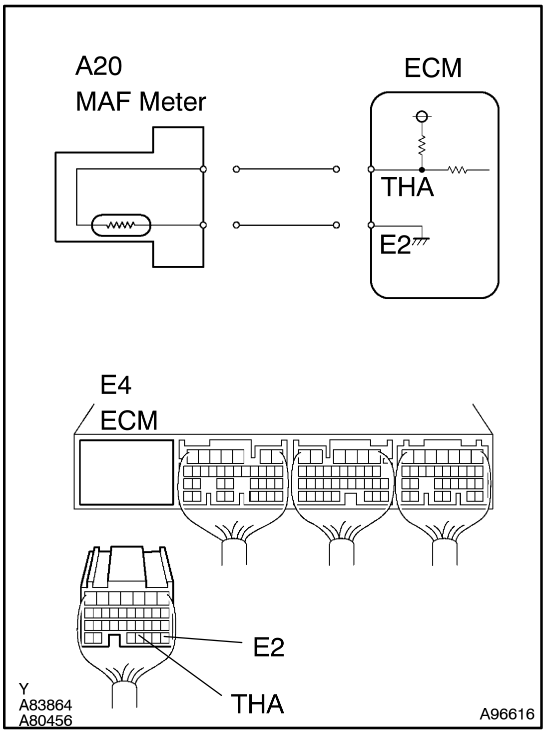


(a) Disconnect the A20 MAF meter connector.
(b) Turn the ignition switch ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / INTAKE AIR. Read the values.
Standard: –40°C (–40°F)

OK → **REPLACE MASS AIR FLOW METER**

NG

5	READ VALUE OF DATA LIST (CHECK FOR SHORT IN ECM)



(a) Disconnect the A20 MAF meter connector.
(b) Disconnect the E4 ECM connector.
(c) Turn the ignition switch ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / INTAKE AIR. Read the values.
Standard: –40°C (–40°F)

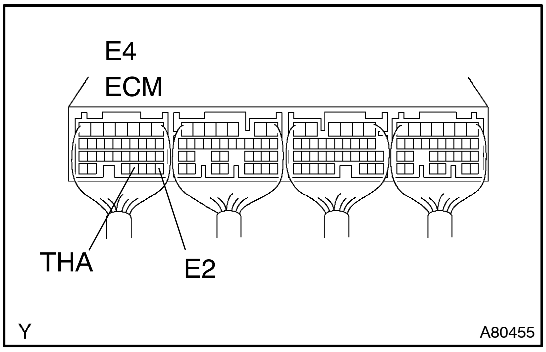
NG → **REPLACE ECM (See page 10–10)**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

When not using hand–held tester:

1	CHECK ECM (THA VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage of the ECM connector.

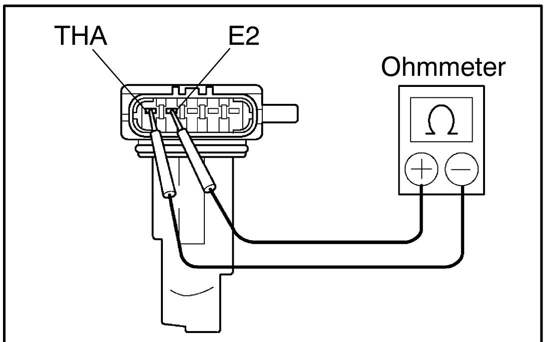
Standard:

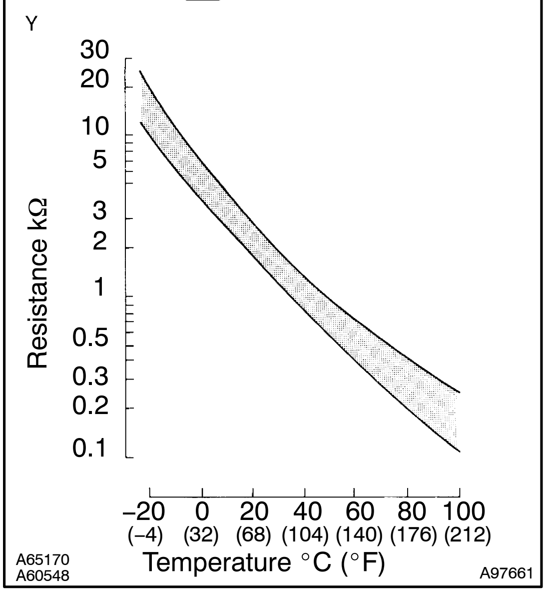
Tester Connection	Condition	Specified Condition
E4–31 (THA) – E4–28 (E2)	20°C (68°F)	0.2 to 3.8 V
E4–31 (THA) – E4–28 (E2)	80°C (176°F)	0.1 to 1.5 V

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

NG

2	INSPECT MASS AIR FLOW METER (IAT SENSOR)





(a) Remove the MAF meter.

(1) Using an ohmmeter, measure the resistance between terminals 4 (E2) and 5 (THA).

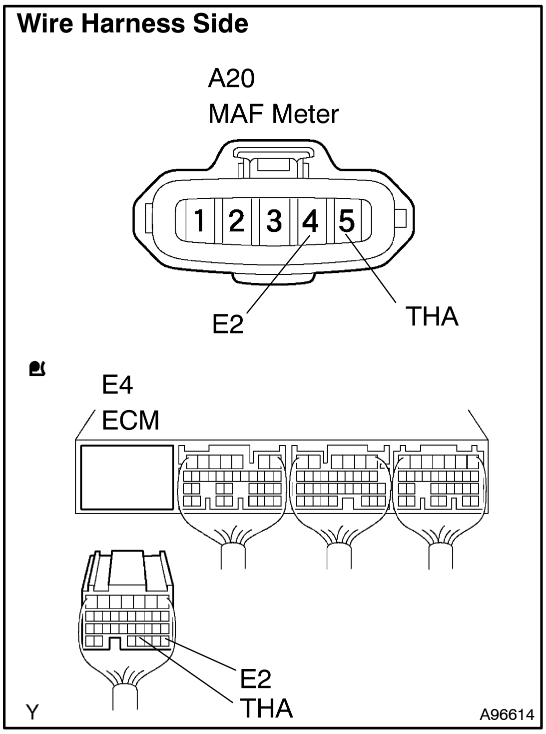
Standard:

Condition	Specified Condition
–20°C (–4°F)	12.5 to 1.69 kΩ
20°C (68°F)	2.19 to 2.67 kΩ
60°C (140°F)	0.5 to 0.68 kΩ

NG → **REPLACE MASS AIR FLOW METER**

OK

3 CHECK WIRE HARNESS (ECM – IAT SENSOR)



(a) Disconnect the A20 MAF meter connector.
(b) Disconnect the E4 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
A20–5 (THA) – E4–31 (THA) A20–4 (E2) – E4–28 (E2)	Below 1 Ω
E4–31 (THA) – E4–28 (E2)	10 kΩ or higher

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

OK

REPLACE ECM (See page 10–10)

DTC	P0115/22	ENGINE COOLANT TEMPERATURE CIRCUIT

DTC	P0117/22	ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

DTC	P0118/22	ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

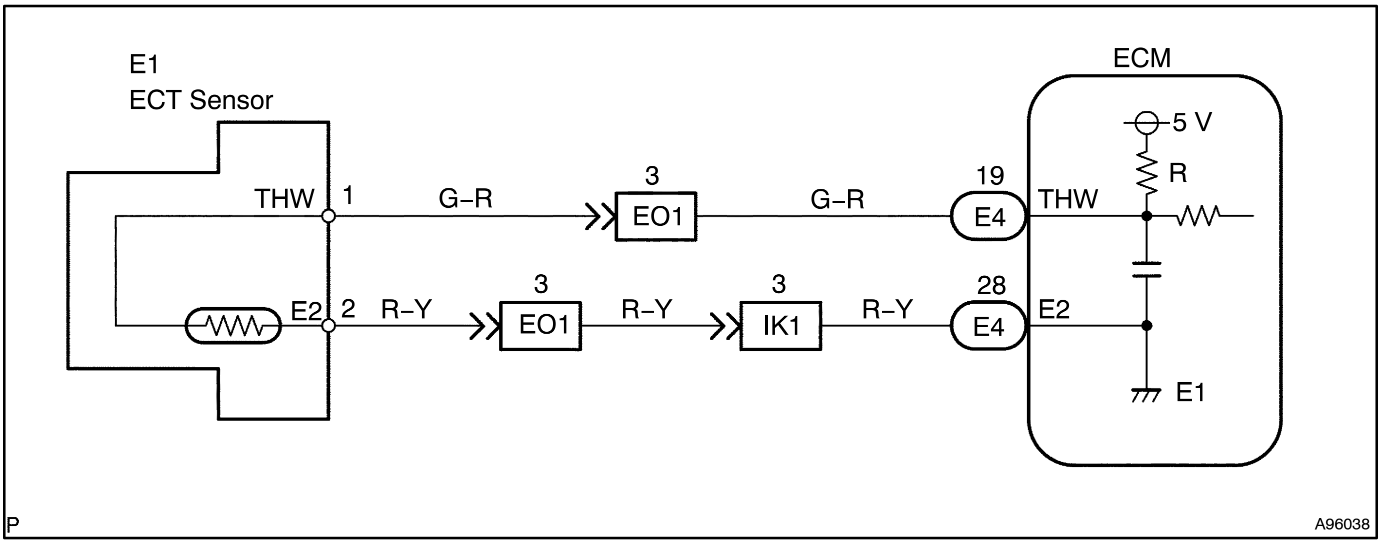
A thermistor is built in the Engine Coolant Temperature (ECT) sensor and changes the resistance value according to the ECT.
The structure of the sensor and connection to the ECM is the same as the Intake Air Temperature (IAT) sensor.

DTC No.	Proceed to	DTC Detection Condition	Trouble Area
P0115/22	Step 1	Open or short in ECT sensor circuit for 0.5 seconds	• Open or short in ECT sensor circuit • ECT sensor • ECM
P0117/22	Step 4	Short in ECT sensor circuit for 0.5 seconds	Same as DTC No. P0115/22
P0118/22	Step 2	Open in ECT sensor circuit for 0.5 seconds	Same as DTC No. P0115/22

HINT:
After confirming DTC P0115/22, P0117/22 or P0118/22, use the hand–held tester to confirm the ECT from the COOLANT TEMP menu (to reach the COOLANT TEMP menu: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / COOLANT TEMP).

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

WIRING DIAGRAM



INSPECTION PROCEDURE

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

When using hand–held tester:

1	READ VALUE OF DATA LIST (COOLANT TEMPERATURE)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / COOLANT TEMP. Read the values.
Standard: Same value as the actual engine coolant temperature.
Result:

Temperature Display	Proceed to
–40°C (–40°F)	A
140°C (284°F)	B
OK (same as actual engine coolant temperature)	C

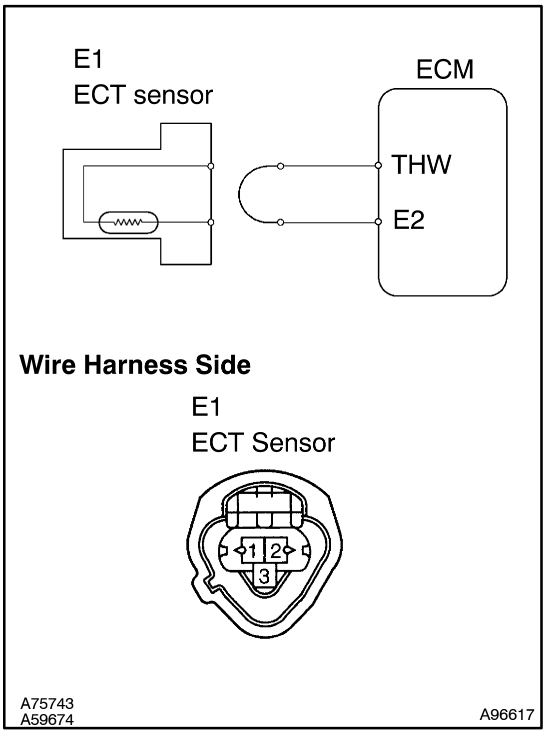
HINT:
- If there is an open circuit, the hand–held tester indicates –40°C (–40°F).
- If there is a short circuit, the hand–held tester indicates 140°C (284°F) or more.

B → **Go to step 4**

C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

A

2	READ VALUE OF DATA LIST (CHECK FOR OPEN IN WIRE HARNESS)

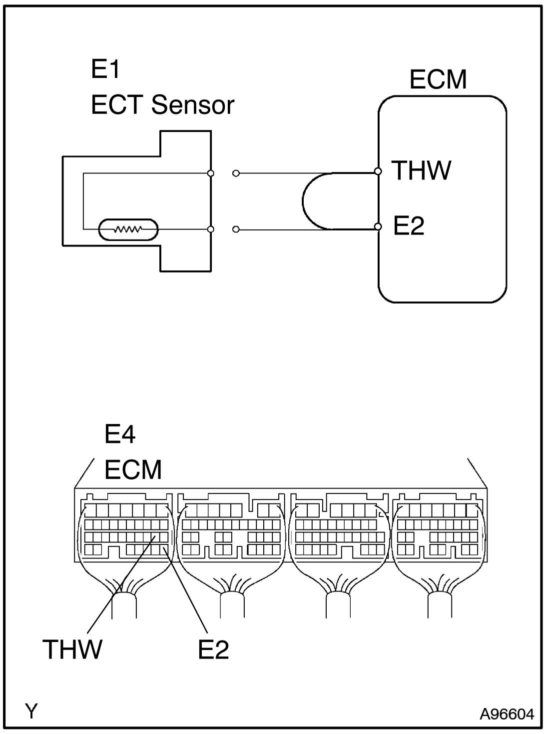


(a) Disconnect the E1 ECT sensor connector.
(b) Connect terminals 1 and 2 of the ECT sensor wire harness side connector.
(c) Turn the ignition switch ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / COOLANT TEMP. Read the values.
Standard: 140°C (284°F) or more

OK → **CONFIRM GOOD CONNECTION AT SENSOR. IF OK, REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

NG

3	READ VALUE OF DATA LIST (CHECK FOR OPEN IN ECM)



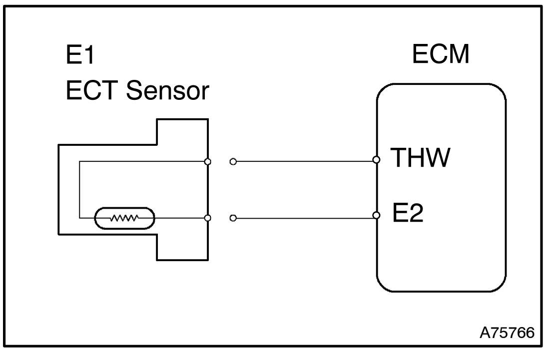
(a) Disconnect the E1 ECT sensor connector.
(b) Connect terminals THW and E2 of the E4 ECM connector.
HINT:
Before checking, perform a visual and contact pressure check for the ECM connector.
(c) Turn the ignition switch ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / COOLANT TEMP. Read the values.
Standard: 140°C (284°F) or more

NG → **CONFIRM GOOD CONNECTION AT ECM. IF OK, REPLACE ECM (See page 10–10)**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

4 READ VALUE OF DATA LIST (CHECK FOR SHORT IN WIRE HARNESS)

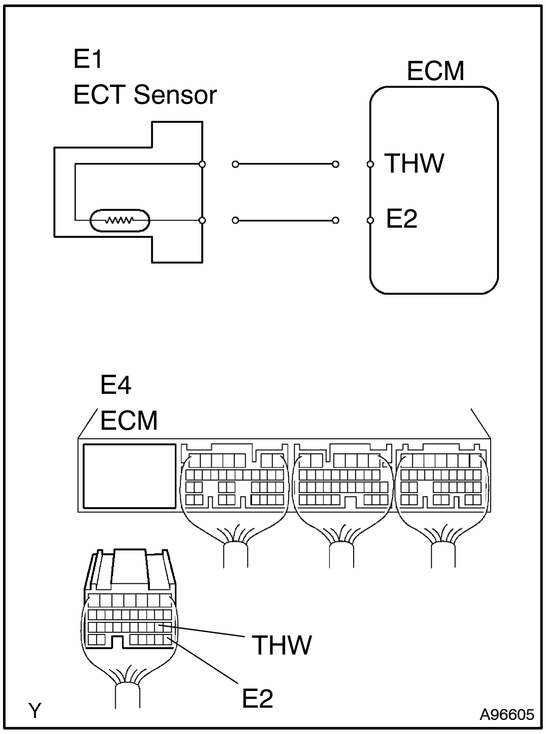


(a) Disconnect the E1 ECT sensor connector.
(b) Turn the ignition switch ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / COOLANT TEMP. Read the values.
Standard: –40°C (–40°F)

OK → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

NG

5 READ VALUE OF DATA LIST (CHECK FOR SHORT IN ECM)



(a) Disconnect the E4 ECM connector.
(b) Turn the ignition switch ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / COOLANT TEMP. Read the values.
Standard: –40°C (–40°F)

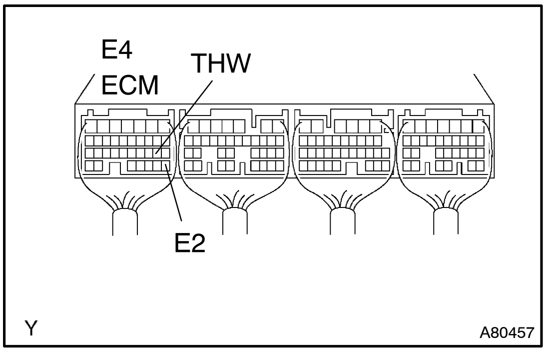
NG → **REPLACE ECM (See page 10–10)**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

When not using hand–held tester:

1 CHECK ECM (THW VOLTAGE)



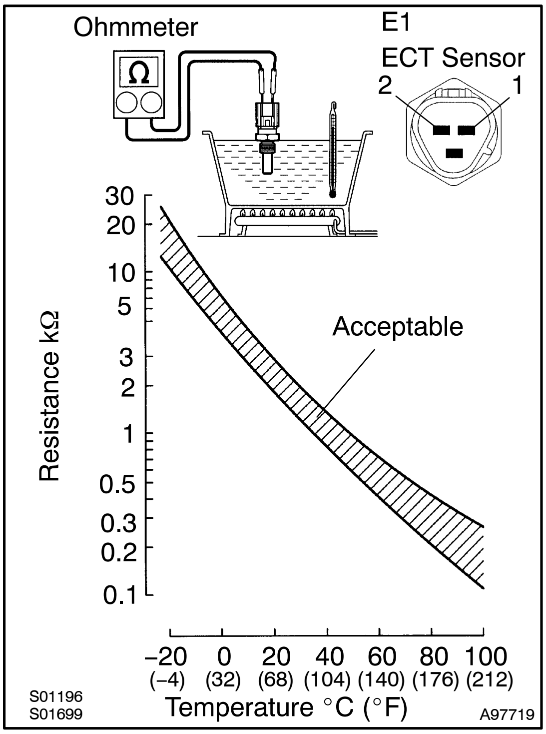
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Condition	Specified Condition
E4–19 (THW) – E4–28 (E2)	20°C (68°F)	0.2 to 3.8 V
E4–19 (THW) – E4–28 (E2)	80°C (176°F)	0.1 to 1.5 V

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 10–10)**

NG ↓

2 INSPECT ENGINE COOLANT TEMPERATURE SENSOR



(a) Remove the ECT sensor.
(b) Measure the resistance between the terminals.
Standard:

Tester Connection	Condition	Specified Condition
1 – 2	20°C (68°F)	2.21 to 2.69 kΩ
1 – 2	80°C (176°F)	0.29 to 0.354 kΩ

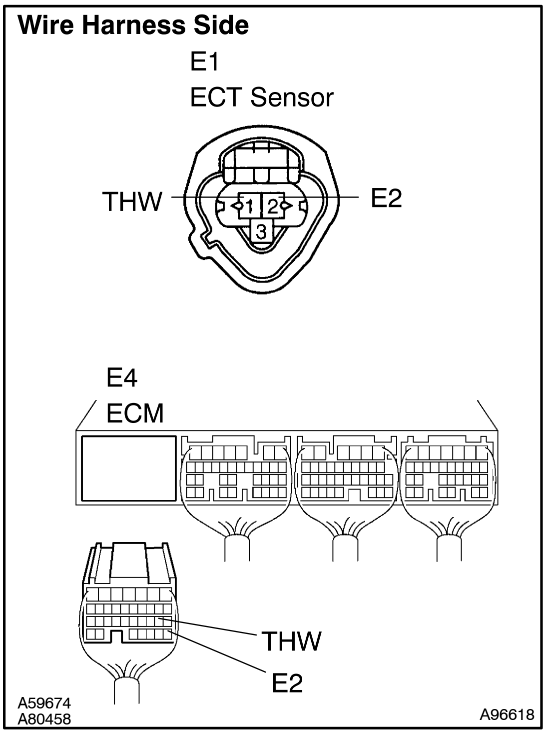
NOTICE:
If checking the ECT sensor in water, be careful not to allow water to contact the terminals. After checking, dry the sensor.

HINT:
Alternate procedure: Connect an ohmmeter to the installed ECT sensor and read the resistance. Use an infrared thermometer to measure the engine coolant temperature in the immediate vicinity of the sensor. Compare these values to the resistance/temperature graph. Change the ECT (warm up or allow to cool down) and repeat the test.

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK ↓

3 CHECK WIRE HARNESS (ECM – ECT SENSOR)



(a) Disconnect the E1 ECT sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
E1–1 (THW) – E4–19 (THW) E1–2 (E2) – E4–28 (E2)	Below 1 Ω
E4–19 (THW) – E4–28 (E2)	10 kΩ or higher

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

OK

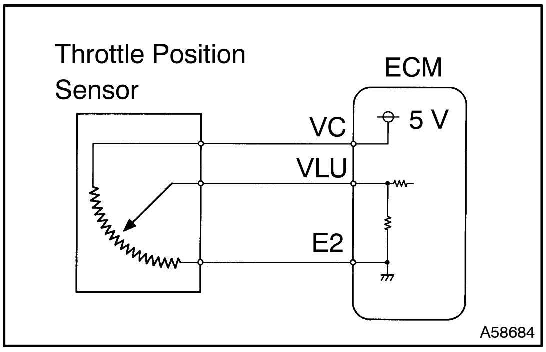
REPLACE ECM (See page 10–10)

DTC	P0120/41	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”A” CIRCUIT

DTC	P0122/41	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”A” CIRCUIT LOW INPUT

DTC	P0123/41	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”A” CIRCUIT HIGH INPUT

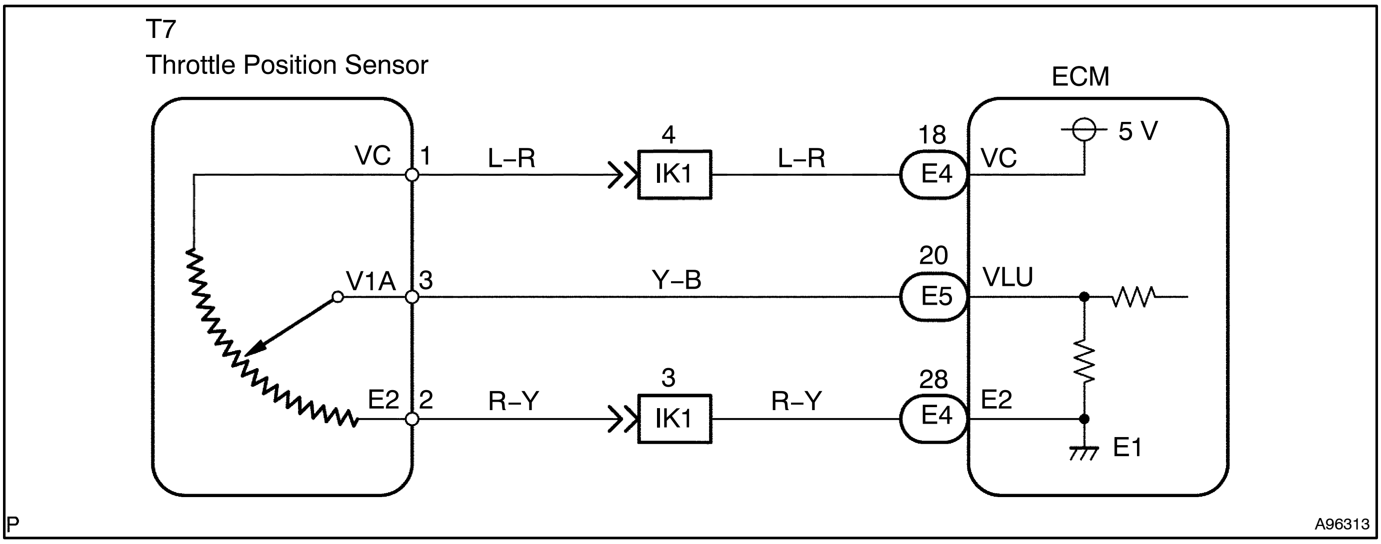
CIRCUIT DESCRIPTION



The throttle position sensor is mounted in the throttle body and detects the throttle valve (intake shutter) opening angle. When the throttle valve is fully closed, a voltage of approximately 0.7 V is applied to terminal VLU of the ECM. The voltage applied to terminal VLU of the ECM increases in proportion to the opening angle of the throttle valve and becomes approximately 3.5 to 5.0 V when the throttle valve is fully opened. The ECM judges the vehicles driving conditions from these signals input from terminal VLU, 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.	DTC Detection Condition	Trouble Area
Condition (a) of DTC P0120/41, P0122/41 or P0123/41 continues for 1 second (open or short in throttle position sensor circuit)		
P0120/41	Detection conditions for DTC P0122/41 and P0123/41 are not satisfied but condition (a) is satisfied. (a) VLU less than 0.2 V or VLU greater than 4.8 V	• Open or short in throttle position sensor circuit • Throttle position sensor • ECM
P0122/41	VLU less than 0.2 V	
P0123/41	VLU greater than 4.8 V	

WIRING DIAGRAM



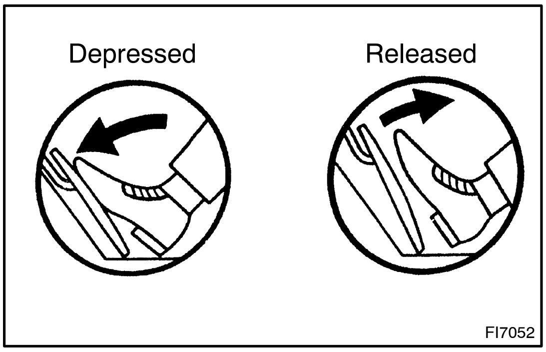
INSPECTION PROCEDURE

HINT:

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

When using hand–held tester:

1	READ VALUE OF DATA LIST (THROTTLE VALVE OPENING PERCENTAGE)



(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / THROTTLE POS. Read the values.

HINT:
The shift position should be neutral and the A/C switch should be turned OFF.

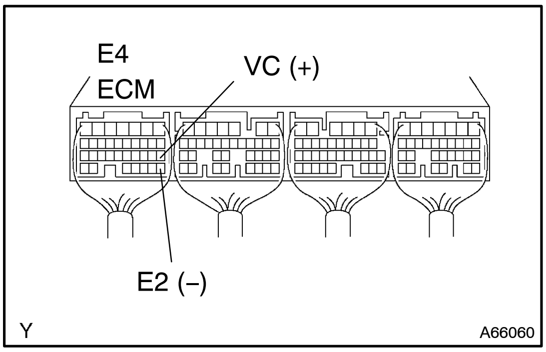
Standard:

Engine Connection	Throttle valve opening position expressed as percentage
Idling	Approx. 60 % to Approx. 80 %
2,000 rpm	Approx. 0 % to Approx. 5 %

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

NG

2 CHECK ECM (VC VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage of the ECM connector.

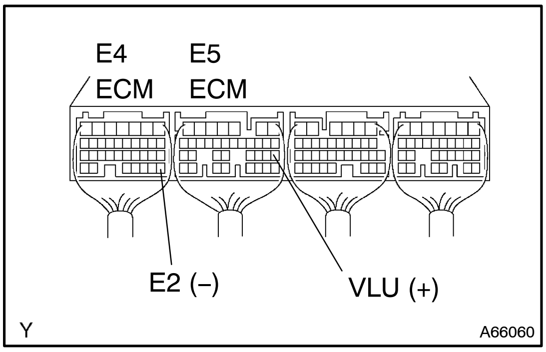
Standard:

Tester Connection	Specified Condition
E4–18 (VC) – E4–28 (E2)	4.5 to 5.5 V

NG ▷ **REPLACE ECM (See page 10–10)**

OK

3 CHECK ECM (VLU VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage of the E4 and E5 ECM connectors.

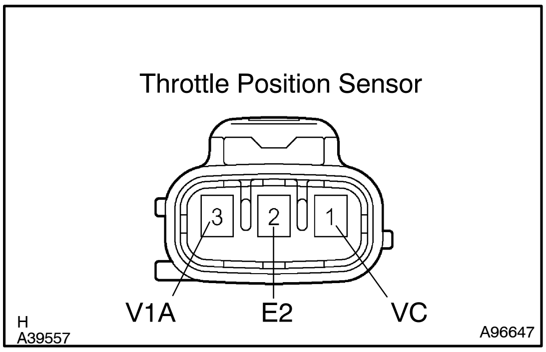
Standard:

Tester Connection	Accelerator Pedal Condition	Specified Condition
E5–20 (VLU) – E4–28 (E2)	Released	3.5 to 4.0 V
E5–20 (VLU) – E4–28 (E2)	Depressed	0.5 to 0.8 V
E5–20 (VLU) – E4–28 (E2)	Released → Depressed	Voltage changes constantly

OK ▷ **REPLACE ECM (See page 10–10)**

NG

4 INSPECT THROTTLE POSITION SENSOR



(a) Disconnect the T7 sensor connector.

(b) Measure the resistance of the sensor.

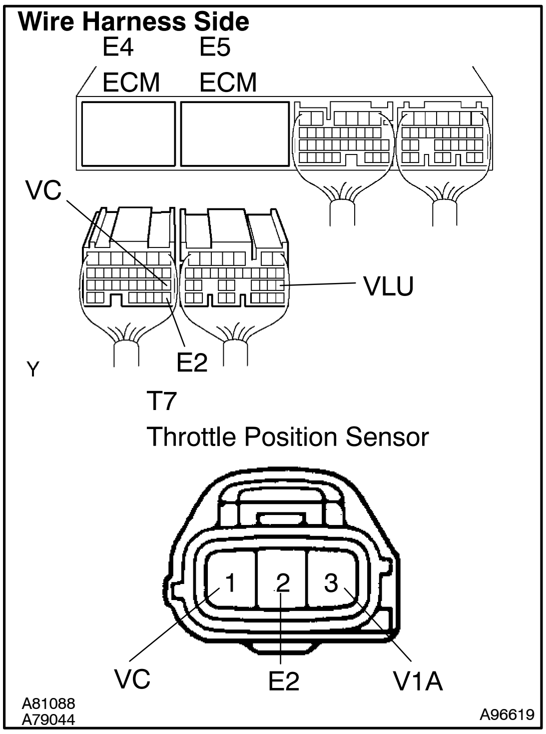
Standard:

Tester Connection	Throttle Valve Condition	Specified Condition
T7–3 (V1A) – T7–2 (E2)	Fully closed	0.2 to 5.7 kΩ
T7–3 (V1A) – T7–2 (E2)	Fully open	2.0 to 10.2 kΩ

NG ▷ **REPLACE THROTTLE POSITION SENSOR**

OK

5	CHECK WIRE HARNESS (ECM – THROTTLE POSITION SENSOR)



(a) Disconnect the E4 and E5 ECM connectors.
(b) Disconnect the T7 throttle position sensor connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
T7–1 (VC) – VC (E4–18) T7–3 (V1A) – E5–20 (VLU) T7–2 (E2) – E4–28 (E2)	Below 1 Ω
T7–1 (VC) or E4–18 (VC) – Body ground T7–3 (V1A) or E5–20 (VLU) – Body ground	10 kΩ or higher

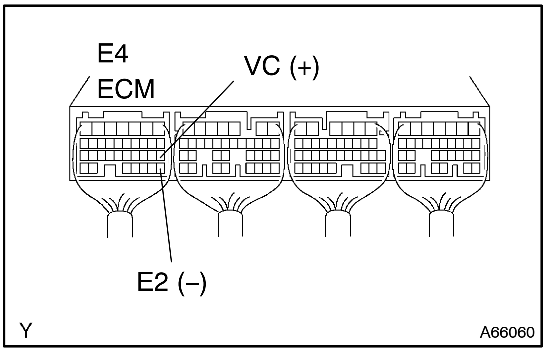
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM (See page 10–10)

When not using hand–held tester:

1	CHECK ECM (VC VOLTAGE)



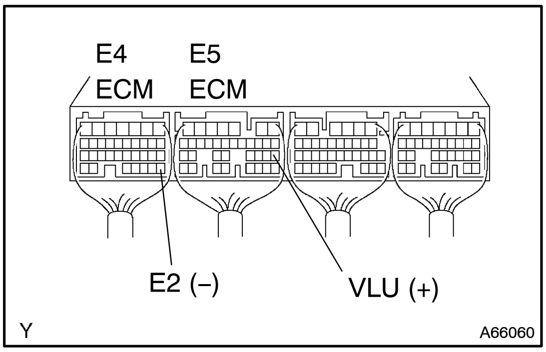
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Specified Condition
E4–18 (VC) – E4–28 (E2)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–10)**

OK

2 CHECK ECM (VLU VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage of the ECM connectors.

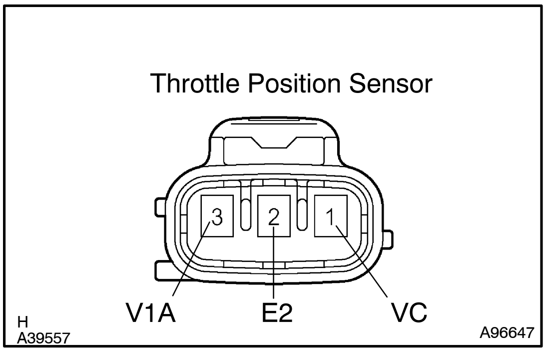
Standard:

Tester Connection	Accelerator Pedal Condition	Specified Condition
E5–20 (VLU) – E4–28 (E2)	Released	3.5 to 4.0 V
E5–20 (VLU) – E4–28 (E2)	Depressed	0.5 to 0.8 V
E5–20 (VLU) – E4–28 (E2)	Released → Depressed	Voltage changes constantly

OK → **REPLACE ECM (See page 10–10)**

NG

3 INSPECT THROTTLE POSITION SENSOR



(a) Disconnect the T7 sensor connector.

(b) Measure the resistance of the sensor.

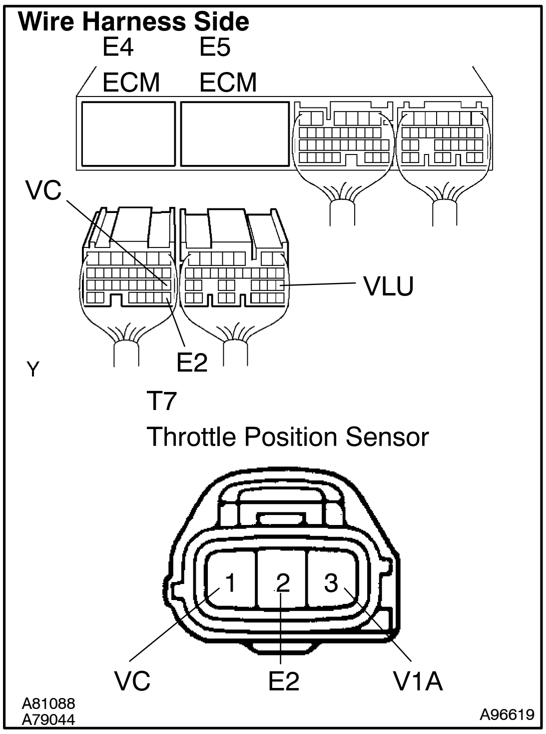
Standard:

Tester Connection	Throttle Valve Condition	Specified Condition
T7–3 (V1A) – T7–2 (E2)	Fully closed	0.2 to 5.7 kΩ
T7–3 (V1A) – T7–2 (E2)	Fully open	2.0 to 10.2 kΩ

NG → **REPLACE THROTTLE POSITION SENSOR**

OK

4 CHECK WIRE HARNESS (ECM – THROTTLE POSITION SENSOR)



(a) Disconnect the E4 and E5 ECM connectors.
(b) Disconnect the T7 throttle position sensor connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
T7–1 (VC) – VC (E4–18) T7–3 (V1A) – E5–20 (VLU) T7–2 (E2) – E4–28 (E2)	Below 1 Ω
T7–1 (VC) or E4–18 (VC) – Body ground T7–3 (V1A) or E5–20 (VLU) – Body ground	10 kΩ or higher

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

OK

REPLACE ECM **(See page 10–10)**

DTC	P0168/39	FUEL TEMPERATURE TOO HIGH

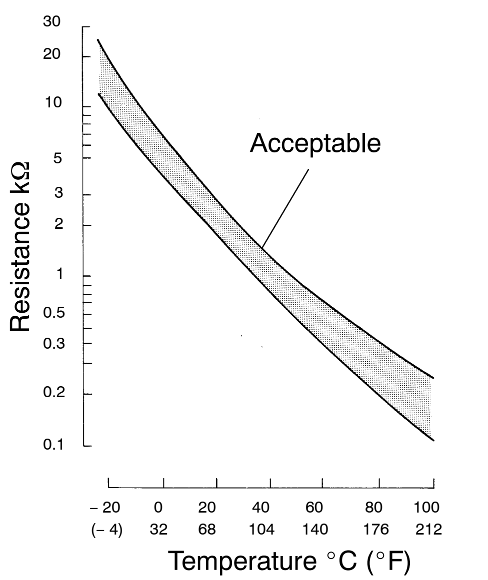
DTC	P0180/39	FUEL TEMPERATURE SENSOR ”A” CIRCUIT

DTC	P0182/39	FUEL TEMPERATURE SENSOR ”A” CIRCUIT LOW INPUT

DTC	P0183/39	FUEL TEMPERATURE SENSOR ”A” CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

(Fig.1)



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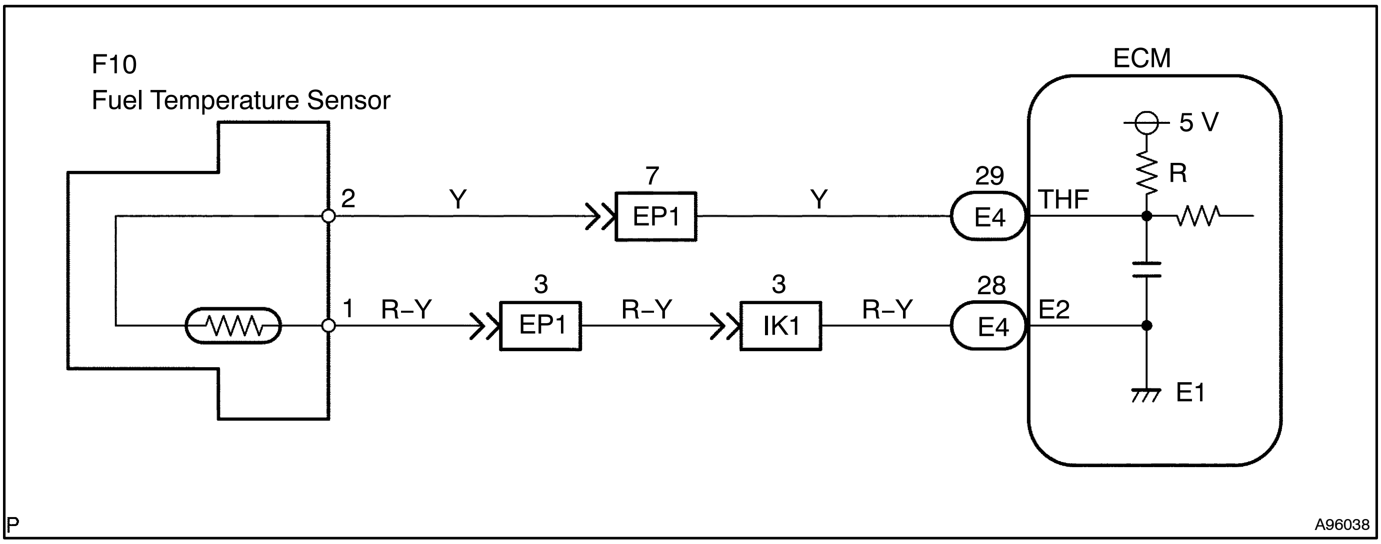
The fuel temperature sensor senses the fuel temperature. A thermistor built into the sensor changes the resistance value according to the fuel temperature. The lower the fuel temperature is, the greater the thermistor resistance becomes, and the higher the fuel temperature is, the lower the thermistor resistance becomes (see Fig. 1).
The fuel temperature sensor is connected to the ECM. The 5 V power source voltage in the ECM is applied to the fuel temperature sensor from terminal THF via resistor R. The resistor R and the fuel temperature sensor are connected in series. When the resistance value of the fuel temperature sensor changes in accordance with the fuel temperature, the voltage at terminal THF also changes. Based on this signal, the ECM corrects the pressure control compensation of the supply pump and an error.

DTC No.	DTC Detection Condition	Trouble Area
P0168/39	After engine is warmed up, conditions (a), (b) and (c) continue for more than 1 second: (a) Engine speed: 1,000 rpm or more (b) Vehicle speed: 10 km/h (6 mph) or more (c) Fuel temperature: 96°C (205°F) or more	• Open or short in fuel temperature sensor circuit • Fuel temperature sensor • ECM
P0180/39	Open or short in fuel temperature sensor circuit for 0.5 seconds	Same as DTC No. P0168/39
P0182/39	Short in fuel temperature sensor circuit for 0.5 seconds	Same as DTC No. P0168/39
P0183/39	Open in fuel temperature sensor circuit for 0.5 seconds	Same as DTC No. P0168/39

HINT:
After confirming DTC ”P0180/39, P0182/39 or P0183/39”, use the hand–held tester to confirm the fuel temperature from the FUEL TEMP menu (to reach the FUEL TEMP menu: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / FUEL TEMP).

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

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

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

When using hand–held tester:

1 READ VALUE OF DATA LIST (FUEL TEMPERATURE)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / FUEL TEMP. Read the values.
Standard: Same value as the actual fuel temperature.
Result:

Temperature Displayed	Proceed to
–40°C (–40°F)	A
140°C (284°F) or more	B
OK (same as actual fuel temperature)	C

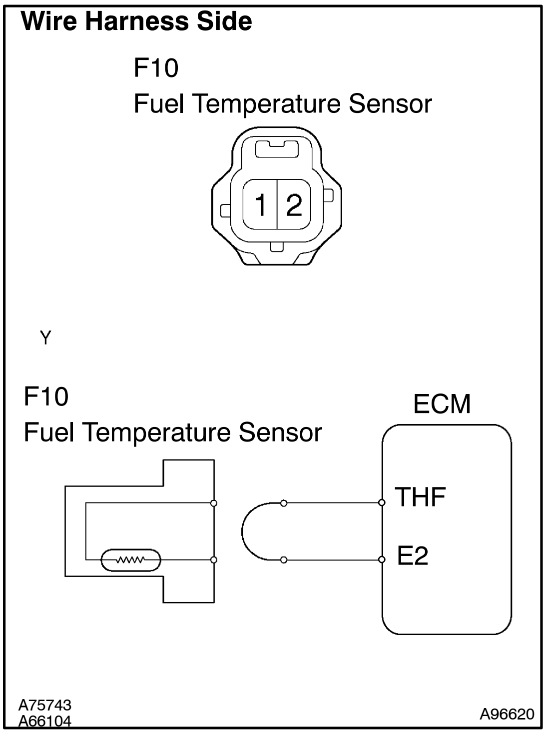
HINT:
- If there is an open circuit, the hand–held tester indicates –40°C (–40°F).
- If there is a short circuit, the hand–held tester indicates 140°C (284°F) or more.

B → **Go to step 4**

C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

A ↓

2 READ VALUE OF DATA LIST (CHECK FOR OPEN IN WIRE HARNESS)

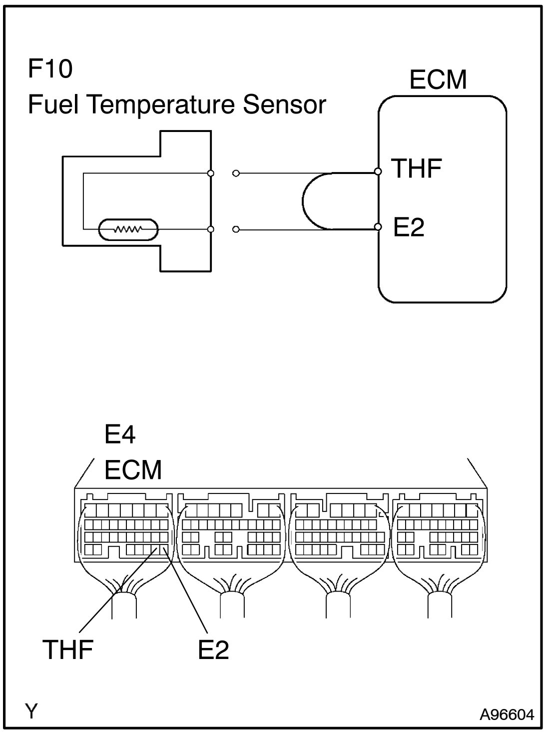


(a) Disconnect the F10 sensor connector.
(b) Connect terminals 1 and 2 of the wire harness side connector.
(c) Turn the ignition switch ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / FUEL TEMP. Read the values.
Standard: 140°C (284°F) or more

OK → **CONFIRM GOOD CONNECTION AT SENSOR. IF OK, REPLACE FUEL TEMPERATURE SENSOR**

NG ↓

3 READ VALUE OF DATA LIST (CHECK FOR OPEN IN ECM)



(a) Disconnect the F10 sensor connector.
(b) Connect terminals THF and E2 of the E4 ECM connector.

HINT:
Before checking, do a visual and contact pressure check for the ECM connector.

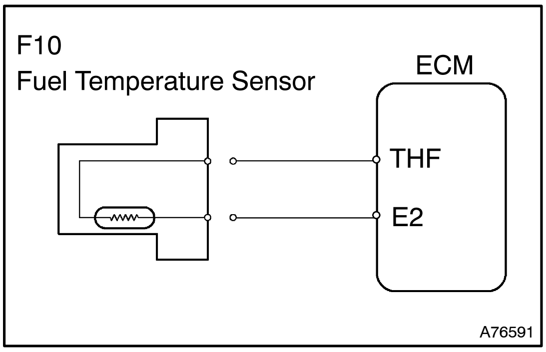
(c) Turn the ignition switch ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / FUEL TEMP. Read the values.
Standard: 140°C (284°F) or more

NG → **CONFIRM GOOD CONNECTION AT ECM. IF OK, REPLACE ECM (See page 10–10)**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

4 READ VALUE OF DATA LIST (CHECK FOR SHORT IN WIRE HARNESS)

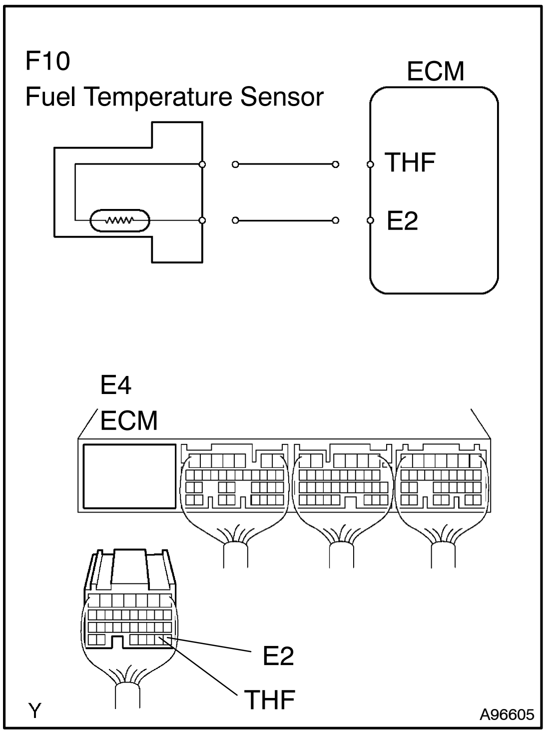


(a) Disconnect the F10 sensor connector.
(b) Turn the ignition switch ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / FUEL TEMP. Read the values.
Standard: –40°C (–40°F)

OK → **REPLACE FUEL TEMPERATURE SENSOR**

NG

5	READ VALUE OF DATA LIST (CHECK FOR SHORT IN ECM)



(a) Disconnect the E4 ECM connector.
(b) Turn the ignition switch ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / Fuel temp. Read the values.
Standard: –40°C (–40°F)

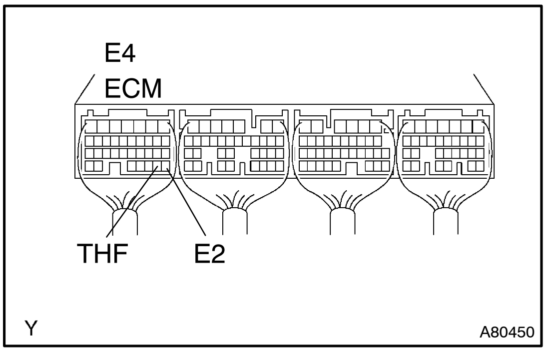
NG → **REPLACE ECM (See page 10–10)**

OK ↓

REPAIR OR REPLACE HARNESS AND CONNECTOR

When not using hand–held tester:

1	CHECK ECM (THF VOLTAGE)



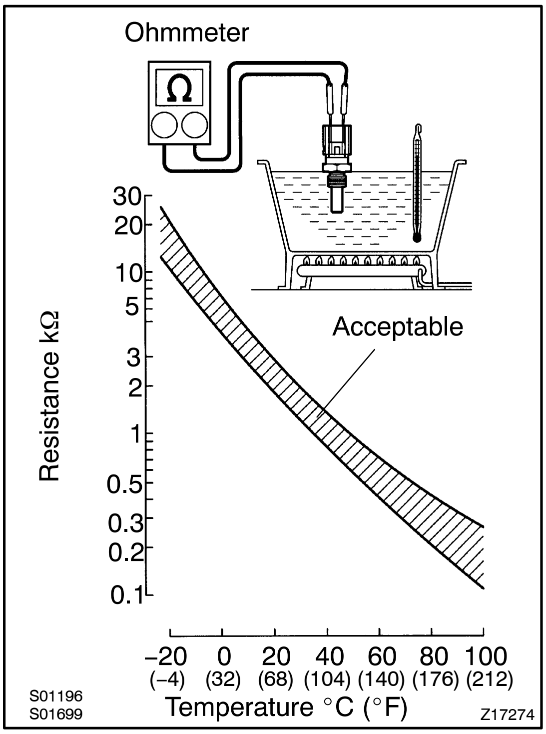
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Condition	Specified Condition
E4–29 (THF) – E4–28 (E2)	Ignition switch ON (engine is cold)	1.2 to 1.6 V

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

NG ↓

2 INSPECT FUEL TEMPERATURE SENSOR



(a) Remove the fuel temperature sensor.

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

Standard:

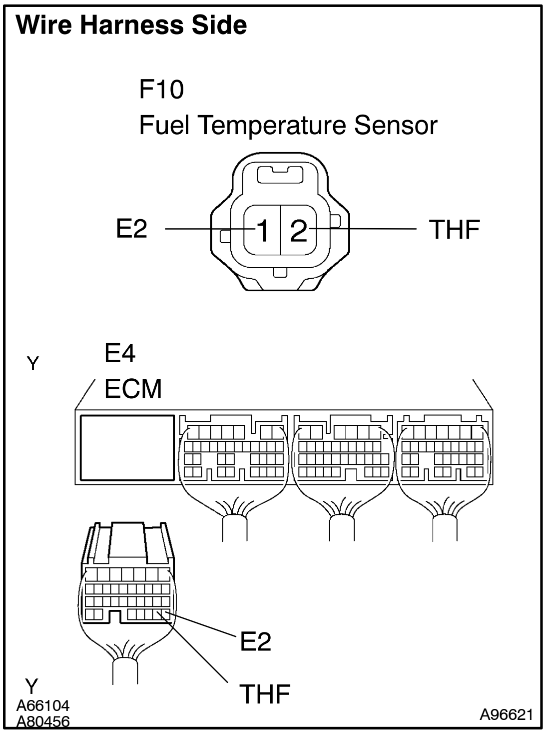
Connection	Specified Condition
20°C (68°F)	2.32 to 2.59 kΩ
80°C (176°F)	0.310 to 0.326 kΩ

NOTICE:
If checking the ECT sensor in the water, be careful not to allow water to go into the terminals, and after checking, wipe out the sensor.

NG → **REPLACE FUEL TEMPERATURE SENSOR**

OK

3 CHECK WIRE HARNESS (ECM – FUEL TEMPERATURE SENSOR)



(a) Disconnect the F10 sensor connector.

(b) Disconnect the E4 ECM connector.

(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
F10–2 (THF) – E4–29 (THF) F10–1 (E2) – E4–28 (E2)	Below 1 Ω
E4–29 (THF) – E4–28 (E2)	10 kΩ or higher

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

OK

REPLACE ECM (See page 10–10)

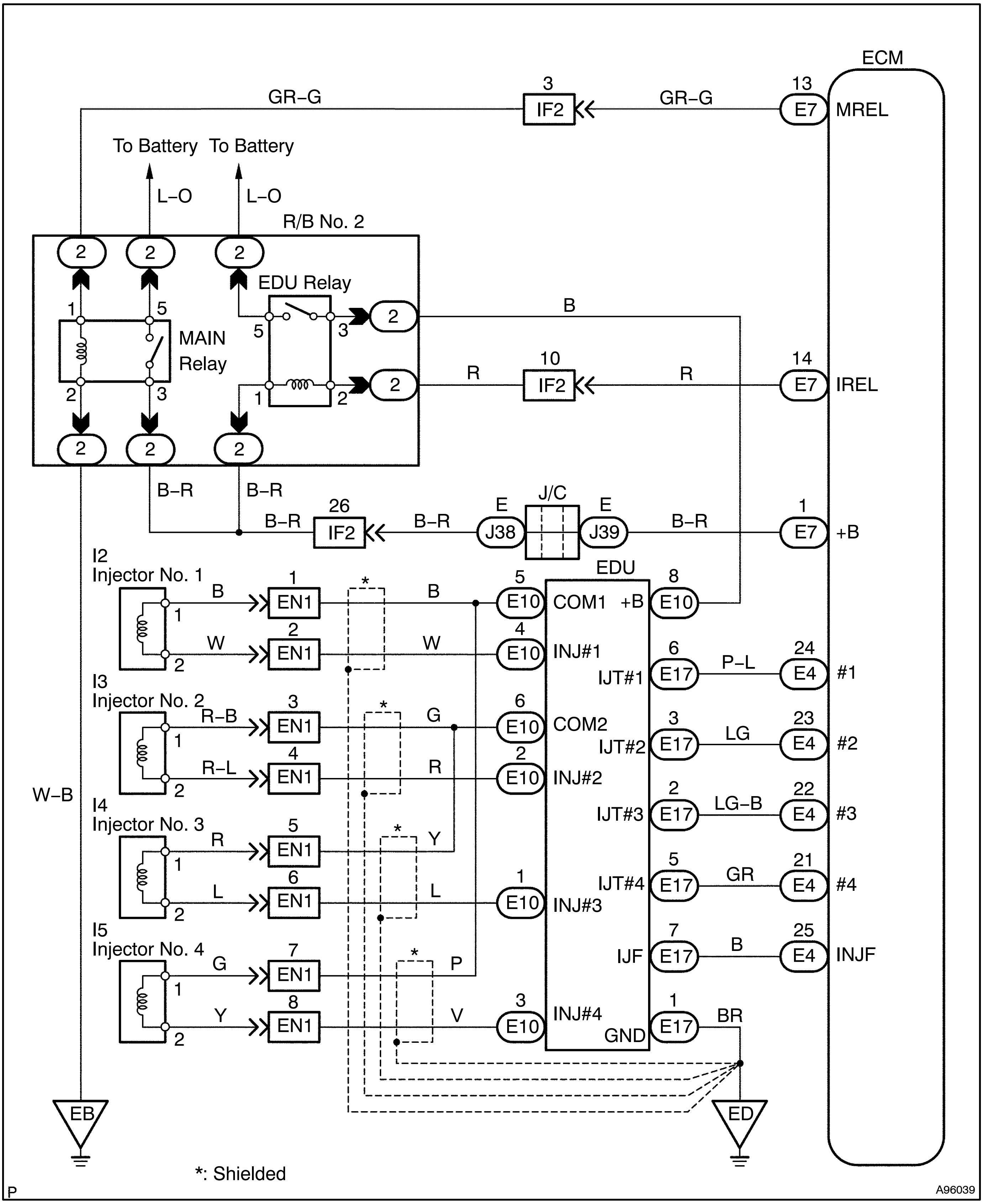
DTC P0200/97 INJECTOR CIRCUIT / OPEN

CIRCUIT DESCRIPTION

The EDU has been adopted to drive the injector at high speeds. The EDU has realized high–speed driving under high fuel pressure conditions through the use of a DC/DC converter that provides a high–voltage, quick–charging system.
The ECM constantly monitors the EDU and stops the engine if an abnormal condition is detected.

DTC No.	DTC Detection Condition	Trouble Area
P0200/97	Open or short in EDU or injector circuit. After engine is started, there is no injection confirmation signal (IJF) from EDU to ECM, despite ECM sending injection command signal (IJT) to EDU.	• Open or short in EDU circuit • Injector • EDU • ECM

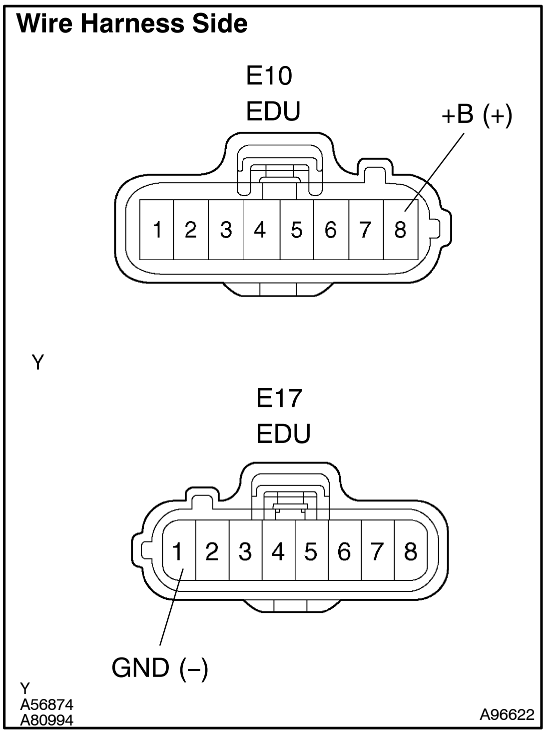
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK EDU (+B VOLTAGE)



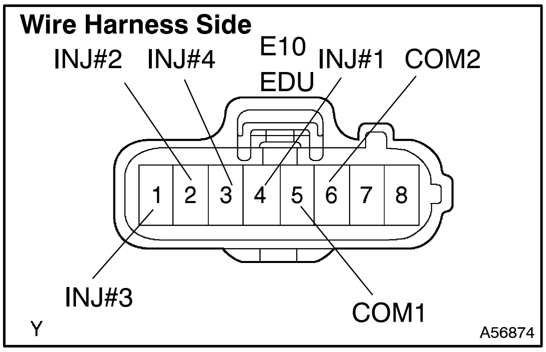
(a) Disconnect the E10 and E17 EDU connectors.
(b) Turn the ignition switch ON.
(c) Measure the voltage of the EDU connectors.
Standard:

Tester Connection	Specified Condition
E10–8 (+B) – E17–1 (GND)	18 to 27 V

NG → **CHECK EDU POWER SOURCE CIRCUIT (BATTERY – EDU)**

OK

2 CHECK EDU (INJECTOR RESISTANCE)



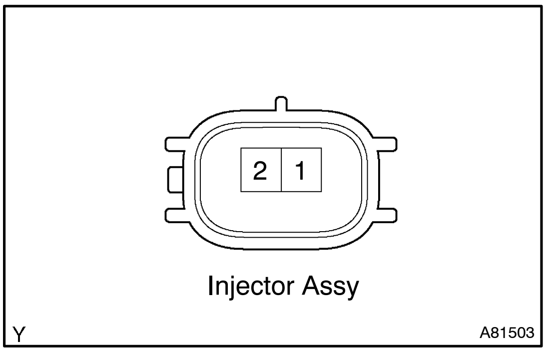
(a) Disconnect the E10 EDU connector.
(b) Measure the resistance of the EDU connector.
Standard:

Tester Connection	Condition	Specified Condition
E10–4 (INJ#1) – E10–5 (COM1) E10–2 (INJ#2) – E10–6 (COM2) E10–1 (INJ#3) – E10–6 (COM2) E10–3 (INJ#4) – E10–5 (COM1)	20°C (68°F)	0.35 to 0.55 Ω

OK → **Go to step 4**

NG

3 INSPECT INJECTOR ASSY



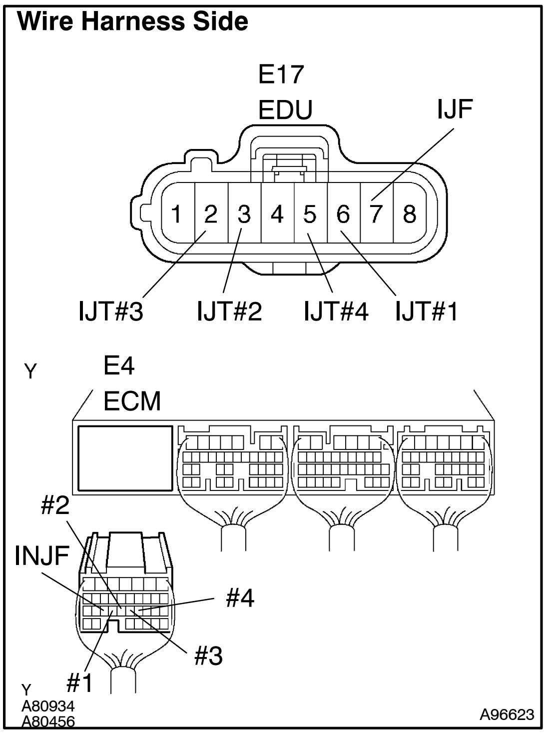
(a) Measure the resistance between the terminals.
Standard: 0.35 to 0.55 Ω at 20°C (68°F)

NG → **REPLACE INJECTOR ASSY (See page 11–20)**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

4 CHECK WIRE HARNESS (EDU – ECM)



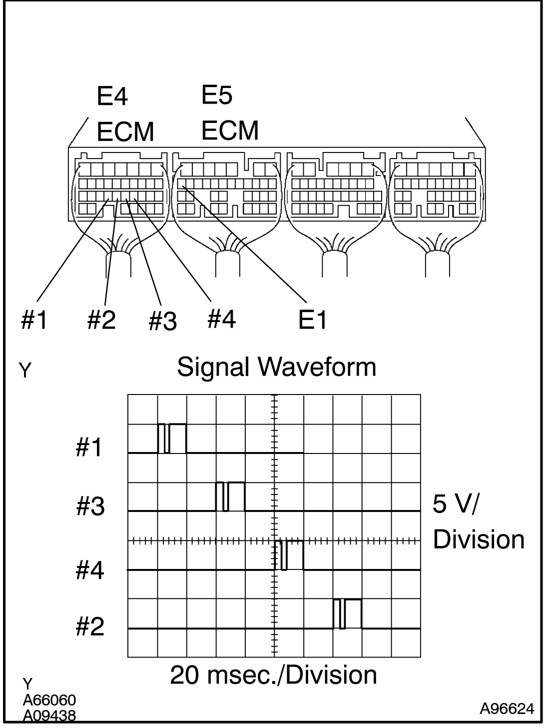
(a) Disconnect the E17 EDU connector.
(b) Disconnect the E4 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
E17–6 (IJT#1) – E4–24 (#1) E17–3 (IJT#2) – E4–23 (#2) E17–2 (IJT#3) – E4–22 (#3) E17–5 (IJT#4) – E4–21 (#4) E17–7 (IJF) – E4–25 (INJF)	Below 1 Ω
E4–24 (#1) or E17–6 (IJT#1) – Body ground E4–23 (#2) or E17–3 (IJT#2) – Body ground E4–22 (#3) or E17–2 (IJT#3) – Body ground E4–21 (#4) or E17–5 (IJT#4) – Body ground E4–25 (INJF) or E17–7 (IJF) – Body ground	10 kΩ or higher

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

OK

5 CHECK ECM



(a) Inspect using an oscilloscope.

(1) While the engine is idling, check the waveform of the ECM connectors.

Standard:

Tester Connection	Specified Condition
E4–24 (#1) – E5–7 (E1) E4–23 (#2) – E5–7 (E1) E4–22 (#3) – E5–7 (E1) E4–21 (#4) – E5–7 (E1)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10–10)**

OK

REPLACE EDU

DTC	P0263/78	CYLINDER 1 CONTRIBUTION/BALANCE

DTC	P0266/78	CYLINDER 2 CONTRIBUTION/BALANCE

DTC	P0269/78	CYLINDER 3 CONTRIBUTION/BALANCE

DTC	P0272/78	CYLINDER 4 CONTRIBUTION/BALANCE

HINT:
These DTCs indicate a malfunction related to the primary circuit.

- If DTC P0263/78 is displayed, check injector No. 1 circuit.
- If DTC P0266/78 is displayed, check injector No. 2 circuit.
- If DTC P0269/78 is displayed, check injector No. 3 circuit.
- If DTC P0272/78 is displayed, check injector No. 4 circuit.

CIRCUIT DESCRIPTION

Refer to DTC P0200/97 on page 05–98.

DTC No.	DTC Detection Condition	Trouble Area
P0263/78 P0266/78 P0269/78 P0272/78	Conditions (a), (b) and (c) continue more than 200 times with engine speed 500 to 1,000 rpm: (a) Engine coolant temperature: 60°C (140°F) or more (b) Difference of compensation value between cylinders is 15 mm^3/sec or more (c) 0 mm^3/st ≦ injection volume ≦ 30 mm^3/st	• Open or short in EDU circuit • Injector • EDU

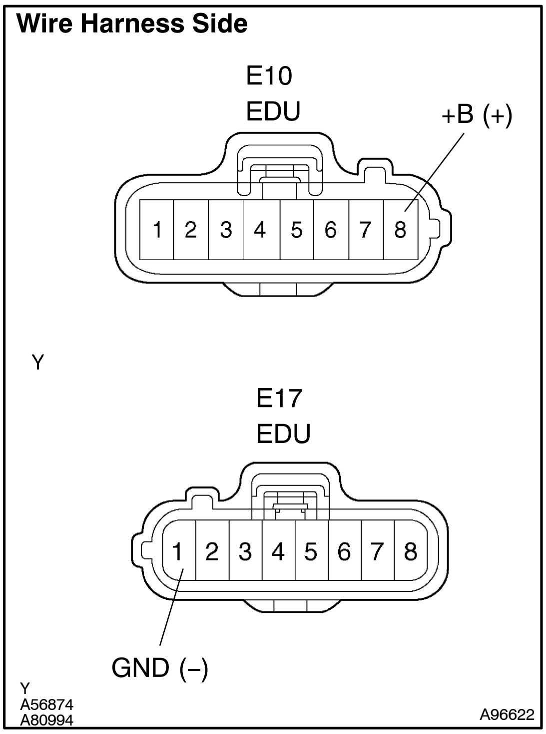
WIRING DIAGRAM

Refer to DTC No. P0200/97 on page 05–98.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK EDU (+B VOLTAGE)



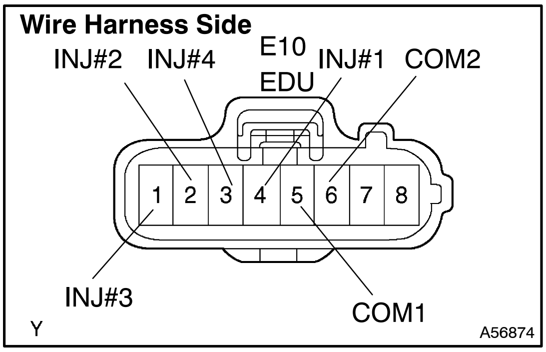
(a) Disconnect the E10 and E17 EDU connectors.
(b) Measure the voltage of the wire harness side connectors.
Standard:

Tester Connection	Condition	Specified Condition
E10–8 (+B) – E17–1 (GND)	Ignition switch ON	18 to 27 V

NG → **CHECK EDU POWER SOURCE CIRCUIT (BATTERY – EDU)**

OK

2 CHECK EDU (INJECTOR RESISTANCE)



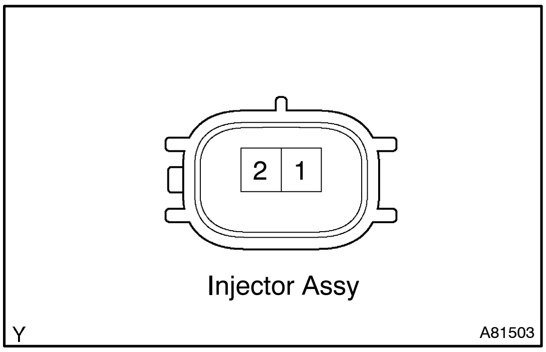
(a) Disconnect the E10 EDU connector.
(b) Measure the resistance of the EDU connector.
Standard:

Tester Connection	Condition	Specified Condition
E10–4 (INJ#1) – E10–5 (COM1) E10–2 (INJ#2) – E10–6 (COM2) E10–1 (INJ#3) – E10–6 (COM2) E10–3 (INJ#4) – E10–5 (COM1)	20°C (68°F)	0.35 to 0.55 Ω

OK → **Go to step 4**

NG

3 INSPECT INJECTOR ASSY



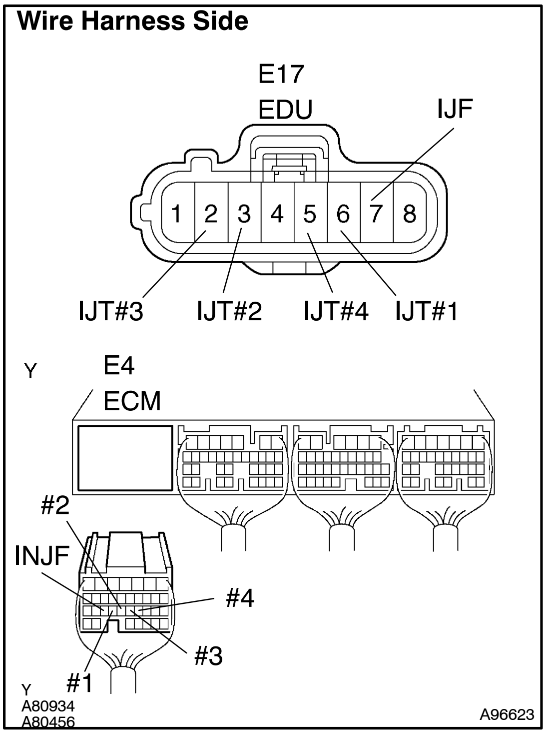
(a) Measure the resistance between the terminals.
Standard: 0.35 to 0.55 Ω at 20°C (68°F)

NG **REPLACE INJECTOR ASSY (See page 11–20)**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

4 CHECK WIRE HARNESS (EDU – ECM)



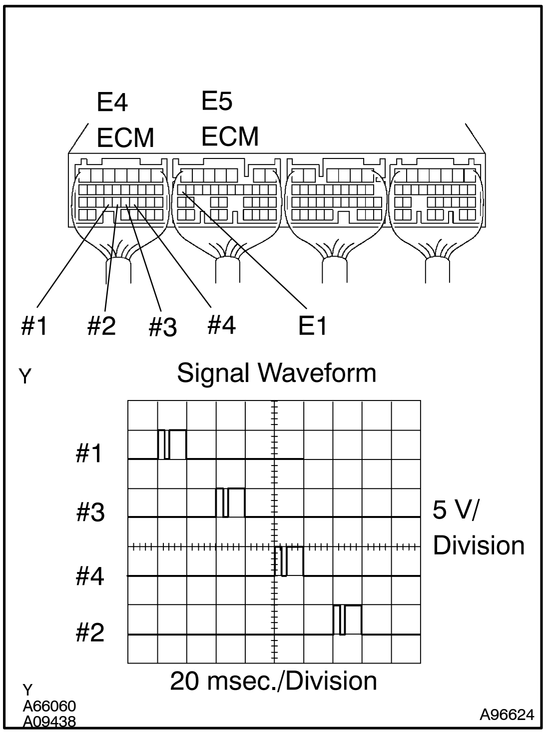
(a) Disconnect the E17 EDU connector.
(b) Disconnect the E4 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
E17–6 (IJT#1) – E4–24 (#1) E17–3 (IJT#2) – E4–23 (#2) E17–2 (IJT#3) – E4–22 (#3) E17–5 (IJT#4) – E4–21 (#4) E17–7 (IJF) – E4–25 (INJF)	Below 1 Ω
E4–24 (#1) or E17–6 (IJT#1) – Body ground E4–23 (#2) or E17–3 (IJT#2) – Body ground E4–22 (#3) or E17–2 (IJT#3) – Body ground E4–21 (#4) or E17–5 (IJT#4) – Body ground E4–25 (INJF) or E17–7 (IJF) – Body ground	10 kΩ or higher

NG **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

5	CHECK ECM



(a) Inspect using an oscilloscope.

(1) While the engine is idling, check the waveform of the ECM connectors.

Standard:

Tester Connection	Specified Condition
E4–24 (#1) – E5–7 (E1) E4–23 (#2) – E5–7 (E1) E4–22 (#3) – E5–7 (E1) E4–21 (#4) – E5–7 (E1)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10–10)**

OK

REPLACE EDU

DTC	P0335/12	CRANKSHAFT POSITION SENSOR ”A” CIRCUIT

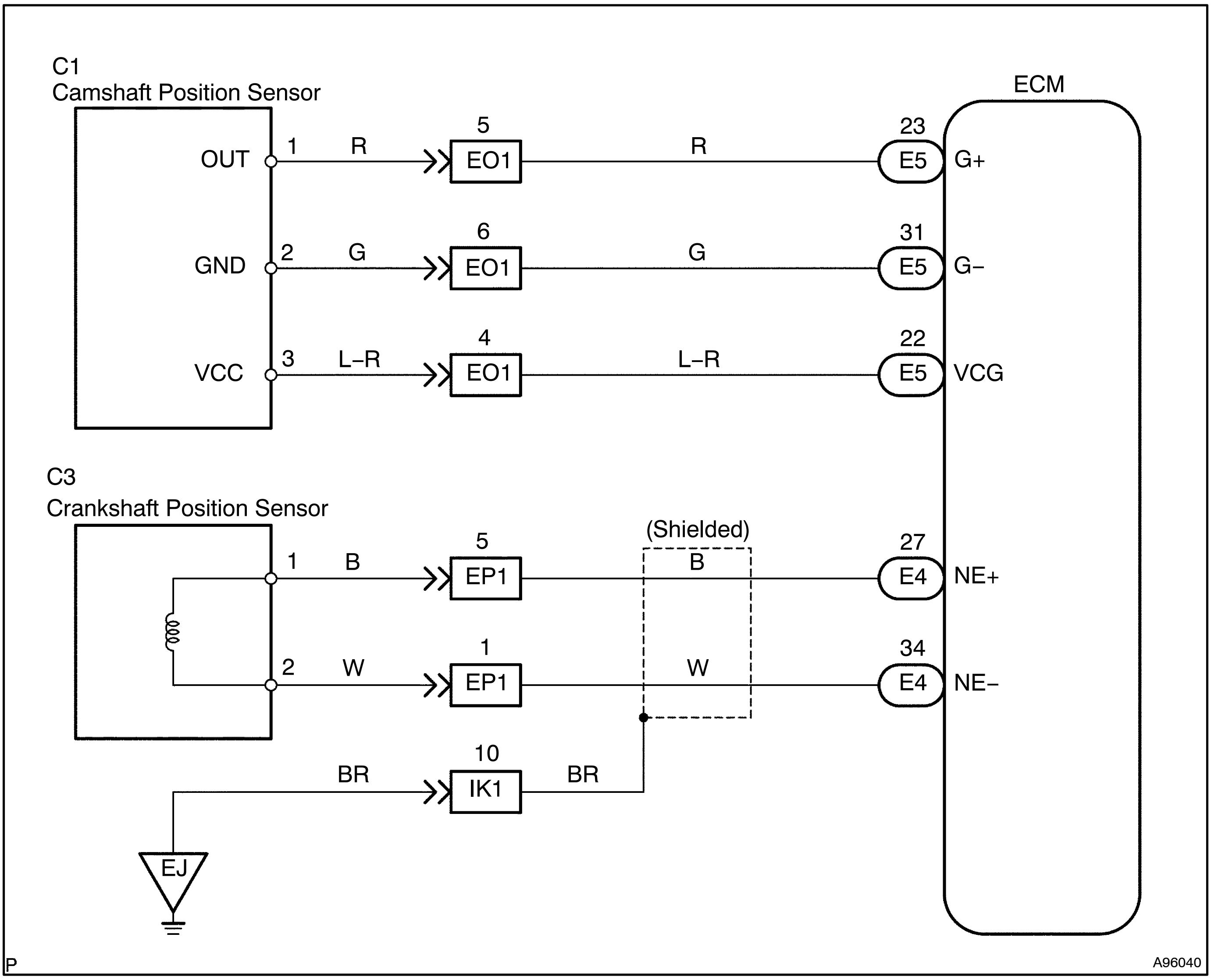
DTC	P0339/13	CRANKSHAFT POSITION SENSOR ”A” CIRCUIT INTERMITTENT

CIRCUIT DESCRIPTION

The crankshaft position sensor (NE signal) consists of a magnet, iron core and pickup coil.
The crankshaft angle sensor plate has 32 teeth and is installed on the injection pump drive gear. The NE signal sensor generates 32 signals of every engine revolution. The ECM detects the standard crankshaft angle based on the G signal from the camshaft position sensor, and the actual crankshaft angle and the engine speed by the NE signal.

DTC No.	DTC Detection Condition	Trouble Area
P0335/12	No crankshaft position sensor signal to ECM while cranking for 4.7 seconds or more	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Crankshaft angle sensor plate • ECM
P0339/13	In conditions (a), (b) and (c), no crankshaft position sensor (NE) signal is input for 0.05 seconds or more. (a) Engine revolution 1,000 rpm or more (b) NE signal is OFF (c) 3 seconds or more has lapsed after STA signal is switched from ON to OFF	Same as DTC No. P0115/22

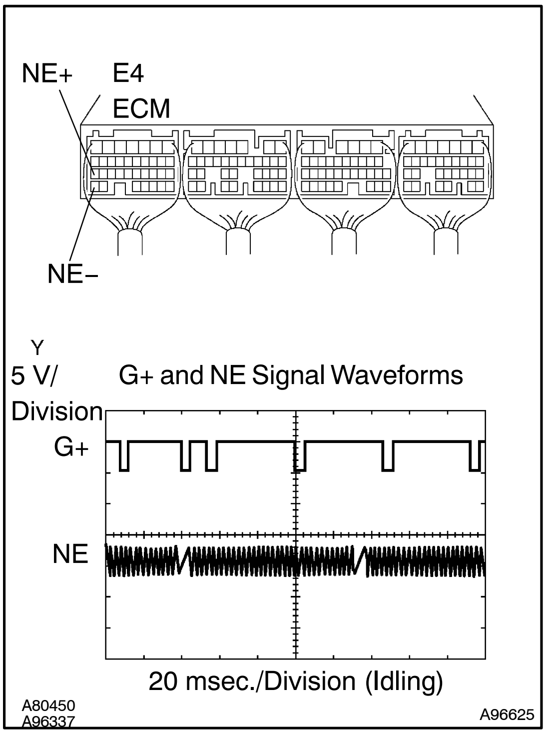
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK CRANKSHAFT POSITION SENSOR



(a) Inspect using an oscilloscope.
  (1) While the engine is idling, check the waveform of the ECM connector.

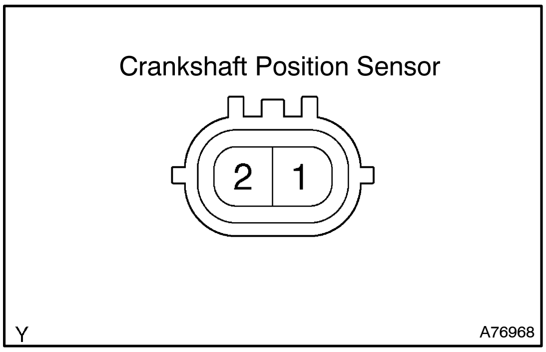
Standard:

Tester Connection	Specified Condition
E4–27 (NE+) – E4–34 (NE–)	Correct waveform is as shown

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

NG

2 INSPECT CRANKSHAFT POSITION SENSOR (RESISTANCE)



(a) Measure the resistance between terminals 1 and 2.

Standard:

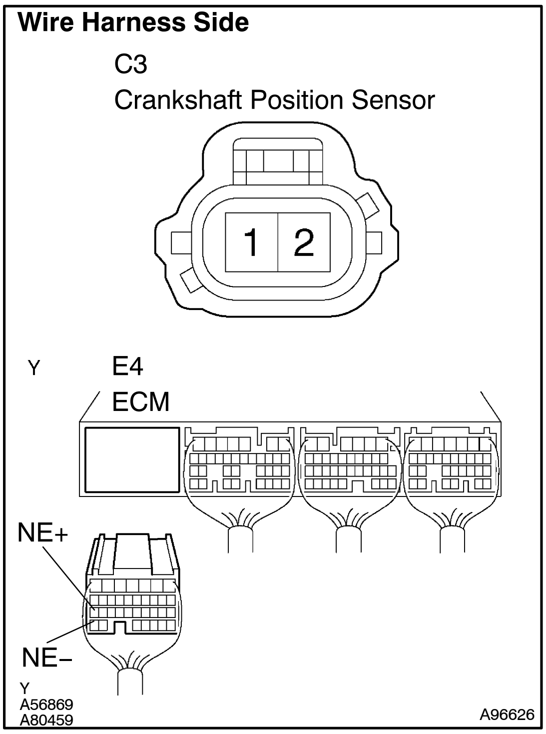
Condition	Specified Condition
Cold	1,630 to 2,740 Ω
Hot	2,065 to 3,225 Ω

NOTICE:
In the above section, the terms ”Cold” and ”Hot” refer to the temperature of the coils. ”Cold” means approximately –10 to 50°C (14 to 122°F). ”Hot” means approximately 50 to 100°C (122 to 212°F).

NG → **REPLACE CRANKSHAFT POSITION SENSOR**

OK

3 CHECK WIRE HARNESS (CRANKSHAFT POSITION SENSOR – ECM)



(a) Disconnect the C3 sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

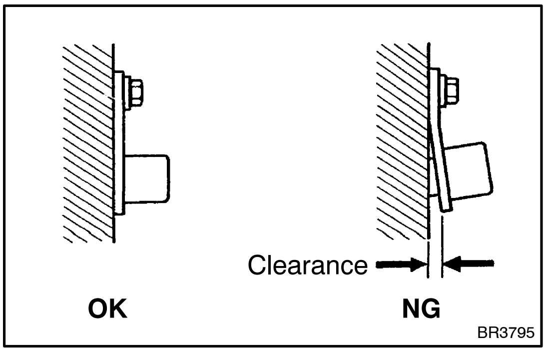
Standard:

Tester Connection	Specified Condition
C3–1 (Crankshaft position sensor) – E4–27 (NE+) C3–2 (Crankshaft position sensor) – E4–34 (NE–)	Below 1 Ω
C3–1 (Crankshaft position sensor) or E4–27 (NE+) – Body ground C3–2 (Crankshaft position sensor) or E4–34 (NE–) – Body ground	10 kΩ or higher

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

OK

4 CHECK SENSOR INSTALLATION (CRANKSHAFT POSITION SENSOR)



OK:
The crankshaft position sensor is installed properly.

NG → **TIGHTEN SENSOR**

OK

5 CHECK CRANKSHAFT ANGLE SENSOR PLATE

(a) Check the teeth of the crankshaft angle sensor plate.

NG → **REPLACE CRANKSHAFT POSITION SENSOR PLATE**

OK

REPLACE ECM (See page 10–10)

DTC	P0340/12	CAMSHAFT POSITION SENSOR ”A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

CIRCUIT DESCRIPTION

The camshaft position sensor (G signal) consists of a magnet and MRE element.
The camshaft drive gear has 5 teeth on its inner circumference. When the camshaft gear rotates, air gap changes between the protrusion on the gear and the pickup coil. The change affects the magnetic field and result in change in the resistance of the MRE element. The crankshaft angle sensor plate has 32 teeth and output 32 signals every engine revolution. The ECM detects the standard crankshaft angle based on the G signal and actual crankshaft angle and engine speed by NE signal.

DTC No.	DTC Detection Condition	Trouble Area
P0340/12	STA ON: No camshaft position sensor signal to ECM during cranking 4 times or more STA OFF: No camshaft position sensor signal to ECM with engine speed 650 to 3,000 rpm 20 times or more	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft drive gear • ECM

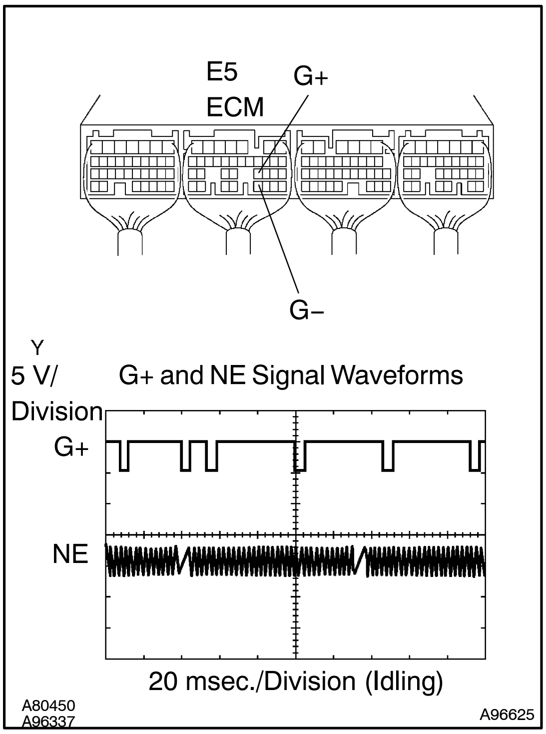
WIRING DIAGRAM

Refer to DTC P0335/12 on page 05–107.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK CAMSHAFT POSITION SENSOR



(a) Inspect using an oscilloscope.
  (1) While the engine is idling, check the waveform of the ECM connector.

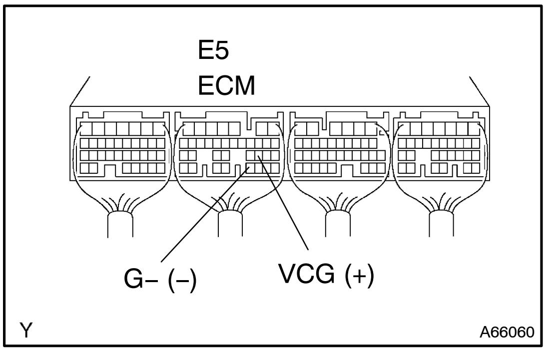
Standard:

Tester Connection	Specified Condition
E5–23 (G+) – E5–31 (G–)	Correct waveform is as shown

NG → **REPLACE CAMSHAFT POSITION SENSOR**

OK

2 CHECK ECM (VCG VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.

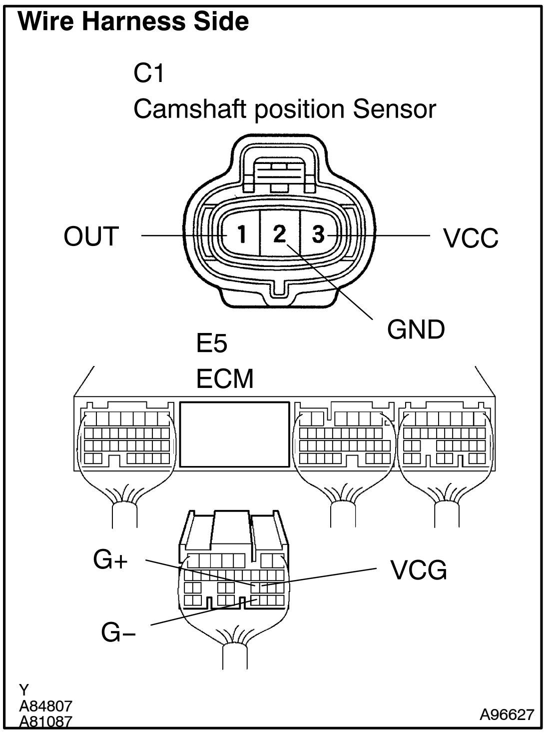
Standard:

Tester Connection	Specified Condition
E5–22 (VCG) – E5–31 (G–)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–10)**

OK

3	CHECK WIRE HARNESS (CAMSHAFT POSITION SENSOR – ECM)



(a) Disconnect the C1 camshaft position sensor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

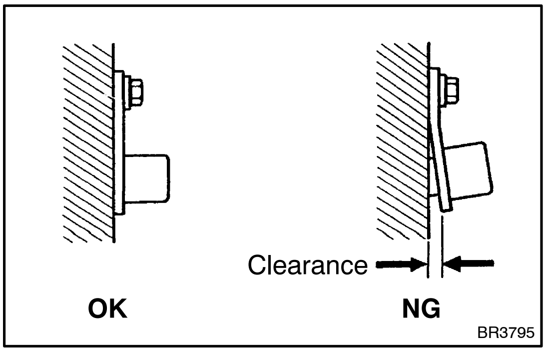
Standard:

Tester Connection	Specified Condition
C1–1 (OUT) – E5–23 (G+) C1–2 (GND) – E5–31 (G–) C1–3 (VCC) – E5–22 (VCG)	Below 1 Ω
C1–1 (OUT) or E5–23 (G+) – Body ground C1–2 (GND) or E5–31 (G–) – Body ground C1–3 (VCC) or E5–22 (VCG) – Body ground	10 kΩ or higher

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

OK

4	CHECK SENSOR INSTALLATION (CAMSHAFT POSITION SENSOR)



OK:
The camshaft position sensor is installed properly.

NG → **TIGHTEN SENSOR**

OK

5	INSPECT CAMSHAFT DRIVE GEAR

(a) Check the teeth of the camshaft drive gear.

NG → **REPLACE CAMSHAFT DRIVE GEAR**

OK

6	REPLACE CAMSHAFT POSITION SENSOR

GO

7 CHECK DTC OUTPUT

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result:

Display (DTC output)	Proceed to
P0340/12 is output	A
No DTC is output	B

B → **SYSTEM IS OK**

A ↓

REPLACE ECM (See page 10–10)

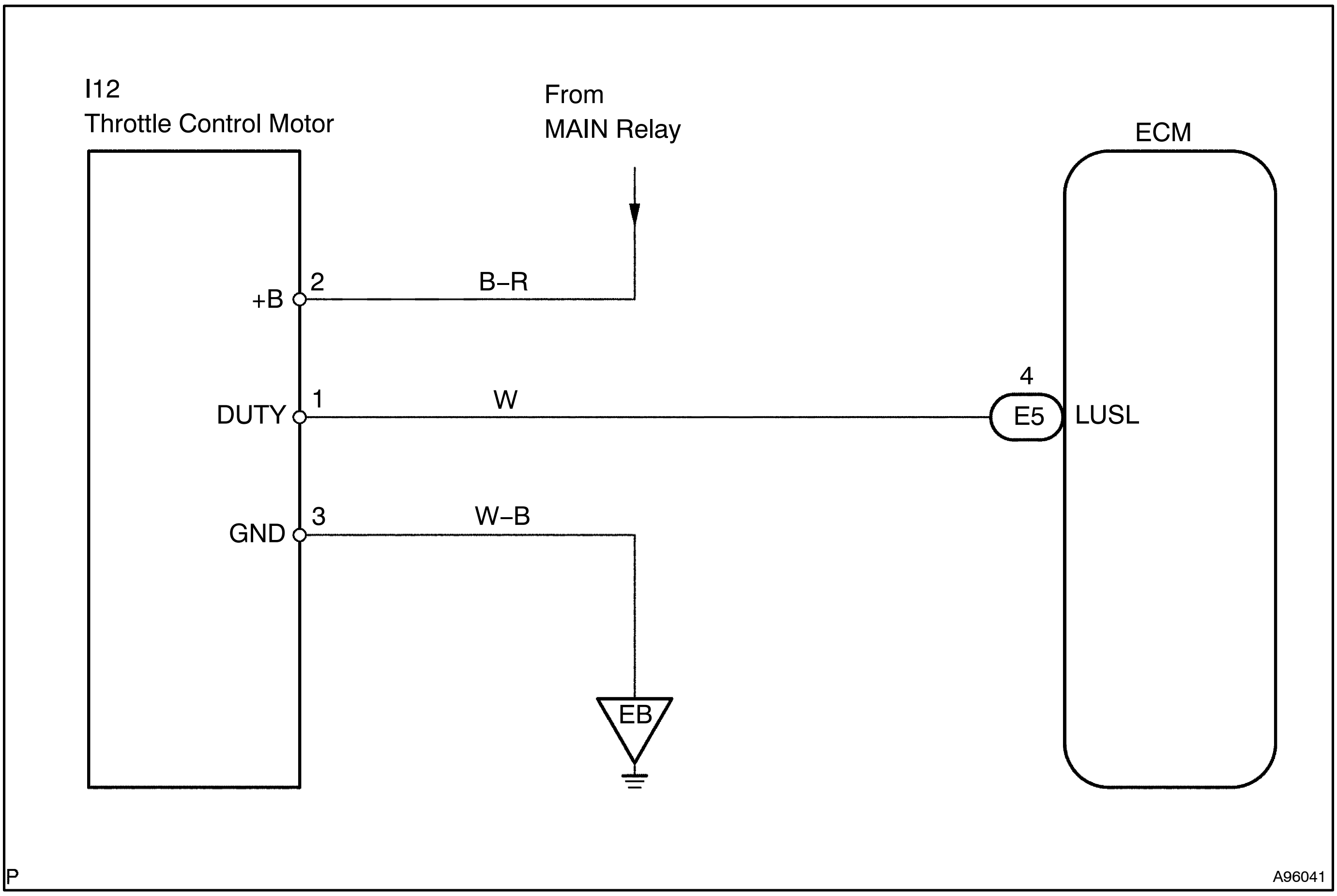
DTC	P0488/15	EXHAUST GAS RECIRCULATION THROTTLE POSITION CONTROL RANGE/PERFORMANCE

CIRCUIT DESCRIPTION

The throttle control motor opens and closes the throttle valve according to a duty–cycle (signal) from the ECM.

DTC No.	DTC Detection Condition	Trouble Area
P0488/15	Conditions (a) or (b) continue for more than 1 second (a) Battery voltage: 18.5 V or more Throttle motor's activation duty is out of the normal range (10 > activation duty ≧ 90) (b) Open, short or stuck in throttle sensor	• Open or short in throttle control motor circuit • Throttle control motor • ECM

WIRING DIAGRAM

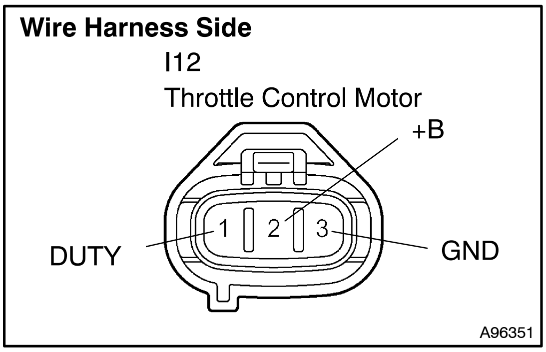


INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK THROTTLE CONTROL MOTOR (+B VOLTAGE)



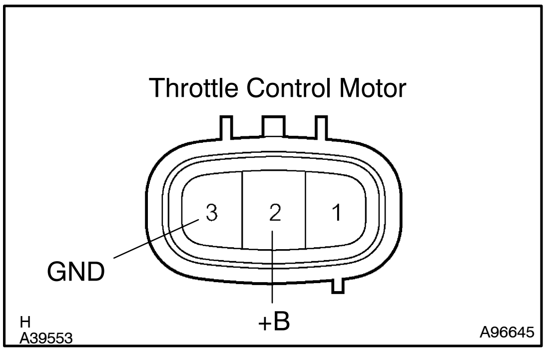
(a) Turn the ignition switch ON.
(b) Disconnect the I12 throttle control motor connector.
(c) Measure the voltage of the wire harness side connector.
Standard:

Tester Connection	Specified Condition
I12–2 (+B) – Body ground	18 to 27 V

NG → **Go to step 3**

OK

2 INSPECT THROTTLE CONTROL MOTOR



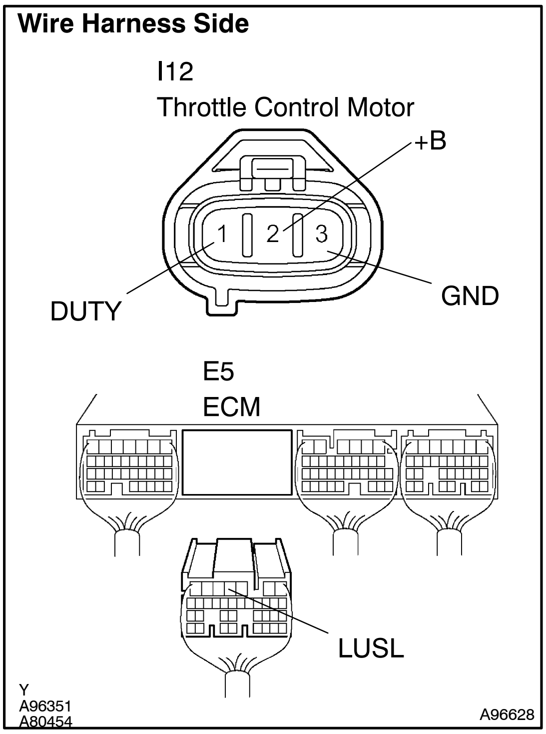
(a) Measure the resistance of the throttle control motor.
Standard:

Tester Connection	Specified Condition
I12–2 (+B) – I12–3 (GND)	2 to 10 kΩ

NG → **REPLACE THROTTLE CONTROL MOTOR**

OK

3 CHECK WIRE HARNESS (THROTTLE CONTROL MOTOR – ECM)



(a) Disconnect the I12 throttle control motor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
I12–1 (DUTY) – E5–4 (LUSL) I12–3 (GND) – Body ground	Below 1 Ω
I12–1 (DUTY) or E5–4 (LUSL) – Body ground	10 kΩ or higher

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

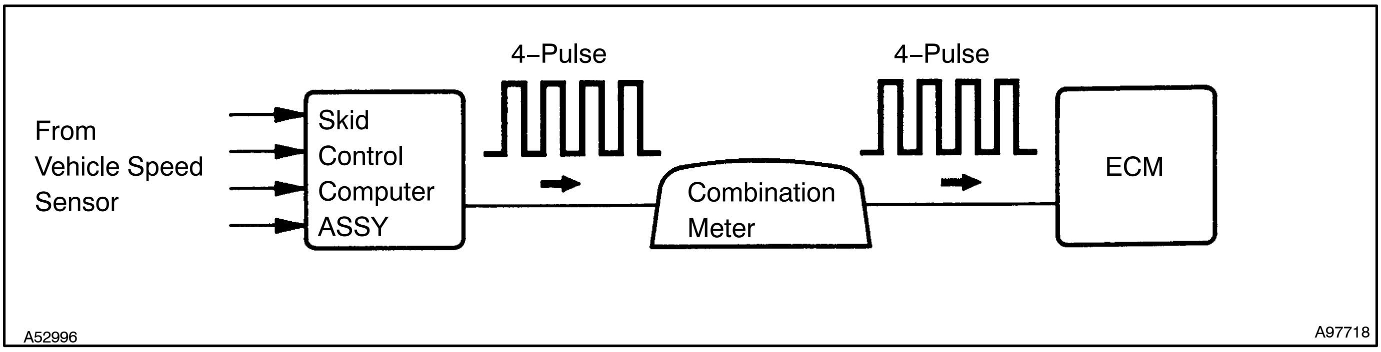
OK

REPLACE ECM (See page 10–10)

DTC	P0500/42	VEHICLE SPEED SENSOR ”A”

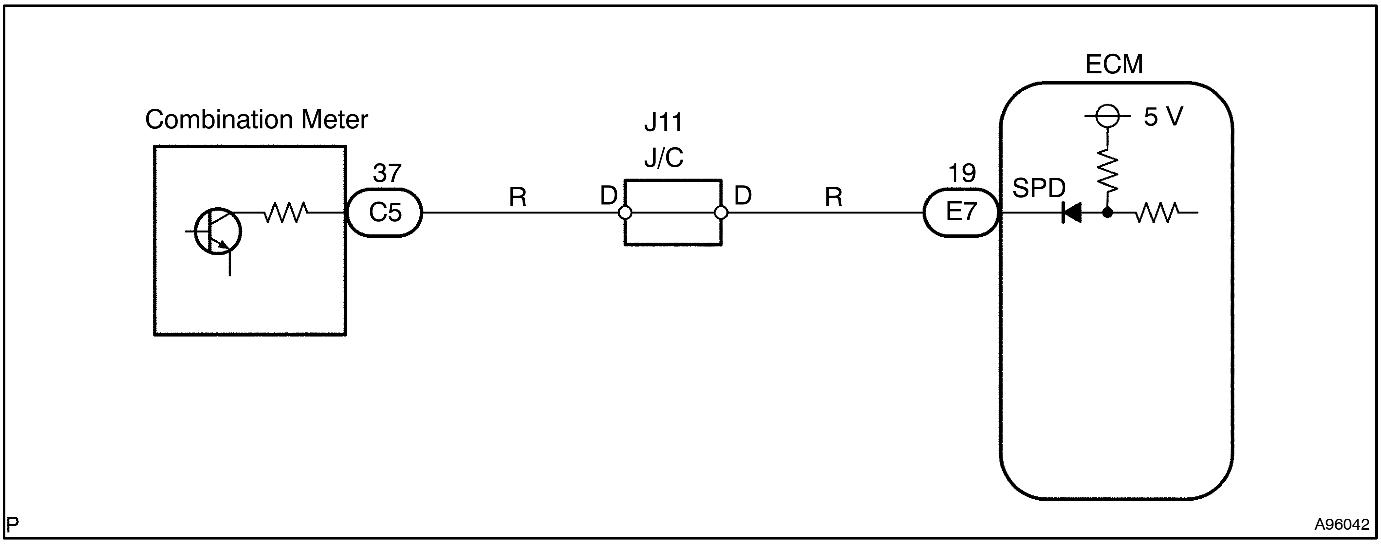
CIRCUIT DESCRIPTION

The speed sensor for skid control ECU detects the wheel speed and sends the appropriate signals to the skid control ECU.
The skid control ECU converts these signals into a 4–pulse signal and outputs it to the combination meter. 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 ECM. The ECM determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	DTC Detection Condition	Trouble Area
P0500/42	All conditions below are detected continuously for 7 seconds or more: (a) Vehicle speed signal: 0 km/h (0 mph) (b) Engine speed: 1,500 to 2,500 rpm (c) Engine coolant temp.: 70°C (158°F) or more (d) ECT sensor, accelerator pedal position sensor, and MAF meter are all normal	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • Combination meter • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

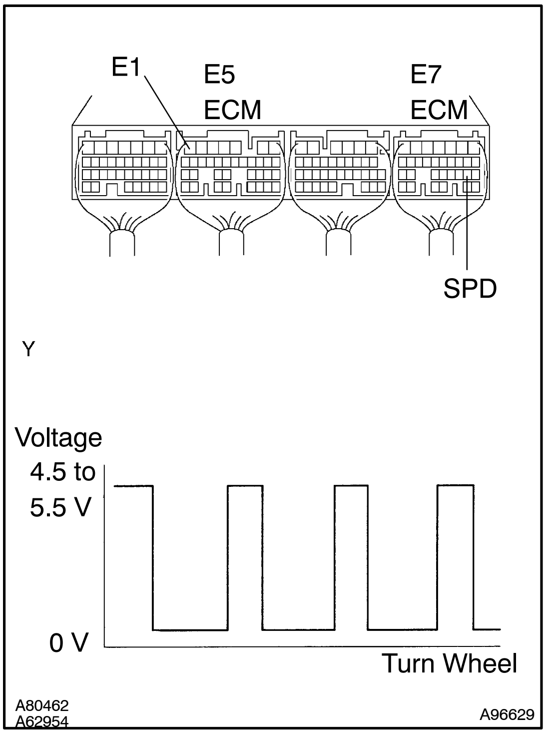
1 CHECK OPERATION OF SPEEDOMETER

Drive the vehicle and check if 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 → **Go to COMBINATION METER SYSTEM (See Pub. No. RM 1008E, page 71–2)**

OK

2 CHECK ECM (SPD VOLTAGE)



(a) Move the transmission gear selector lever to the neutral position.
(b) Jack up the vehicle.
(c) Turn the ignition switch ON.
(d) Measure the voltage of the ECM connectors as the wheel is turned slowly.
Standard:

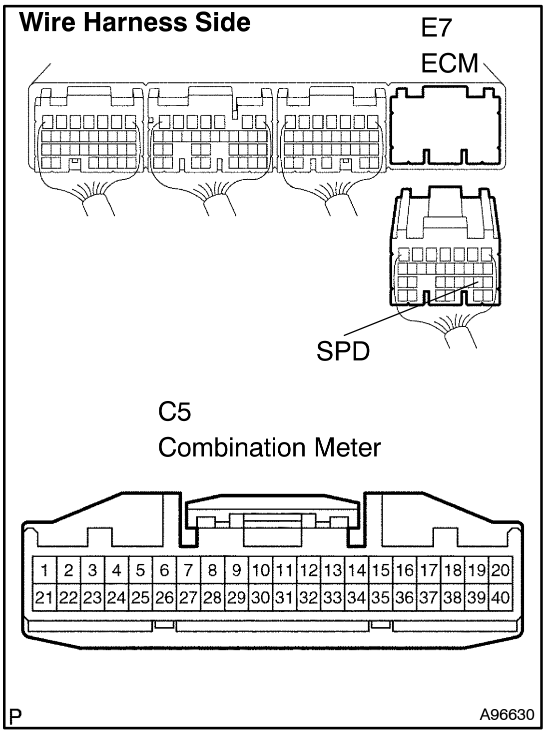
Tester Connection	Specified Condition
E7–19 (SPD) – E5–7 (E1)	Generated intermittently

HINT:
The output voltage should fluctuate up and down similarly to the diagram on the left when the wheel is turned slowly.

OK → **REPLACE ECM (See page 10–10)**

NG

3 CHECK WIRE HARNESS (COMBINATION METER – ECM)



(a) Disconnect the C5 meter connector.
(b) Disconnect the E7 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
E7–19 (SPD) – C5–37 (Combination meter)	Below 1 Ω
E7–19 (SPD) – C5–37 (Combination meter)	10 kΩ or higher

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

OK

REPLACE ECM (See page 10–10)

DTC P0504/51 BRAKE SWITCH ”A”/”B” CORRELATION

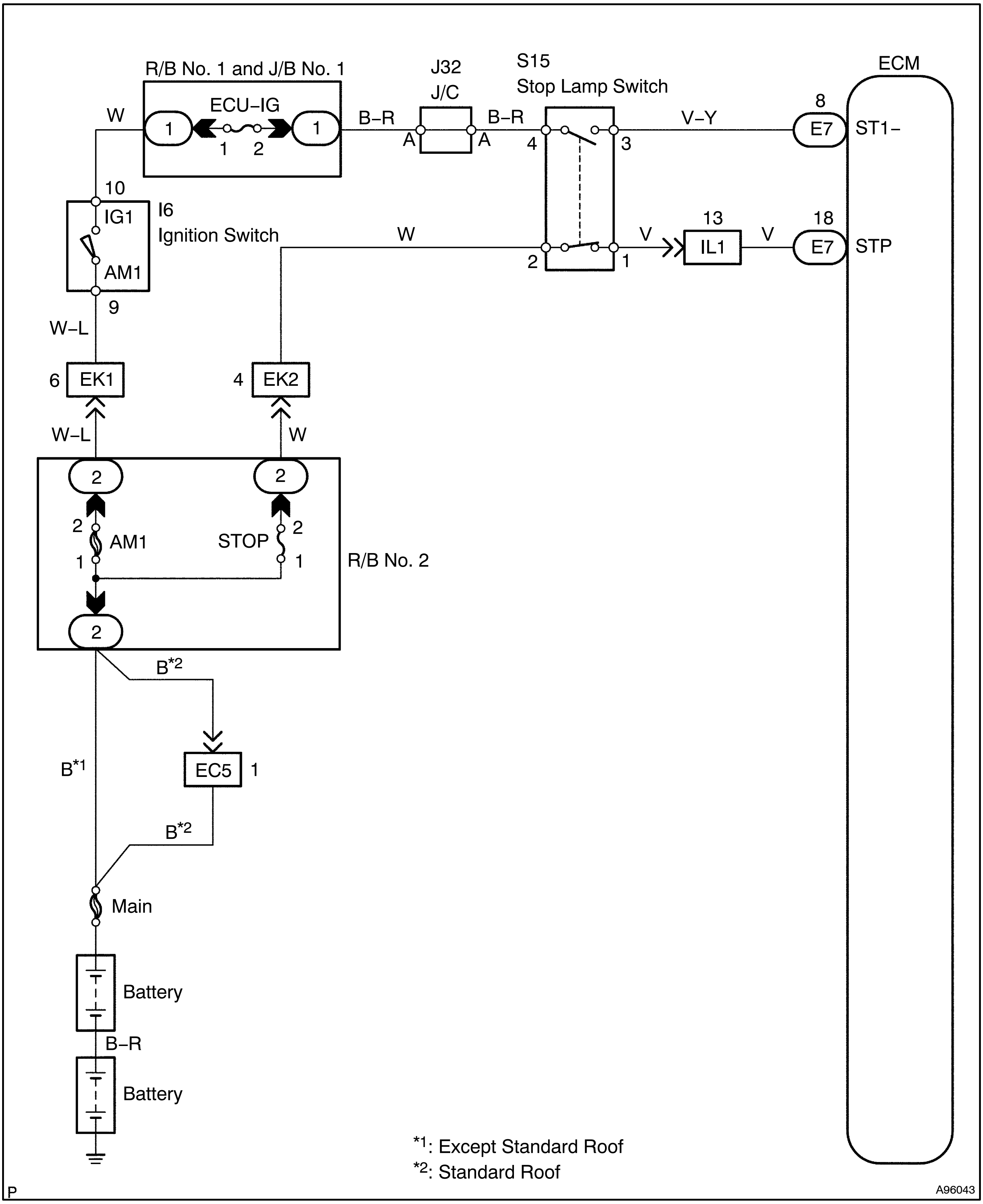
CIRCUIT DESCRIPTION

In this system, signals of the stop lamp switch are used to judge whether the brake system is abnormal or not.
The stop lamp switch has a duplex system (signals STP and ST1–) to memorize the abnormality when the signals of depressing and releasing the brake pedal are detected simultaneously.
HINT:
Normal condition is as shown in the table below.

Signal	Brake Pedal Released	In Transition	Brake Pedal Depressed
STP	OFF	ON	ON
ST1–	ON	ON	OFF

DTC No.	DTC Detection Condition	Trouble Area
P0504/51	Conditions (a) and (b) continue for 0.5 second or more: (a) Ignition switch ON (b) Open or short in stop lamp switch signal circuit	• Short in stop lamp switch signal circuit • Stop lamp switch • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

When using hand–held tester:

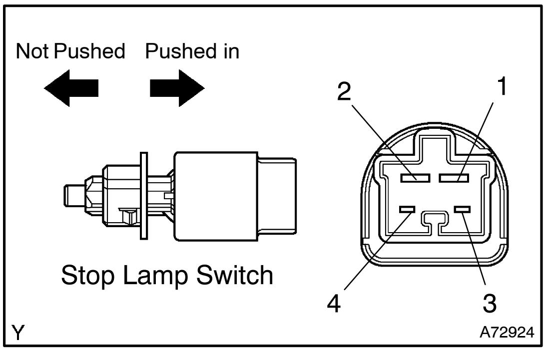
1	CHECK OPERATION OF STOP LAMP

(a) Check if the stop lamps turn on and off normally when the brake pedal is depressed and released.

OK → **REPAIR OR REPLACE STOP LAMP SWITCH CIRCUIT**

NG

2	INSPECT STOP LAMP SWITCH ASSY



(a) Measure the resistance of the switch.

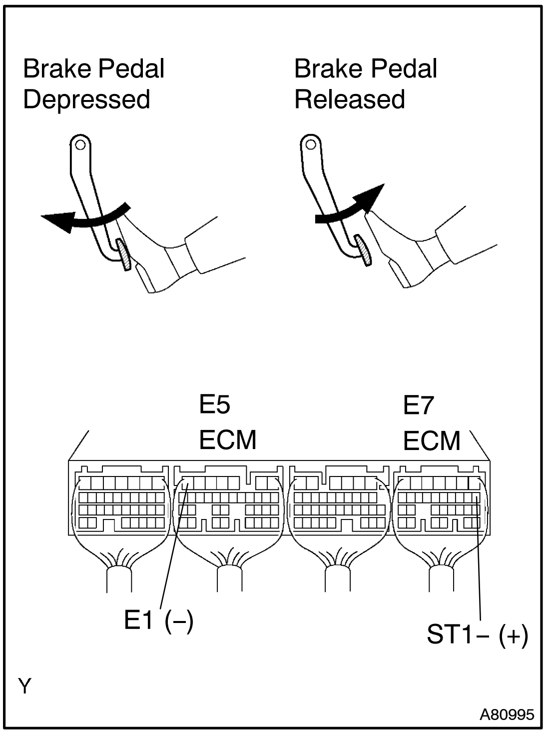
Standard:

Tester Condition	Switch Condition	Specified Condition
1 – 2	Pin not pushed	Below 1 Ω
3 – 4	Pin not pushed	10 kΩ or higher
1 – 2	Pin pushed in	10 kΩ or higher
3 – 4	Pin pushed in	Below 1 Ω

NG → **REPLACE STOP LAMP SWITCH ASSY**

OK

3 READ VALUE OF DATA LIST (STP SIGNAL AND ST1– VOLTAGE)



(a) Turn the ignition switch ON.

(b) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / STOP LIGHT SW. Read the values.

Standard:

Brake Pedal Condition	Specified Condition
Depressed	STP Signal ON
Released	STP Signal OFF

(c) Measure the voltage of the ECM connectors.

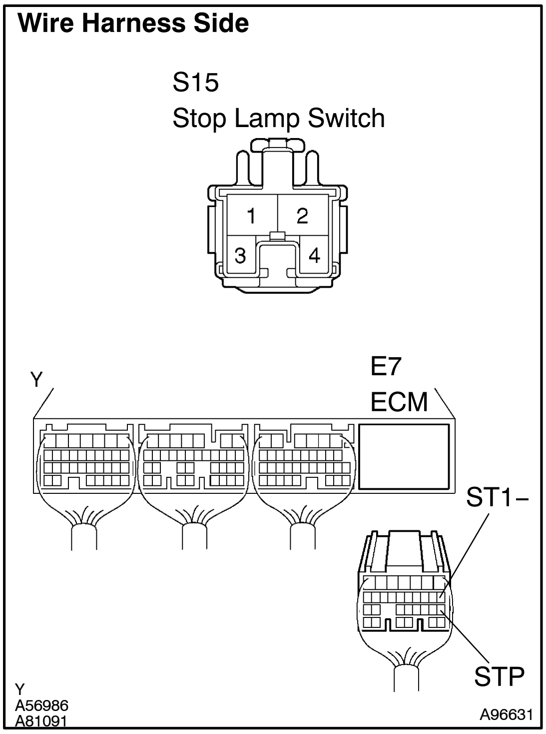
Standard:

Tester Connection	Brake Pedal Condition	Specified Condition
E7–8 (ST1–) – E5–7 (E1)	Depressed	Below 2 V
E7–8 (ST1–) – E5–7 (E1)	Released	18 to 27 V

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

NG

4 CHECK WIRE HARNESS (STOP LAMP SWITCH – ECM)



(a) Disconnect the S15 switch connector.

(b) Disconnect the E7 ECM connector.

(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
S15–1 (Stop lamp switch) – E7–18 (STP) S15–3 (Stop lamp switch) – E7–8 (ST1–)	Below 1 Ω

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

OK

REPLACE ECM (See page 10–10)

When not using hand–held tester:

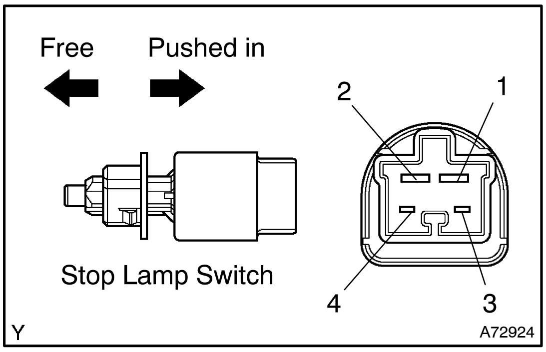
1	CHECK OPERATION OF STOP LAMP

(a) Check if the stop lamps turn on and off normally when the brake pedal is depressed and released.

NG → **REPAIR OR REPLACE STOP LAMP SWITCH CIRCUIT**

OK

2	INSPECT STOP LAMP SWITCH ASSY



(a) Measure the resistance of the switch.

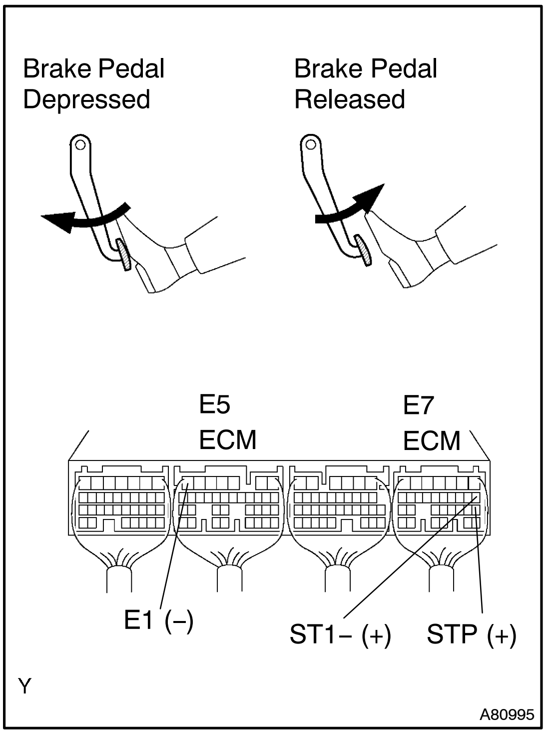
Standard:

Tester Condition	Switch Condition	Specified Condition
1 – 2	Pin not pushed	Below 1 Ω
3 – 4	Pin not pushed	10 kΩ or higher
1 – 2	Pin pushed in	10 kΩ or higher
3 – 4	Pin pushed in	Below 1 Ω

NG → **REPLACE STOP LAMP SWITCH ASSY**

OK

3	CHECK ECM (STP, ST1– VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage of the ECM connectors.

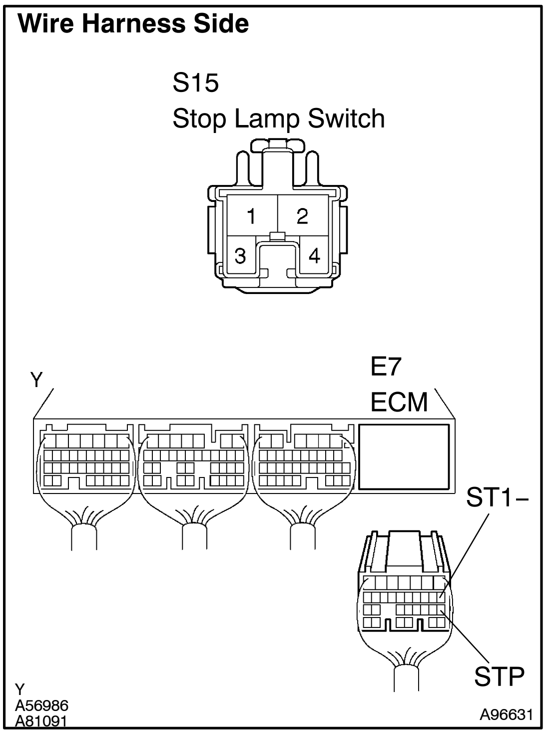
Standard:

Tester Connection	Brake Pedal Condition	Specified Condition
E7–18 (STP) – E5–7 (E1)	Depressed	18 to 27 V
E7–18 (STP) – E5–7 (E1)	Released	Below 2 V
E7–8 (ST1–) – E5–7 (E1)	Depressed	Below 2 V
E7–8 (ST1–) – E5–7 (E1)	Released	18 to 27 V

OK → **CHECK FOR INTERMITTENT PROBLEMS** **(See page 05–10)**

NG

4	**CHECK WIRE HARNESS (STOP LAMP SWITCH – ECM)**



(a) Disconnect the S15 stop lamp switch connector.
(b) Disconnect the E7 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified condition
S15–1 (Stop lamp switch) – E7–18 (STP) S15–3 (Stop lamp switch) – E7–8 (ST1–)	Below 1 Ω

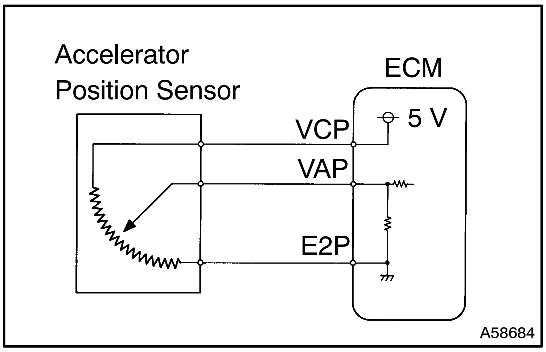
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM (See page 10–10)

DTC	P1133	ACCELERATOR POSITION SENSOR CIRCUIT HIGH

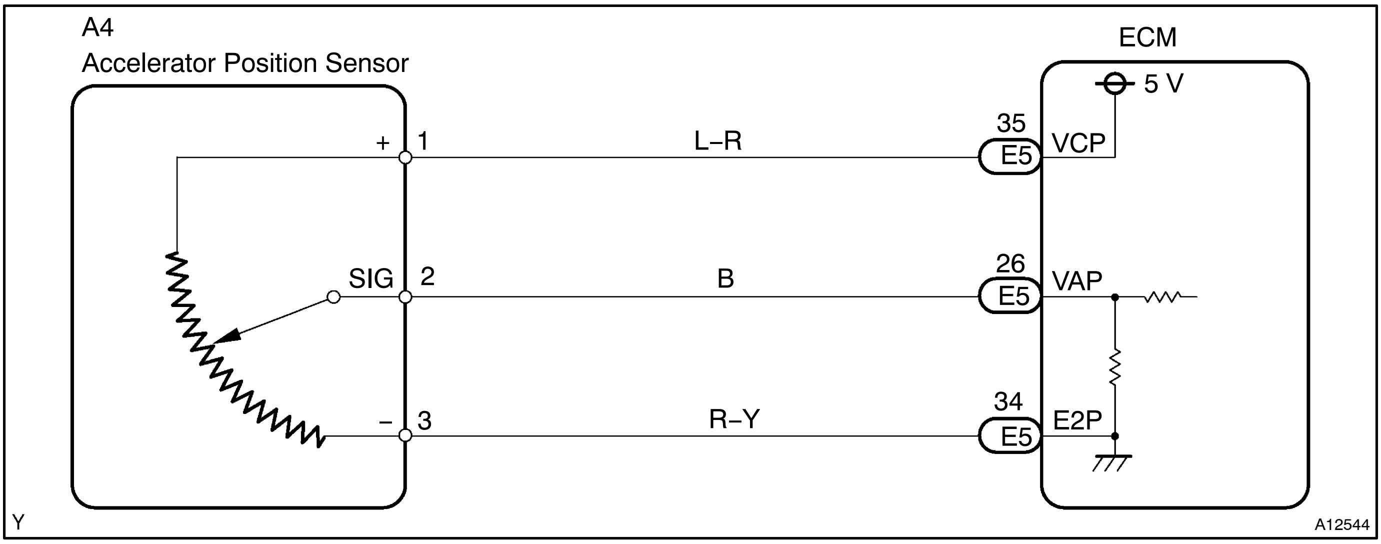
CIRCUIT DESCRIPTION



The outer accelerator position sensor, mounted on the accelerator bellcrank, is used to control the PTO. The sensor converts the opening degrees of the accelerator pedal into voltage of 0 to 5 V and output it to the ECM.

DTC No.	DTC Detection Condition	Trouble Area
P1133	Short in accelerator position sensor circuit for more than 1 second	• Short in accelerator position sensor circuit • Accelerator position sensor • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

When using hand–held tester:

1	READ VALUE OF DATA LIST

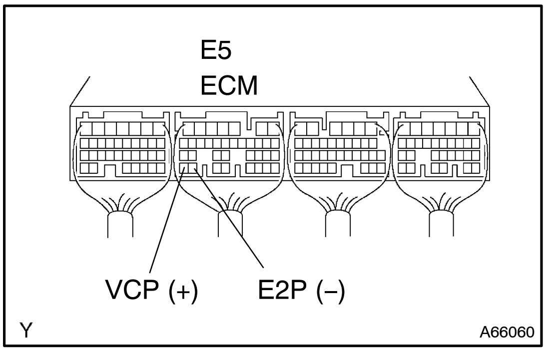
(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Start the engine.
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / PTO SW. Read the values.
Standard:

PTO Switch Condition	Specified Condition
Fully closed → Fully open	0.7 to 1.0 V → 3.3 to 3.9 V (voltage changes constantly)

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

NG

2	CHECK ECM (VCP VOLTAGE)



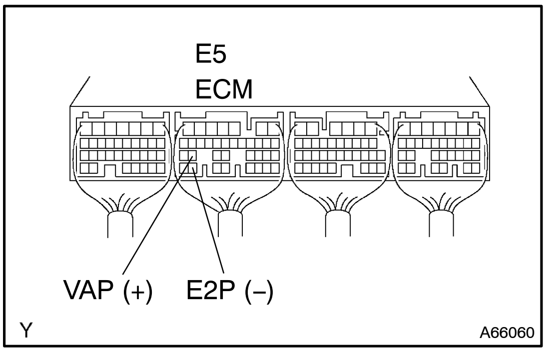
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Specified Condition
E5–35 (VCP) – E5–34 (E2P)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–10)**

OK

3	CHECK ECM (VAP VOLTAGE)



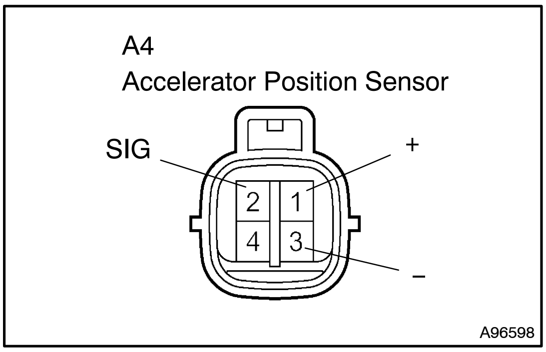
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	PTO Switch Condition	Specified Condition
E5–26 (VAP) – E5–34 (E2P)	Fully closed	0.7 to 1.0 V
E5–26 (VAP) – E5–34 (E2P)	Fully open	3.3 to 3.9 V
E5–26 (VAP) – E5–34 (E2P)	Fully closed → Fully open → Fully closed	Voltage changes constantly

OK → **REPLACE ECM (See page 10–10)**

NG

4	INSPECT ACCELERATOR POSITION SENSOR ASSY



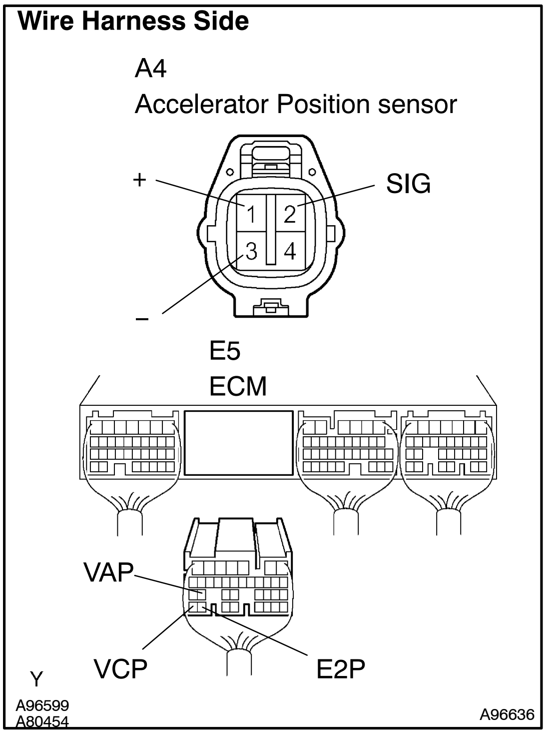
(a) Disconnect the A4 sensor connector.
(b) Measure the resistance of the sensor.
Standard:

Tester Connection	Accelerator Pedal Condition	Specified Condition
A4–1 (+) – A4–3 (–)	–	1.6 to 2.4 kΩ
A4–2 (SIG) – A4–3 (–)	Released → Depressed	Resistance changes constantly

NG → **REPLACE ACCELERATOR POSITION SENSOR ASSY**

OK

5	CHECK WIRE HARNESS (ECM – ACCELERATOR POSITION SENSOR)



(a) Disconnect the A4 sensor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
E5 – 35 (VCP) – A4 – 1 (+) E5 – 28 (E2P) – A4 – 3 (–) E5 – 26 (VAP) – A4 – 2 (SIG)	Below 1 Ω
E5–35 (VCP) or A4–1 (+) – Body ground E5–28 (E2P) or A4–3 (–) – Body ground E5–26 (VAP) or A4–2 (SIG) – Body ground	10 kΩ or higher

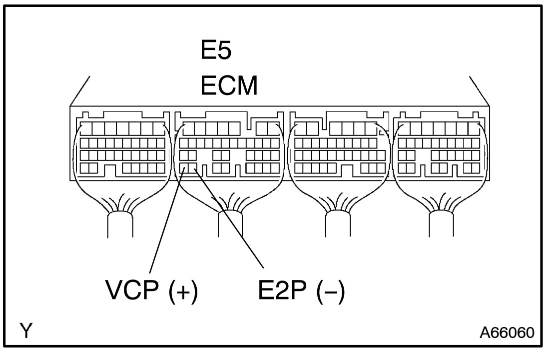
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM (See page 10–10)

When not using hand–held tester:

1	CHECK ECM (VCP VOLTAGE)



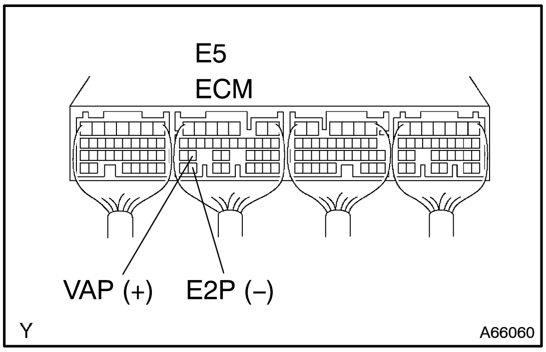
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Specified Condition
E5–35 (VCP) – E5–34 (E2P)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–10)**

OK

2	CHECK ECM (VAP VOLTAGE)



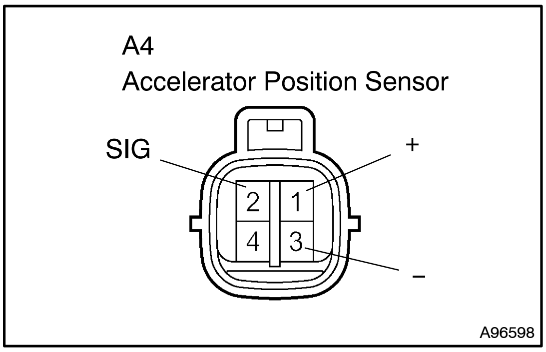
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	PTO Switch Condition	Specified Condition
E5–26 (VAP) – E5–34 (E2P)	Fully closed	0.7 to 1.0 V
E5–26 (VAP) – E5–34 (E2P)	Fully open	3.3 to 3.9 V
E5–26 (VAP) – E5–34 (E2P)	Fully closed → Fully open → Fully closed	Voltage changes constantly

OK → **REPLACE ECM (See page 10–10)**

NG

3	INSPECT ACCELERATOR POSITION SENSOR ASSY



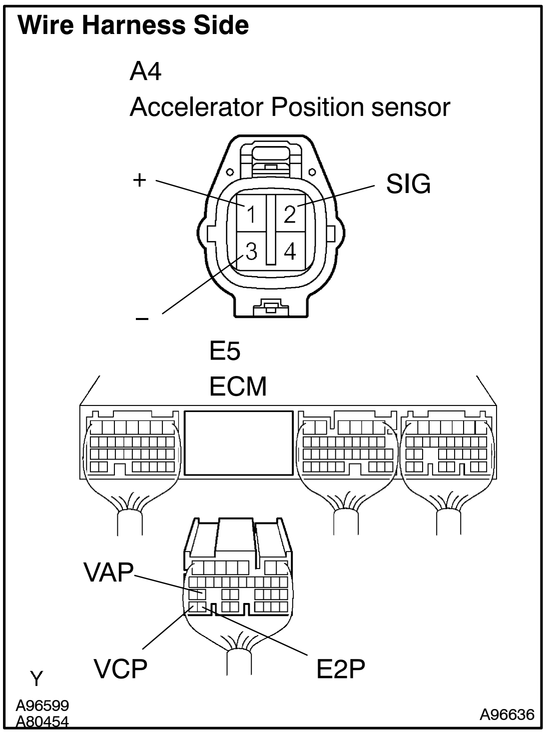
(a) Disconnect the A4 sensor connector.
(b) Measure the resistance of the sensor.
Standard:

Tester Connection	Accelerator Pedal Condition	Specified Condition
A4–1 (+) – A4–3 (–)	–	1.6 to 2.4 kΩ
A4–2 (SIC) – A4–3 (–)	Released → Depressed	Resistance changes constantly

NG → **REPLACE ACCELERATOR POSITION SENSOR ASSY**

OK

4	CHECK WIRE HARNESS (ECM – ACCELERATOR POSITION SENSOR)



(a) Disconnect the A4 sensor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
E5–35 (VCP) – A4–1 (+) E5–28 (E2P) – A4–3 (–) E5–26 (VAP) – A4–2 (SIG)	Below 1 Ω
E5–35 (VCP) or A4 1 (+) – Body ground E5–28 (E2P) or A4–3 (–) – Body ground E5–26 (VAP) or A4–2 (VICM) – Body ground	10 kΩ or higher

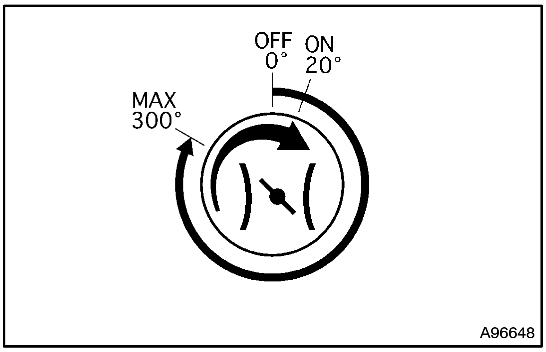
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM (See page 10–10)

DTC	P1143/19	IDLE VARIABLE RESISTOR SWITCH CIRCUIT MALFUNCTION (SHORT)

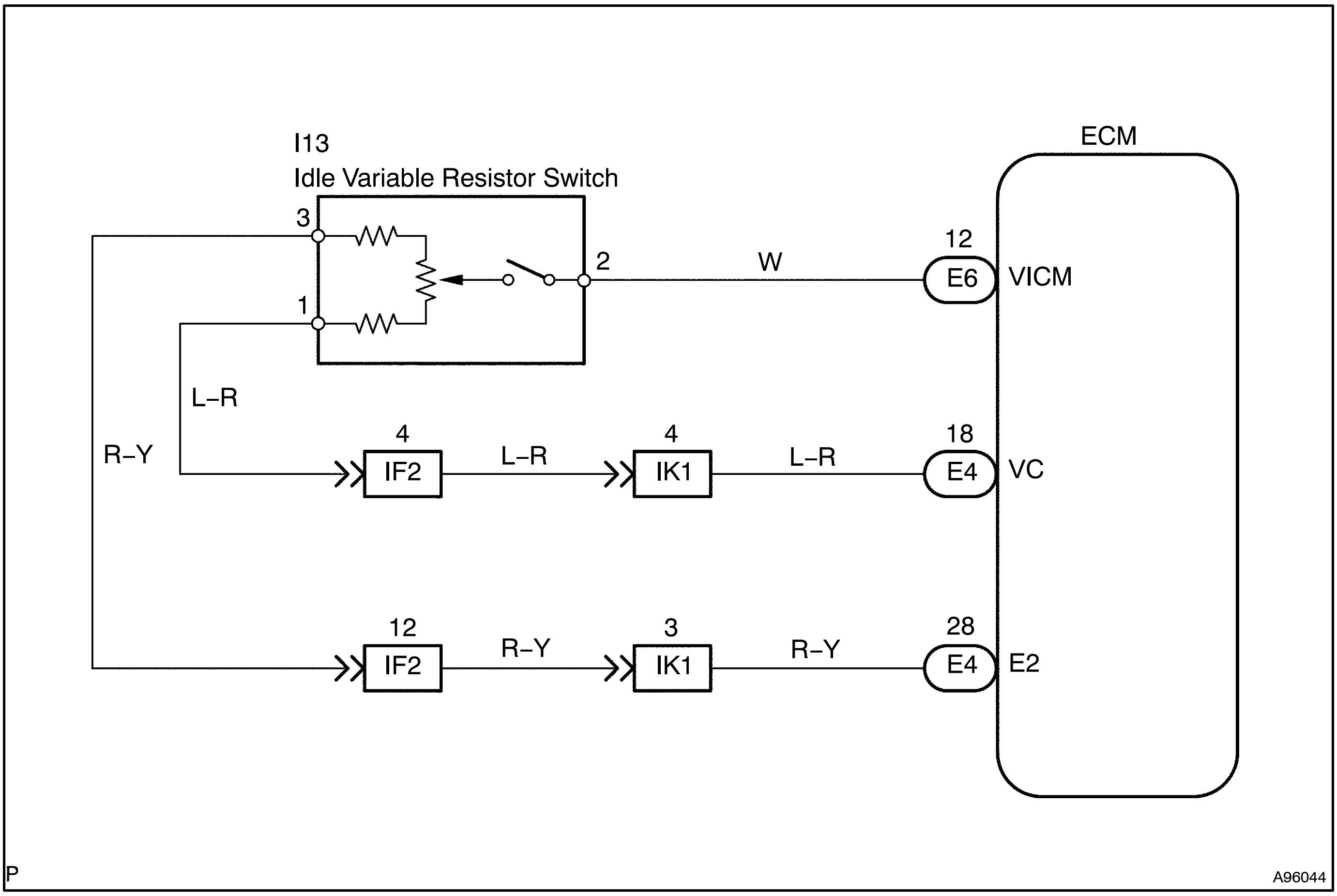
CIRCUIT DESCRIPTION



The throttle knob (idle variable resistor switch) is on the instrument panel. The drives use the knob to idle up the engine with manual operation. Turn the switch 20° clockwise to start idling. When turning the switch 300° clockwise, the idling will become the maximum speed.
If the switch circuit is shorted, DTC P1143/19 will be output.

DTC No.	DTC Detection Condition	Trouble Area
P1143/19	Conditions (a) and (b) continue for 3 seconds or more: (a) Ignition switch ON (b) Short in idle variable resistor switch circuit	• Short in idle variable resistor switch circuit • Idle variable resistor switch • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

When using hand–held tester:

1	READ VALUE OF DATA LIST

(a) Connect the hand–held tester to the DLC3.
(b) Start the engine.
(c) Turn the hand–held tester ON.
(d) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / THROTTLE KNOB. Read the values.

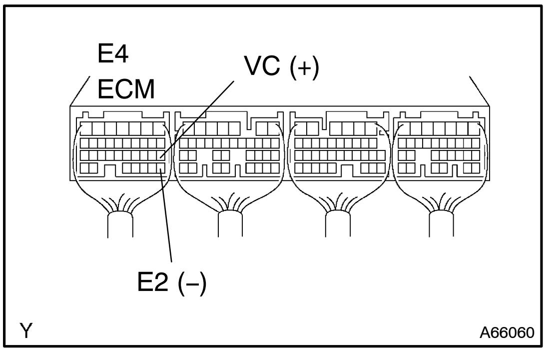
Standard:

Idle Variable Resistor Switch Condition	Specified Condition
ON → MAX	0.5 to 0.9 V → 4.0 to 4.5 V (voltage changes constantly)

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–10)**

NG ↓

2	CHECK ECM (VC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.

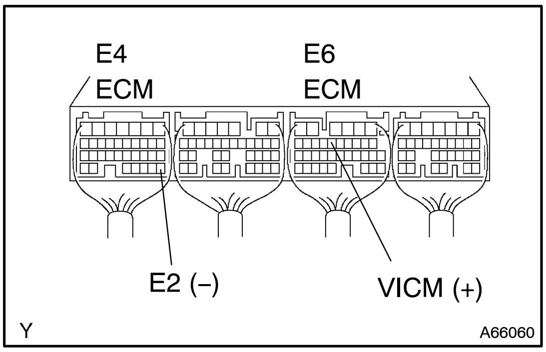
Standard:

Tester Connection	Specified Condition
E4–18 (VC) – E4–28 (E2)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–10)**

OK ↓

3 CHECK ECM (VICM VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage of the ECM connectors.

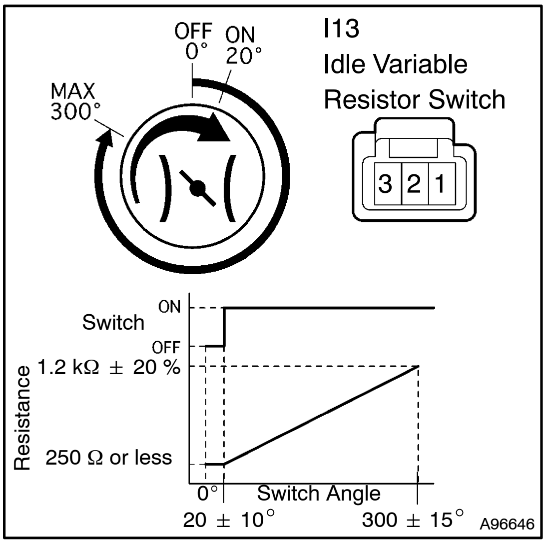
Standard:

Tester Connection	Idle Variable Resistor Switch Condition	Specified Condition
E6–12 (VICM) – E4–28 (E2)	ON	0.5 to 0.9 V
E6–12 (VICM) – E4–28 (E2)	MAX	4.0 to 4.5 V
E6–12 (VICM) – E4–28 (E2)	ON → MAX	0.5 to 0.9 → 4.0 to 4.5 V (voltage changes constantly)

OK → **REPLACE ECM (See page 10–10)**

NG

4 INSPECT IDLE VARIABLE RESISTOR SWITCH



(a) Disconnect the I13 switch connector.

(b) Measure the resistance of the switch.

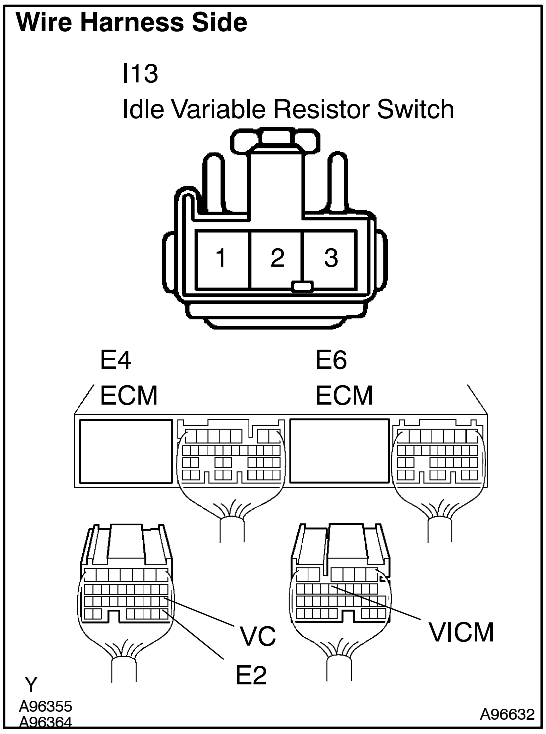
Standard:

Tester Connection	Idle Variable Resistor Switch Condition	Specified Condition
I13–2 – I13–3	ON	250 Ω
I13–2 – I13–3	MAX	1.2 kΩ
I13–2 – I13–3	ON → MAX	Resistance changes constantly

NG → **REPLACE IDLE VARIABLE RESISTOR SWITCH**

OK

5	CHECK WIRE HARNESS (ECM – IDLE VARIABLE RESISTOR SWITCH)



(a) Disconnect the I13 switch connector.
(b) Disconnect the E4 and E6 ECM connectors.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
E4–18 (VC) – I13–1 E4–28 (E2) – I13–3 E6–12 (VICM) – I13–2	Below 1 Ω
E4–18 (VC) or I13–1 – Body ground E4–28 (E2) or I13–3 – Body ground E6–12 (VICM) or I3–2 – Body ground	10 kΩ or higher

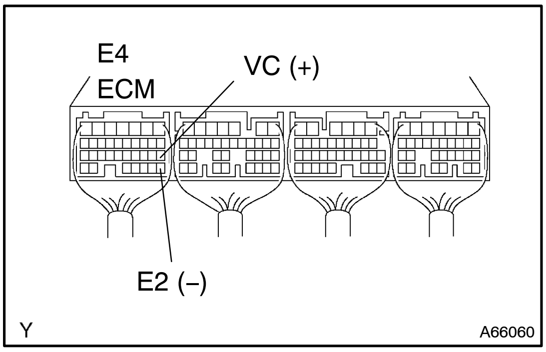
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM (See page 10–10)

When not using hand–held tester:

1	CHECK ECM (VC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.

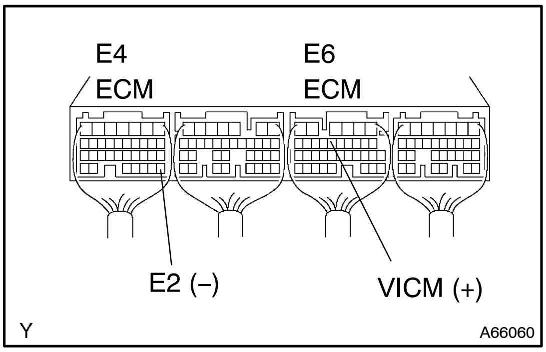
Standard:

Tester Connection	Specified Condition
E4–18 (VC) – E4–28 (E2)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–10)**

OK

2 CHECK ECM (VICM VOLTAGE)



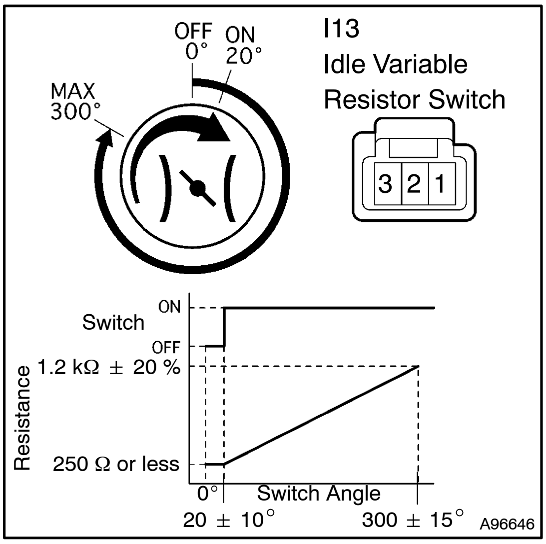
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard:

Tester Connection	Idle Variable Resistor Switch Condition	Specified Condition
E6–12 (VICM) – E4–28 (E2)	ON	0.5 to 0.9 V
E6–12 (VICM) – E4–28 (E2)	MAX	4.0 to 4.5 V
E6–12 (VICM) – E4–28 (E2)	ON → MAX	0.5 to 0.9 → 4.0 to 4.5 V (voltage changes constantly)

OK → **REPLACE ECM (See page 10–10)**

NG

3 INSPECT IDLE VARIABLE RESISTOR SWITCH



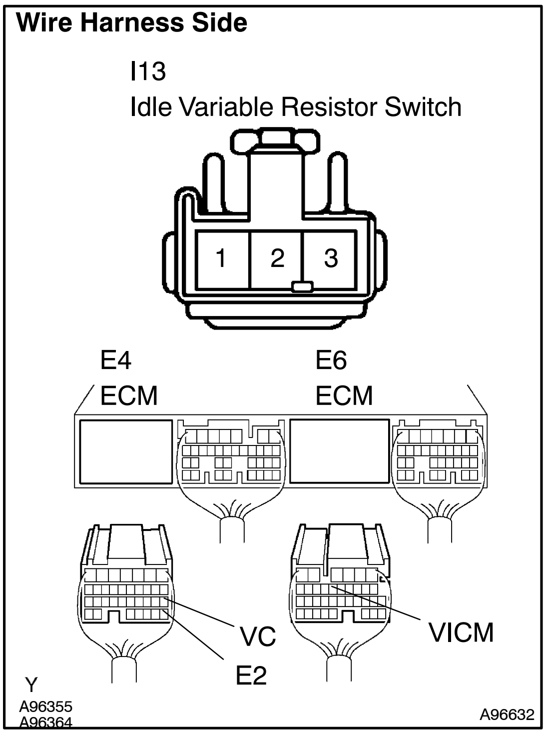
(a) Disconnect the I13 switch connector.
(b) Measure the resistance of the switch.
Standard:

Tester Connection	Idle Variable Resistor Switch Condition	Specified Condition
I13–2 – I13–3	ON	250 Ω
I13–2 – I13–3	MAX	1.2 kΩ
I13–2 – I13–3	ON → MAX	Resistance changes constantly

NG → **REPLACE IDLE VARIABLE RESISTOR SWITCH**

OK

4	CHECK WIRE HARNESS (ECM – IDLE VARIABLE RESISTOR SWITCH)



(a) Disconnect the I13 switch connector.
(b) Disconnect the E4 and E6 ECM connectors.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
E4 – 18 (VC) – I13 – 1 E4 – 28 (E2) – I13 – 3 E6 – 12 (VICM) – I13 – 2	Below 1 Ω
E4 – 18 (VC) or I13 – 1 – Body ground E2 (E4 – 28) or I13 – 3 – Body ground VICM (E6 – 12) or I3 – 2 – Body ground	10 kΩ or higher

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

OK

REPLACE ECM **(See page 10–10)**

DTC	P1601/89	INJECTOR CORRECTION CIRCUIT MALFUNCTION (EEPROM)

CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
P1601/89	• Injector compensation code is not registered • Wrong injector compensation code is registered	• Injector compensation code • ECM

INSPECTION PROCEDURE

1	CHECK INJECTOR COMPENSATION CODE (See page 05–1)

NG → **SET INJECTOR COMPENSATION CODE (See page 05–1)**

OK

REPLACE ECM (See page 10–10)

DTC P1611/17 RUN PULSE MALFUNCTION

CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
P1611/17	ECM inside error	ECM

INSPECTION PROCEDURE

REPLACE ECM (See page 10–10)

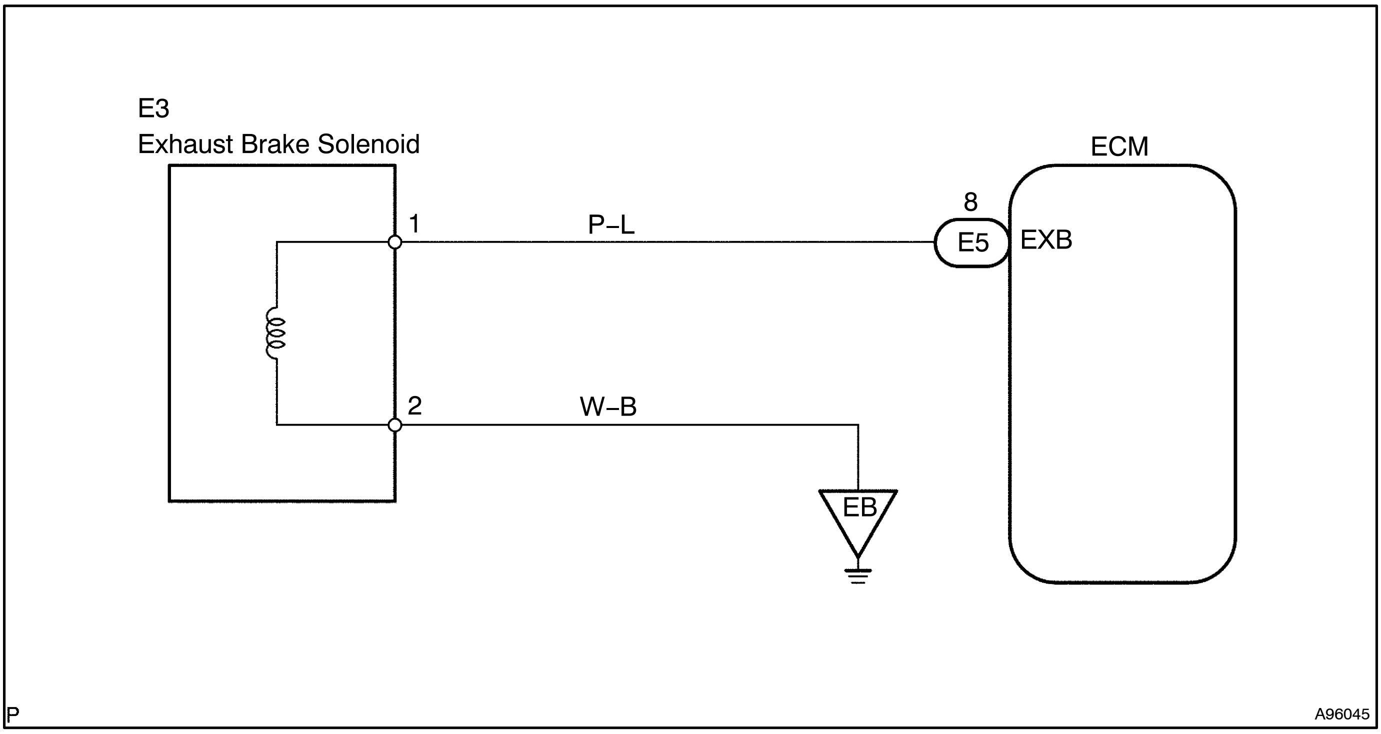
DTC	P1674/36	SOLENOID FOR EXHAUST BRAKE CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION

The exhaust brake VSV, mounted on the exhaust retarder, opens and closes according to the signals from the ECM. The ECM receives the signals from the clutch switch and exhaust retarder switch. Through the brake VSV, the ECM controls the negative pressure applied to the diaphragm in the retarder.

DTC No.	DTC Detection Condition	Trouble Area
P1674/36	Open or short in exhaust brake solenoid circuit for more than 3 seconds with clutch pedal released	• Open or short exhaust brake solenoid circuit • Exhaust brake solenoid • ECM

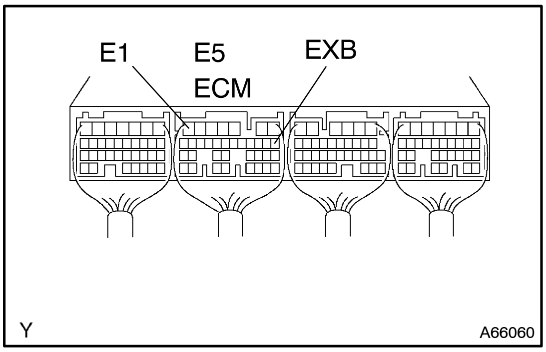
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK ECM (EXB VOLTAGE)



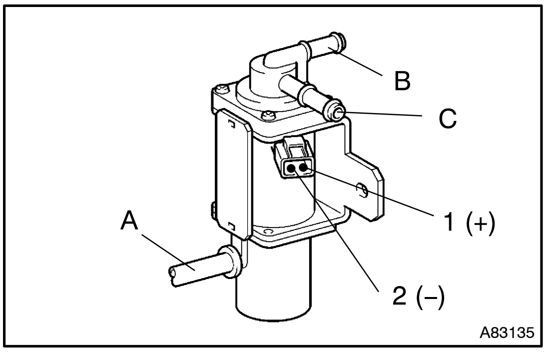
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Condition	Specified Condition
E5–8 (EXB) – E5–7 (E1)	Exhaust brake is operat-ing	18 to 27 V

OK → **REPLACE ECM (See page 10–10)**

NG

2 INSPECT EXHAUST BRAKE SOLENOID ASSY



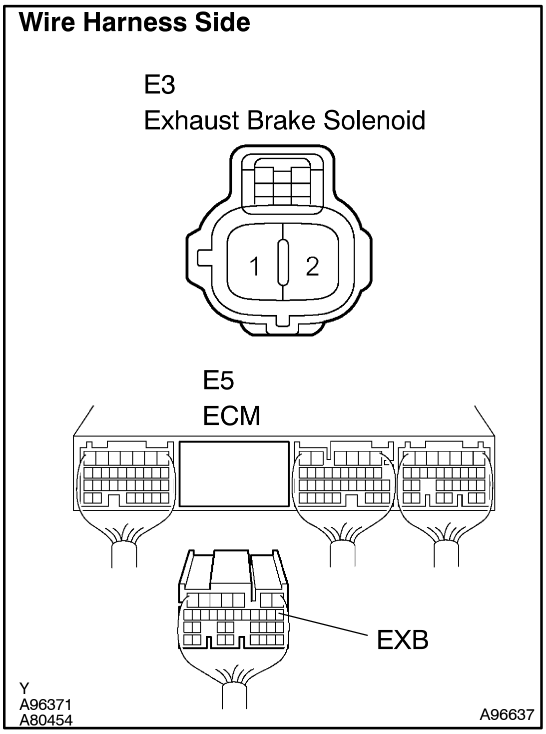
(a) Remove the exhaust brake solenoid connector.
(b) Check operation of the exhaust brake solenoid.
OK:

Port Connection	Specified Condition
A – B	Air does not flow
A – B	Air flows (when battery voltage is applied to terminals 1 and 2)
A – C	Air flows
A – C	Air does not flow (when battery voltage is applied to terminals 1 and 2)

NG → **REPLACE EXHAUST BRAKE SOLENOID ASSY**

OK

3 CHECK WIRE HARNESS (ECM – EXHAUST BRAKE SOLENOID)



(a) Disconnect the E3 exhaust brake solenoid connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
E3–1 – E5–8 (EXB)	Below 1 Ω
E3–1 or E5–8 (EXB) – Body ground	10 kΩ or higher

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

OK

REPLACE ECM (See page 10–10)

DTC	**P2120/19**	**THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT**

DTC	**P2121/19**	**THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT RANGE/PERFORMANCE**

DTC	**P2122/19**	**THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT LOW INPUT**

DTC	**P2123/19**	**THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT HIGH INPUT**

DTC	**P2125/19**	**THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT**

DTC	**P2127/19**	**THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT LOW INPUT**

DTC	**P2128/19**	**THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT HIGH INPUT**

DTC	**P2138/19**	**THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D”/”E” VOLTAGE CORRELATION**

HINT:
This is the repair procedure for the accelerator pedal position sensor.

CIRCUIT DESCRIPTION

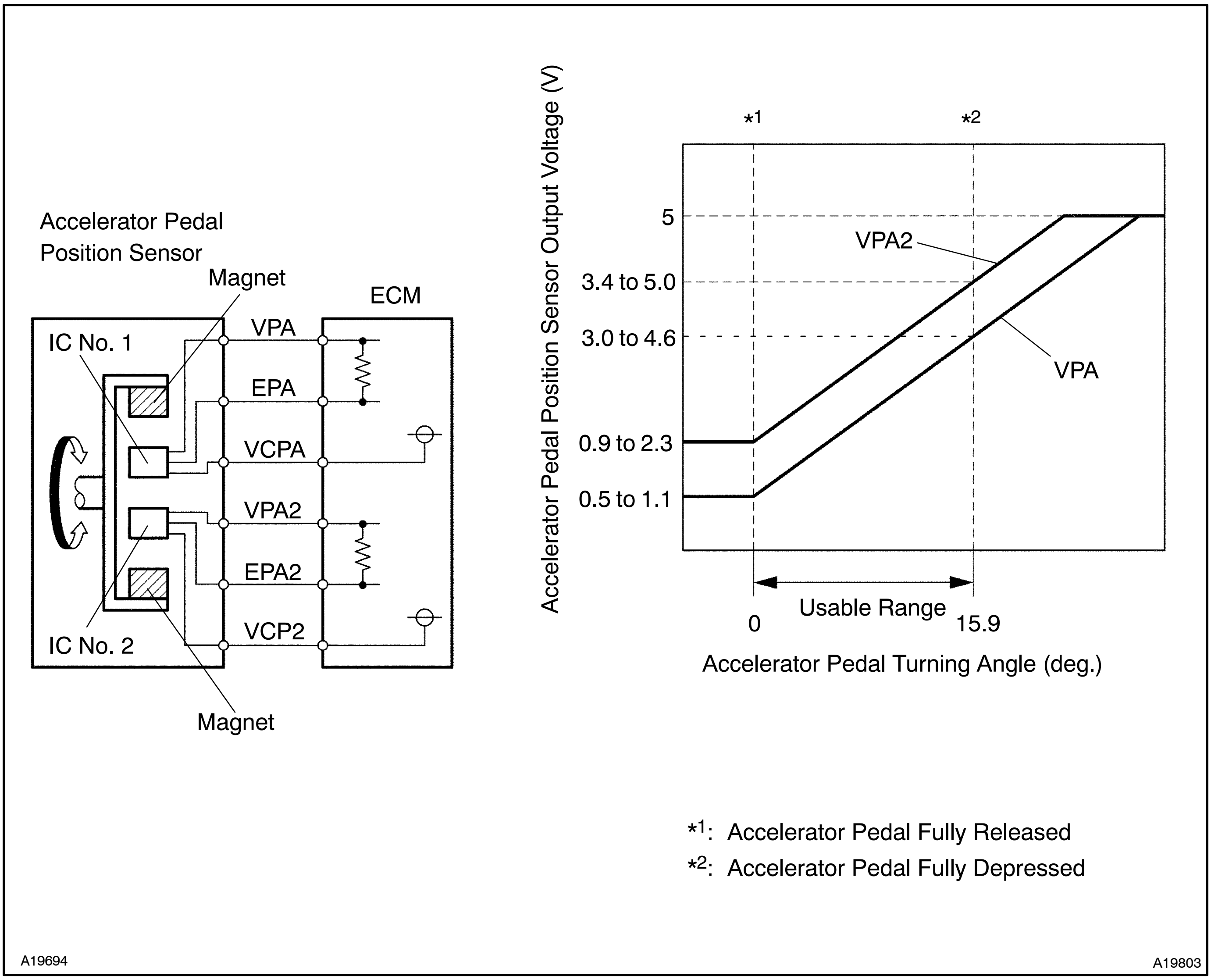
HINT:

- This electrical throttle system does not use a throttle cable.
- This accelerator pedal position sensor is non–contact type.

The accelerator pedal position sensor is mounted on the accelerator pedal and detects the opening angle of the accelerator pedal. Since this sensor is electronically controlled with Hall–effect elements, accurate control and reliability can be obtained. It has 2 sensors to detect the accelerator position and a malfunction of the accelerator position sensor.

In the accelerator pedal position sensor, the voltage applied to pedal terminals VPA and VPA2 of the ECM changes between 0 V and 5 V, in proportion to the opening angle of the accelerator pedal. The VPA is a signal to indicate the actual accelerator pedal opening angle which is used for the engine control, and the VPA2 is a signal to indicate the information about the opening angle which is used for detecting a malfunction.

The ECM judges the current opening angle of the accelerator pedal from these signals input from terminals VPA and VPA2 and, the ECM controls the throttle motor based on these signals.



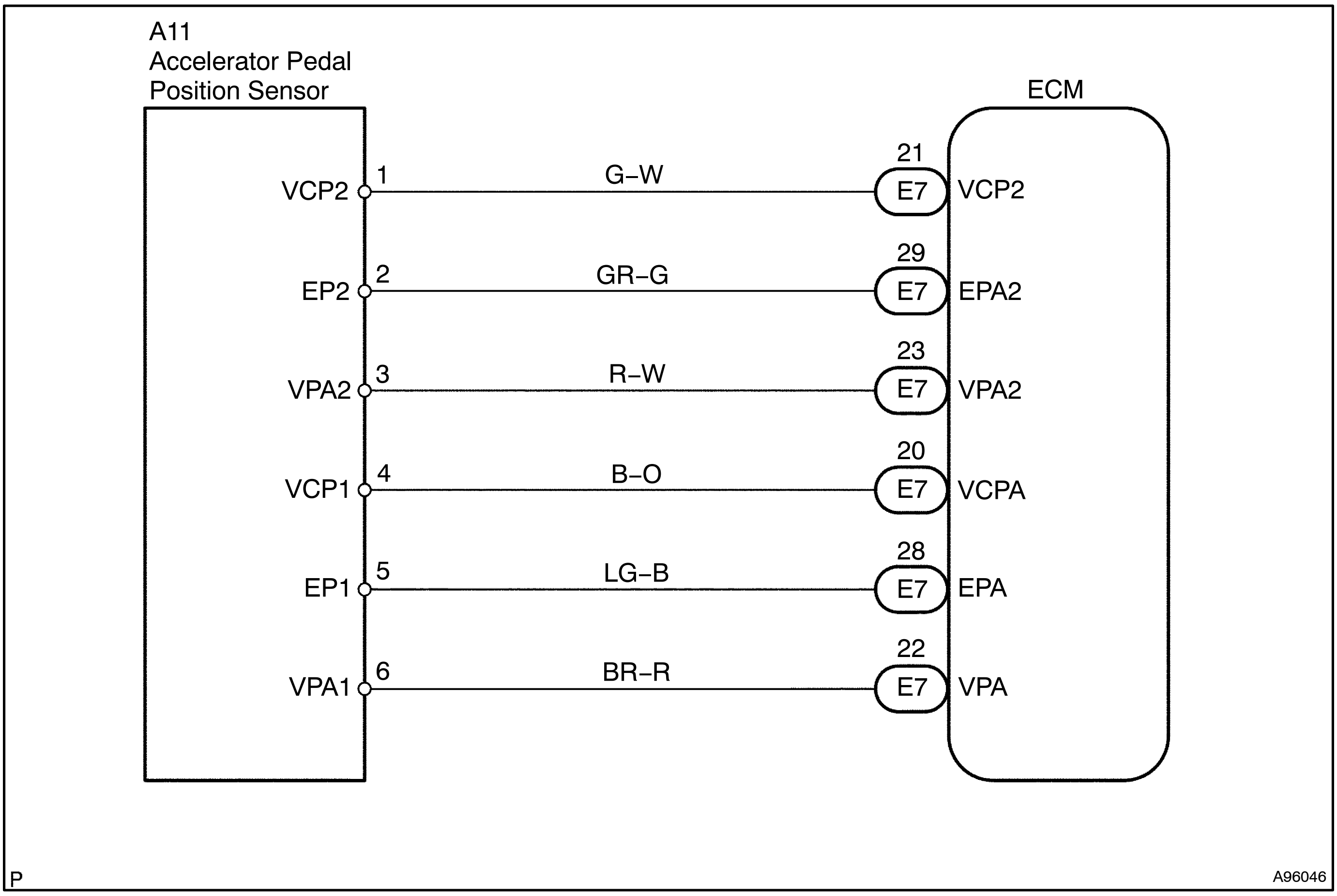
DTC No.	DTC Detecting Condition	Trouble Area
P2120/19	Condition (a) continues for 1 second or more: (a) VPA less than 0.2 V and VPA2 greater than 0.97 deg, or VPA greater than 4.8 V	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM
P2121/19	Conditions (a) and (b) continue for 1 second or more: (a) Difference between VPA and VPA2 exceeds the threshold (b) IDL is OFF	Same as DTC No. P2120/19
P2122/19	Conditions (a) and (b) continue for 1 second or more: (a) VPA less than 0.2 V (b) VPA2 greater than 0.97 deg	Same as DTC No. P2120/19
P2123/19	Condition (a) continues for 2 seconds or more: (a) VPA greater than 4.8 V	Same as DTC No. P2120/19
P2125/19	Condition (a) continues for 1 second or more: (a) VPA2 less than 0.5 V and VPA greater than 0.97 deg, or VPA2 greater than 4.8 V and VPA greater than 0.2 V but less than 3.45 V	Same as DTC No. P2120/19
P2127/19	Conditions (a) and (b) continue for 1 second or more: (a) VPA2 less than 0.5 V (b) VPA greater than 0.97 deg	Same as DTC No. P2120/19
P2128/19	Conditions (a) and (b) continue for 2 seconds or more: (a) VPA2 greater than 4.8 V (b) VPA greater than 0.2 V but less than 3.45 V	Same as DTC No. P2120/19
P2138/19	Condition (a) or (b) continues for 2 seconds or more: (a) Difference between VPA and VPA2 less than 0.02 V (b) VPA less than 0.2 V and VPA2 less than 0.5 V	Same as DTC No. P2120/19

HINT:

After confirming "DTC P2120/19, P2122/19, P2123/19, P2125/19, P2127/19, P2128/19 and P2138/19", use the hand–held tester to confirm the accelerator pedal position sensor output voltage.

Trouble Area	Accelerator pedal position expressed as voltage output			
	Accelerator pedal released		Accelerator pedal depressed	
	ACCEL POS #1	ACCEL POS #2	ACCEL POS #1	ACCEL POS #2
VC circuit open	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V
VPA1 circuit open or ground short	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 5.3 V
VPA2 circuit open or ground short	0.5 to 1.1 V	0 to 0.2 V	2.9 to 3.6 V	0 to 0.2 V
EPA circuit open	4.5 to 5.5 V	4.5 to 5.5 V	4.5 to 5.5 V	4.5 to 5.5 V

WIRING DIAGRAM



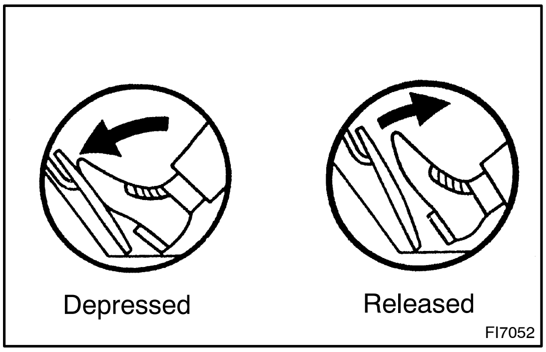
INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

When using hand–held tester:

1	READ VALUE OF DATA LIST (ACCEL POS #1 AND ACCEL POS #2)



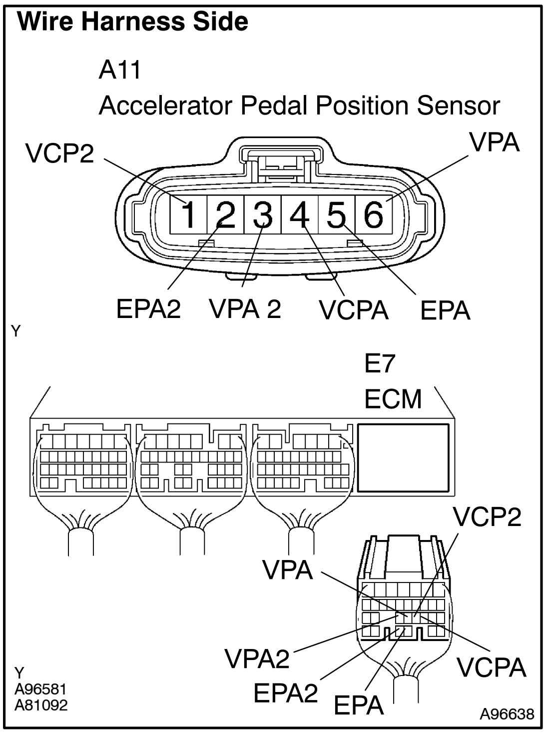
(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ETCS / ACCEL POS #1 and ACCEL POS #2. Read the values.
Standard:

Accelerator Pedal Condition	ACCEL POS #1	ACCEL POS #2
Released	0.5 to 1.1 V	0.9 to 2.3 V
Depressed	3.0 to 4.6 V	3.4 to 5.0 V

OK → **Go to step 5**

NG

2	CHECK WIRE HARNESS (ECM – ACCELERATOR PEDAL POSITION SENSOR)



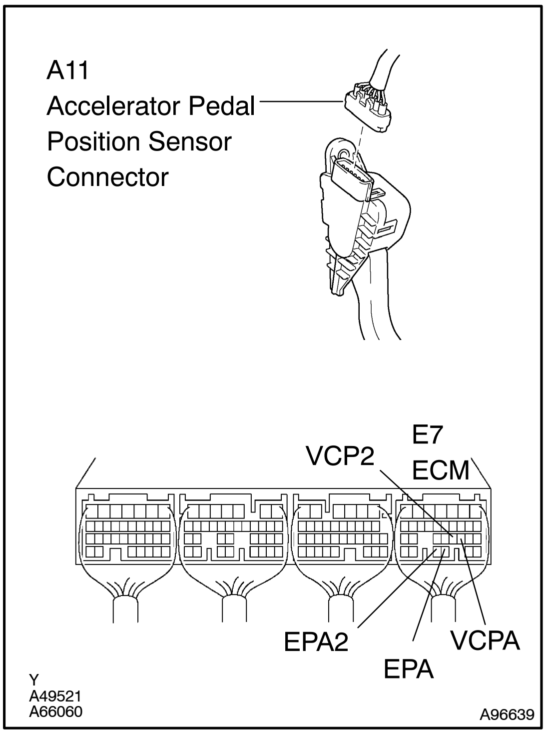
(a) Disconnect the A11 sensor connector.
(b) Disconnect the E7 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
A11–1 (VCP2) – E7–21 (VCP2) A11–2 (EPA2) – E7–29 (EPA2) A11–3 (VPA2) – E7–23 (VPA2) A11–4 (VCPA) – E7–20 (VCPA) A11–5 (EPA) – E7–28 (EPA) A11–6 (VPA) – E7–22 (VPA)	Below 1 Ω
A11–1 (VCP2) or E7–21 (VCP2) – Body ground A11–2 (EPA2) or E7–29 (EPA2) – Body ground A11–3 (VPA2) or E7–23 (VPA2) – Body ground A11–4 (VCPA) or E7–20 (VCPA) – Body ground A11–5 (EPA) or E7–28 (EPA) – Body ground A11–6 (VPA) or E7–22 (VPA) – Body ground	10 kΩ or higher

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

OK

3 CHECK ECM (VCPA, VCP2 VOLTAGE)



(a) Disconnect the A11 sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Specified Condition
E7–20 (VCPA) – E7–28 (EPA) E7–21 (VCP2) – E7–29 (EPA2)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10–10)**

OK

4 REPLACE ACCELERATOR PEDAL ROD ASSY (See page 10–9)

GO

5 READ OUTPUT DTC (ACCELERATOR PEDAL POSITION SENSOR DTC IS OUTPUT AGAIN)

(a) Clear the DTC (see page 05–29).
(b) Start the engine.
(c) Drive the engine at idle for 15 seconds or more.
(d) Read the DTC.
Result:

Display (DTC output)	Proceed to
P2120/19, P2121/19, P2122/19, P2123/19, P2125/19, P2127/19, P2128/19 or P2138/19 is output again	A
P2120/19, P2121/19, P2122/19, P2123/19, P2125/19, P2127/19, P2128/19 or P2138/19 is not output	B

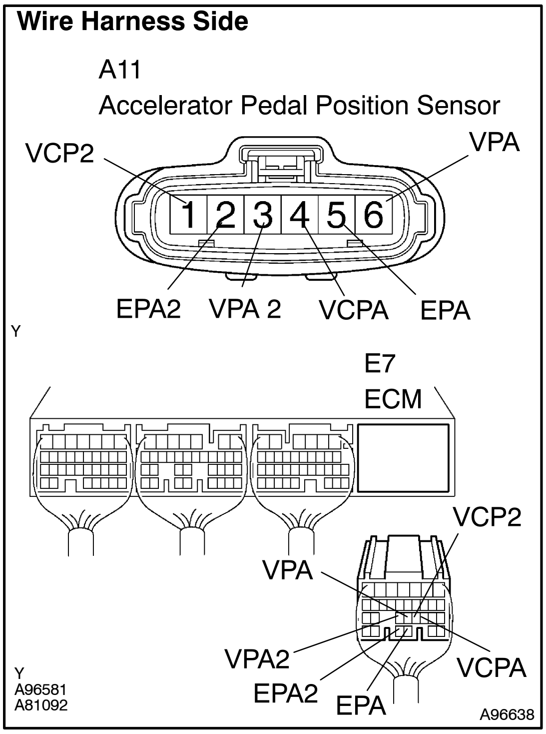
B → **SYSTEM OK**

A

REPLACE ECM (See page 10–10)

When not using hand–held tester:

1	CHECK WIRE HARNESS (ECM – ACCELERATOR PEDAL POSITION SENSOR)



(a) Disconnect the A11 sensor connector.
(b) Disconnect the E7 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

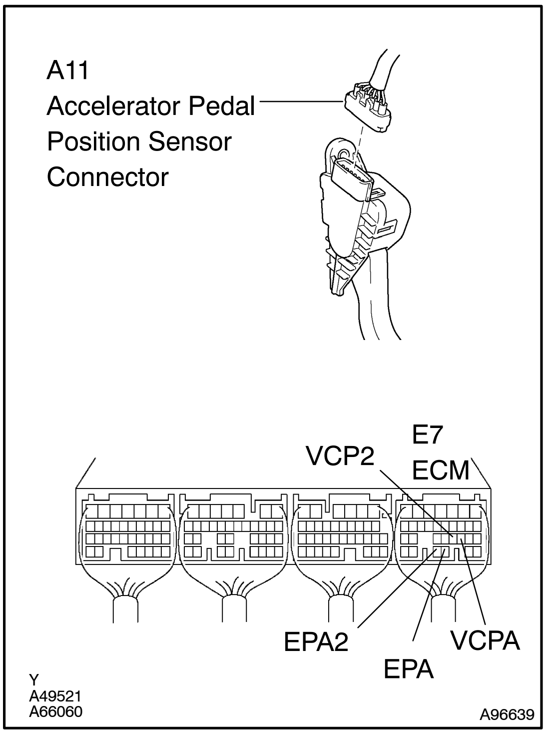
Standard:

Tester Connection	Specified Condition
A11–1 (VCP2) – E7–21 (VCP2) A11–2 (EPA2) – E7–29 (EPA2) A11–3 (VPA2) – E7–23 (VPA2) A11–4 (VCPA) – E7–20 (VCPA) A11–5 (EPA) – E7–28 (EPA) A11–6 (VPA) – E7–22 (VPA)	Below 1 Ω
A11–1 (VCP2) or E7–21 (VCP2) – Body ground A11–2 (EPA2) or E7–29 (EPA2) – Body ground A11–3 (VPA2) or E 7–23 (VPA2) – Body ground A11–4 (VCPA) or E7–20 (VCPA) – Body ground A11–5 (EPA) or E7–28 (EPA) – Body ground A11–6 (VPA) or E7–22 (VPA) – Body ground	10 kΩ or higher

NG	REPAIR OR REPLACE HARNESS AND CONNECTOR

OK

2 CHECK ECM (VCPA, VCP2 VOLTAGE)



(a) Disconnect the A11 sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Specified Condition
E7–20 (VCPA) – E7–28 (EPA) E7–21 (VCP2) – E7–29 (EPA2)	4.5 to 5.5 V

NG ▷ **REPLACE ECM (See page 10–10)**

OK

3 REPLACE ACCELERATOR PEDAL ROD ASSY (See page 10–9)

GO

4 READ OUTPUT DTC (ACCELERATOR PEDAL POSITION SENSOR DTC IS OUTPUT AGAIN)

(a) Clear the DTC (see page 05–29).
(b) Start the engine.
(c) Drive the engine at idle for 15 seconds or more.
(d) Read the DTC.
Result:

Display (DTC output)	Proceed to
P2120/19, P2121/19, P2122/19, P2123/19, P2125/19, P2127/19, P2128/19 or P2138/19 is output again	A
P2120/19, P2121/19, P2122/19, P2123/19, P2125/19, P2127/19, P2128/19 or P2138/19 is not DTC output	B

B ▷ **SYSTEM OK**

A

REPLACE ECM (See page 10–10)

DTC	P2226/A5	BAROMETRIC PRESSURE CIRCUIT

DTC	P2228/A5	BAROMETRIC PRESSURE CIRCUIT LOW INPUT

DTC	P2229/A5	BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

The atmospheric pressure sensor, built in the ECM, detects the atmospheric pressure. According to the value of the atmospheric pressure, the ECM corrects the injection timing, the injection volume and the amount of common rail internal fuel pressure for an optimum combustion.

DTC No.	DTC Detection Condition	Trouble Area
P2226/A5	Open or short in atmospheric pressure sensor circuit for more than 0.5 seconds (ECM internal malfunction)	• ECM
P2228/A5	Open in atmospheric pressure sensor circuit for more than 0.5 seconds (ECM internal malfunction)	• ECM
P2229/A5	Short in atmospheric pressure sensor circuit for more than 0.5 seconds (ECM internal malfunction)	• ECM

HINT:
”A” in the above table indicates that the MIL flashes 10 times.

INSPECTION PROCEDURE

1	CHECK OTHER DTC OUTPUT

(a) Read the DTCs using the hand–held tester.
Result:

Display (DTC output)	Proceed to
P2226/A5, P2228/A5 or P2229/A5 and other DTCs are output	A
P2226/A5, P2228/A5 or P2229/A5 is output	B

B → **REPLACE ECM (See page 10–10)**

A

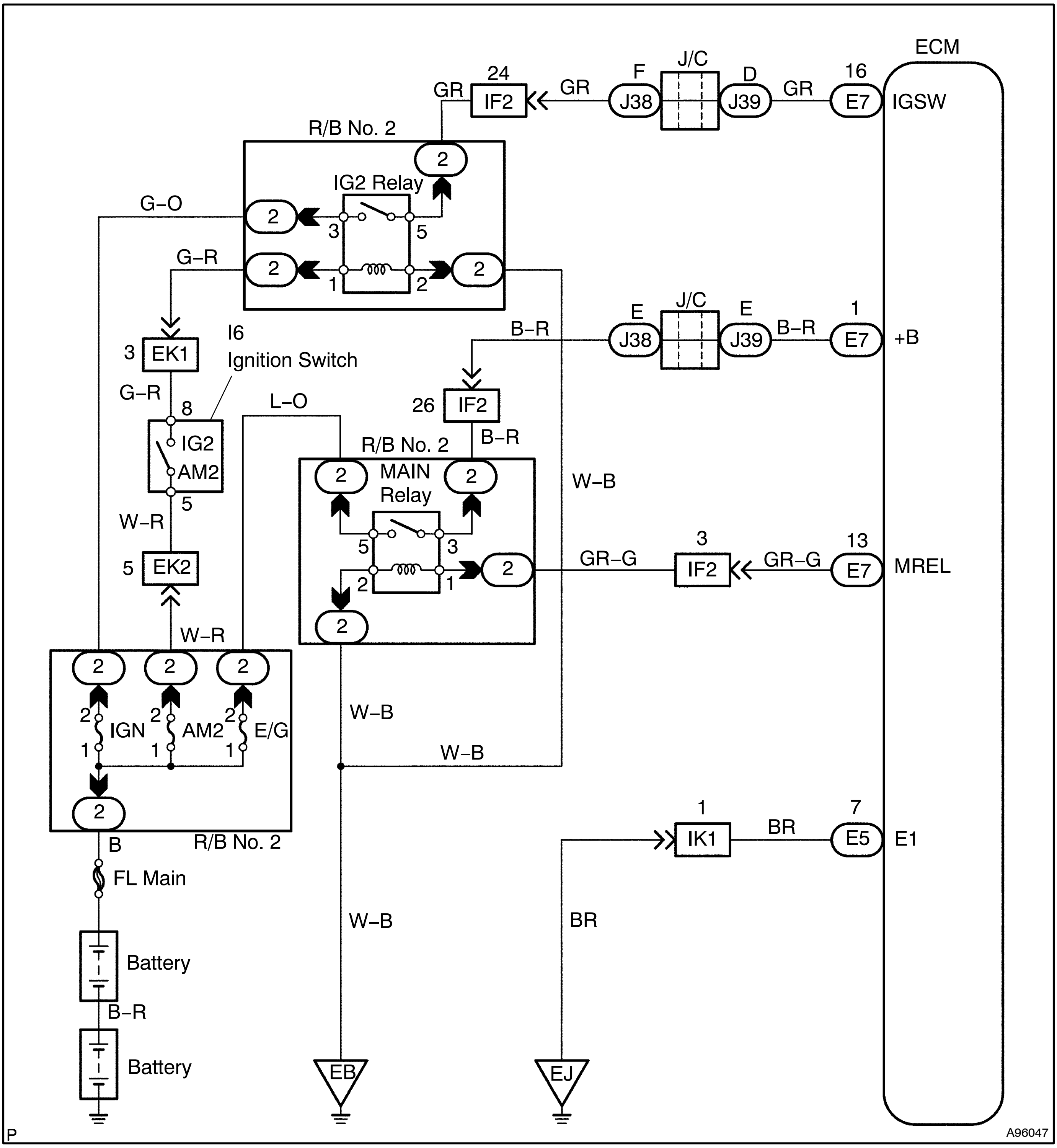
Go to RELEVANT DTC CHART (See page 05–38)

ECM POWER SOURCE CIRCUIT

CIRCUIT DESCRIPTION

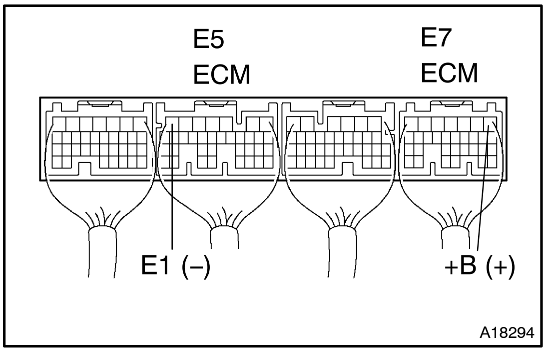
When the ignition switch is turned ON, battery positive voltage is applied to the coil, closing the contacts of the MAIN relay and supplying power to terminal +B of the ECM.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 CHECK ECM (+B VOLTAGE)



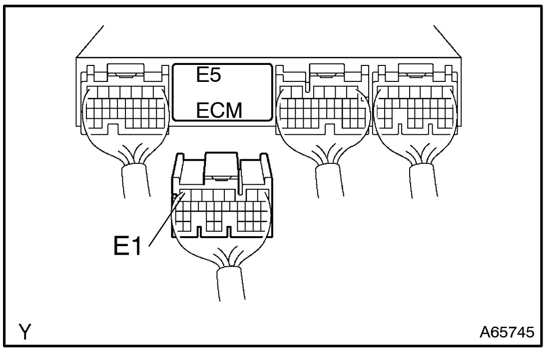
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard:

Tester Connection	Specified Condition
E7–1 (+B) – E5–7 (E1)	18 to 27 V

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN PROBLEM SYMPTOMS TABLE** **(See page 05–22)**

NG

2 CHECK WIRE HARNESS (ECM – BODY GROUND)



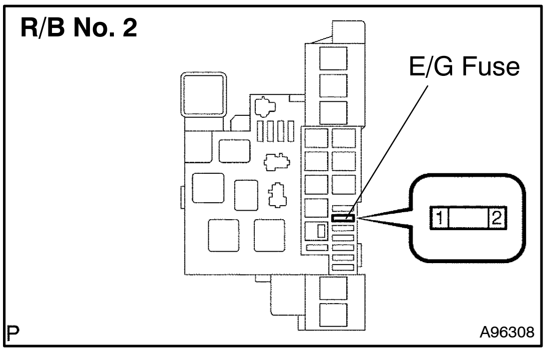
(a) Disconnect the E5 ECM connector.
(b) Measure the resistance of the wire harness side connector.
Standard:

Tester Connection	Specified Condition
E5–7 (E1) – Body ground	Below 1 Ω

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

OK

3 INSPECT FUSE (E/G)

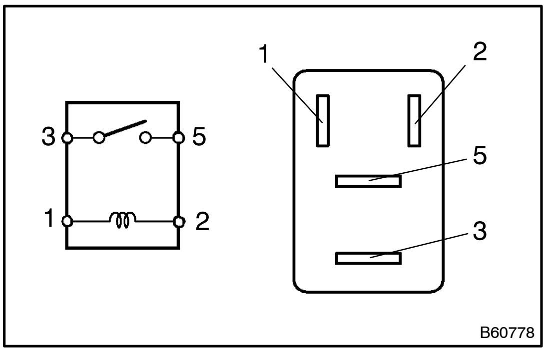


(a) Remove the E/G fuse from the R/B No. 2.
(b) Measure the resistance of the fuse.
Standard: Below 1 Ω

NG → **REPLACE FUSE**

OK

4 INSPECT RELAY (MAIN)



(a) Remove the MAIN relay from the R/B No. 2.
(b) Measure the resistance of the relay.

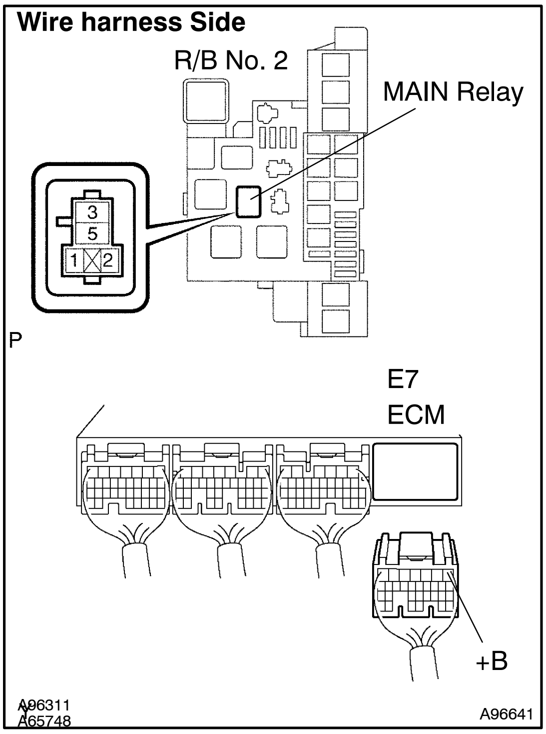
Standard:

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → **REPLACE RELAY**

OK

5 CHECK WIRE HARNESS (MAIN RELAY – ECM, MAIN RELAY – BODY GROUND)



(a) Check the wire harness between the MAIN relay and ECM.
(1) Remove the MAIN relay from the R/B No. 2.
(2) Disconnect the E7 ECM connector.
(3) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
R/B No. 2 MAIN relay terminal 3 – E7–1 (+B)	Below 1 Ω
R/B No. 2 MAIN relay terminal 3 or E7–1 (+B) – Body ground	10 kΩ or higher

(b) Check the wire harness between the MAIN relay and body ground.
(1) Remove the MAIN relay from the R/B No. 2.
(2) Measure the resistance of the wire harness side connector.

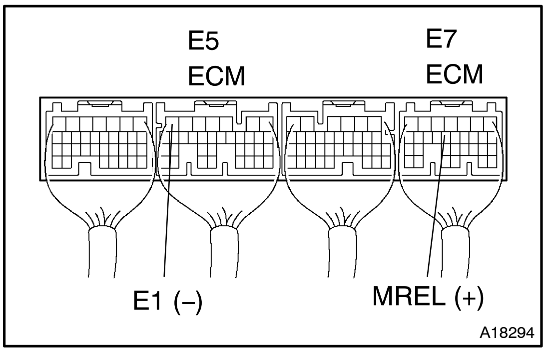
Standard:

Tester Connection	Specified Condition
R/B No. 2 MAIN relay terminal 2 – Body ground	Below 1 Ω

NG → **CHECK AND REPAIR HARNESS AND CONNECTOR (TERMINAL +B OF ECM – BATTERY POSITIVE TERMINAL)**

OK

6 CHECK ECM (MREL VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.

Standard:

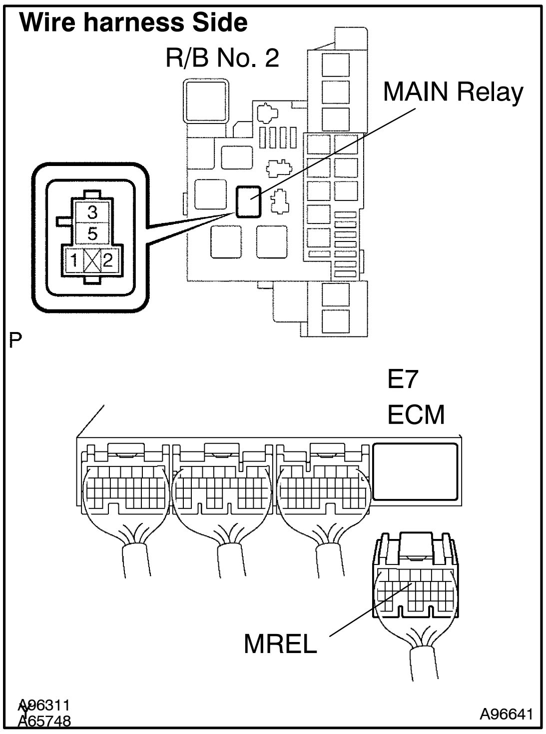
Tester Connection	Specified Condition
E7–13 (MREL) – E5–7 (E1)	17 to 28 V

NG → **REPLACE ECM (See page 10–10)**

(See page 10–10)

OK

7 CHECK WIRE HARNESS (MAIN RELAY – ECM, MAIN RELAY – BODY GROUND)



(a) Check the wire harness between the MAIN relay and ECM.
(1) Remove the MAIN relay from the R/B No. 2.
(2) Disconnect the E7 ECM connector.
(3) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
R/B No. 2 MAIN relay terminal 1 – E7–13 (MREL)	Below 1 Ω
R/B No. 2 MAIN relay terminal 1 or E7–13 (MREL) – Body ground	10 kΩ or higher

(b) Check the wire harness between the MAIN relay and body ground.
(1) Remove the MAIN relay from the R/B No. 2.
(2) Measure the resistance of the wire harness side connector.

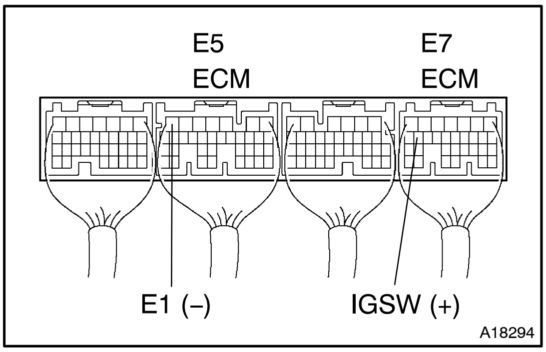
Standard:

Tester Connection	Specified Condition
R/B No. 2 MAIN relay terminal 2 – Body ground	Below 1 Ω

NG → **CHECK AND REPAIR HARNESS AND CONNECTOR (TERMINAL +B OF ECM – BATTERY POSITIVE TERMINAL)**

OK

8 CHECK ECM (IGSW VOLTAGE)



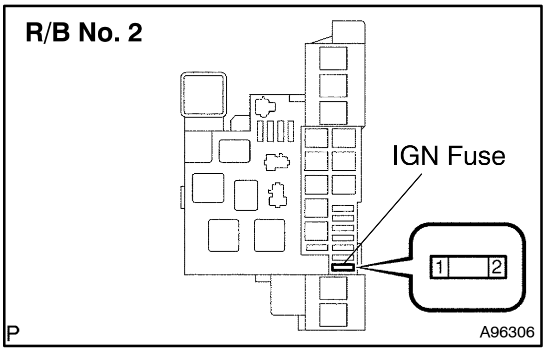
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard:

Tester Connection	Specified Condition
E7–16 (IGSW) – E5–7 (E1)	17 to 28 V

OK → **REPLACE ECM** **(See page 10–10)**

NG

9 INSPECT FUSE (IGN)

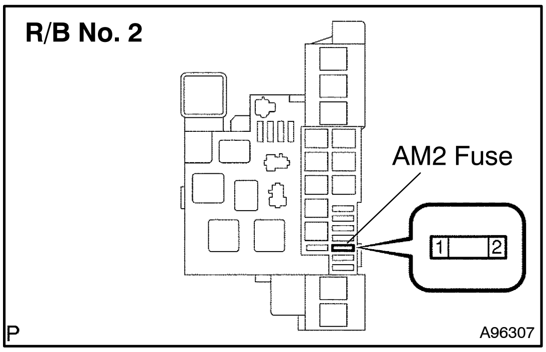


(a) Remove the IGN fuse from the R/B No. 2.
(b) Measure the resistance of the fuse.
Standard: Below 1 Ω

NG → **REPLACE FUSE**

OK

10 INSPECT FUSE (AM2)

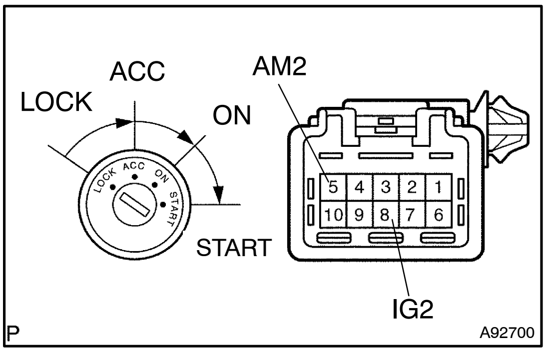


(a) Remove the AM2 fuse from the R/B No. 2.
(b) Measure the resistance of the fuse.
Standard: Below 1 Ω

NG → **REPLACE FUSE**

OK

11 INSPECT IGNITION SWITCH ASSY



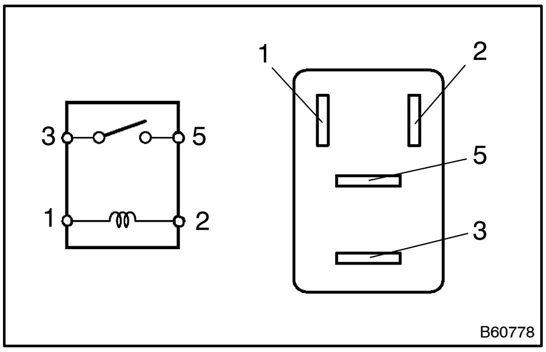
(a) Measure the resistance between the switch terminals.

Tester Connection	Condition	Specified Condition
5 (AM2) – 8 (IG2)	LOCK	10 kΩ or higher
5 (AM2) – 8 (IG2)	ON	Below 1 Ω

NG → **REPLACE IGNITION SWITCH ASSY**

OK

12 INSPECT RELAY (IG2)



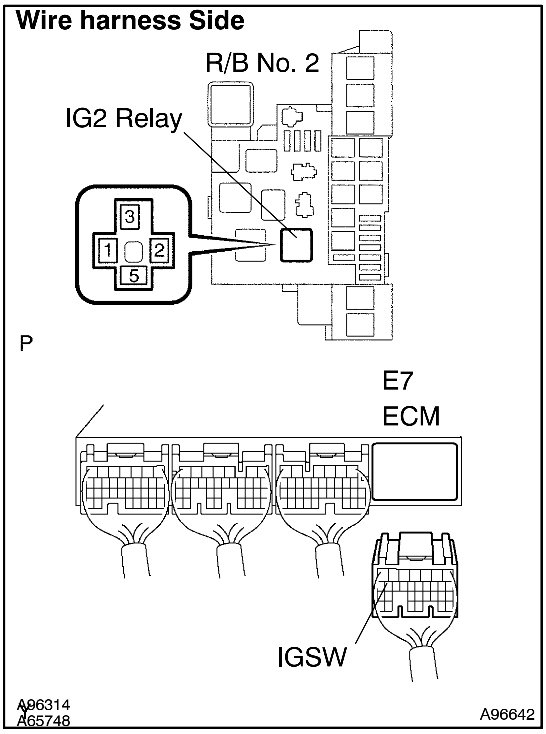
(a) Remove the IG2 relay from the R/B No. 2.
(b) Measure the resistance of the relay.
Standard:

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → **REPLACE RELAY**

OK

13 CHECK WIRE HARNESS (IG2 RELAY – ECM, IG2 RELAY – BODY GROUND)



(a) Check the wire harness between the IG2 relay and ECM.
(1) Remove the IG2 relay from the R/B No. 2.
(2) Disconnect the E7 ECM connector.
(3) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
R/B No. 2 IG2 relay terminal 5 – IGSW (E7–16)	Below 1 Ω
R/B No. 2 IG2 relay terminal 5 or IGSW (E7–16) – Body ground	10 kΩ or higher

(b) Check the wire harness between the IG2 relay and body ground.
(1) Remove the IG2 relay from the R/B No. 2.
(2) Measure the resistance of the wire harness side connector.

Standard:

Tester Connection	Specified Condition
R/B No. 2 IG2 relay terminal 2 – Body ground	Below 1 Ω

NG → **CHECK AND REPAIR HARNESS AND CONNECTOR (TERMINAL +B OF ECM – BATTERY POSITIVE TERMINAL)**

OK

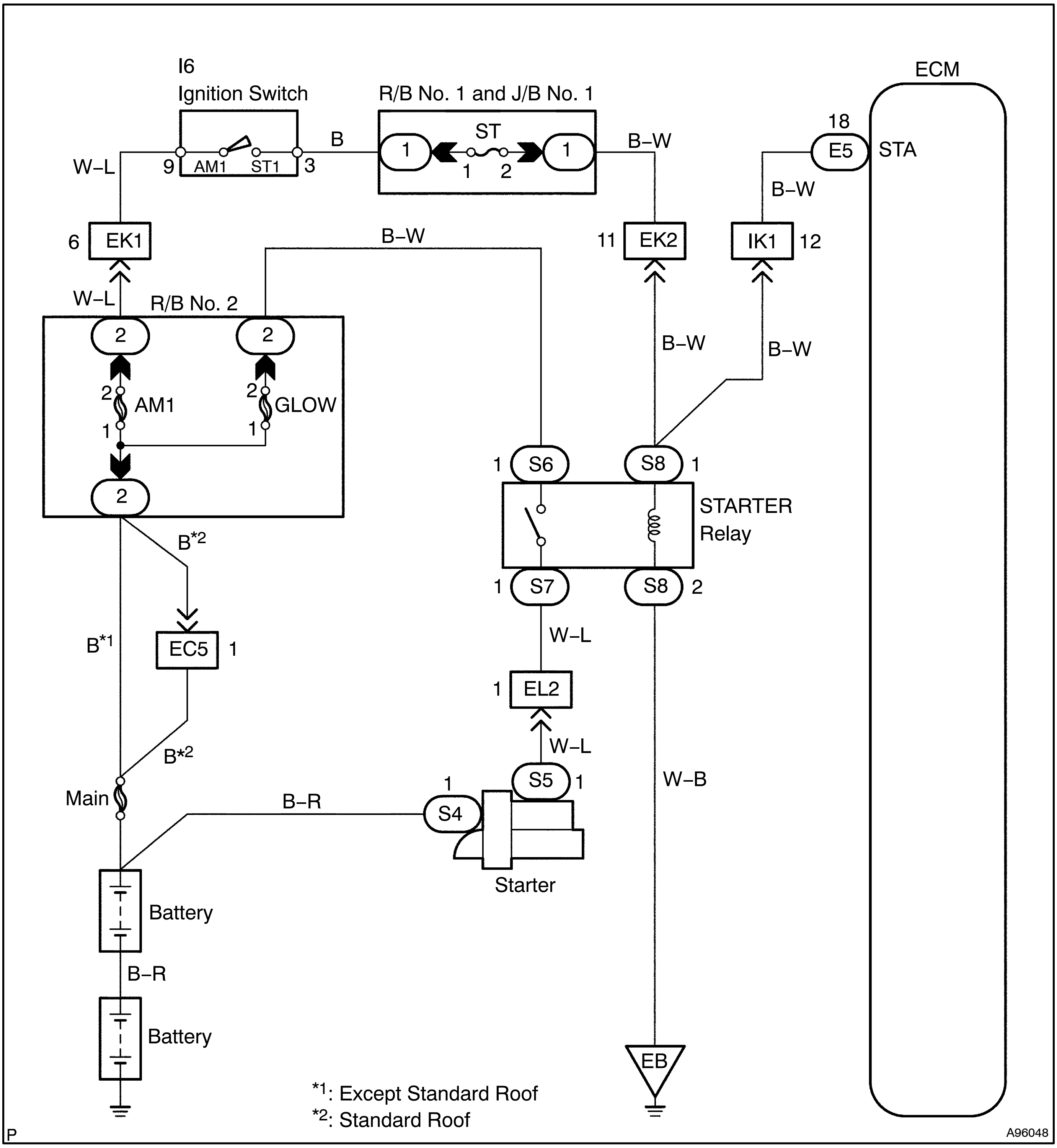
REPAIR OR REPLACE HARNESS AND CONNECTOR

STARTER SIGNAL CIRCUIT

CIRCUIT DESCRIPTION

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

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 05–22.

When using hand–held tester:

1	READ VALUE OF DATA LIST (STA SIGNAL)

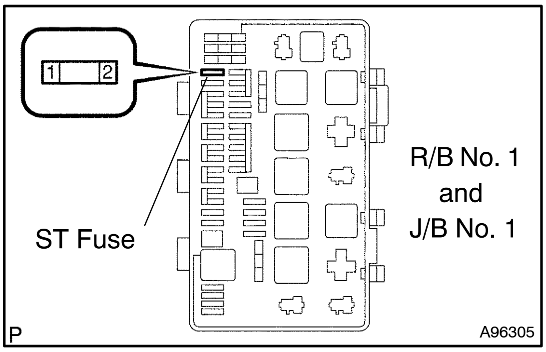
(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / STARTER SIG. Read the values.
Standard:

Ignition Switch Position	ON	START
STARTER	OFF	ON

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN ON PROBLEM SYMPTOMS TABLE (See page 05–22)**

NG

2	INSPECT FUSE (ST)

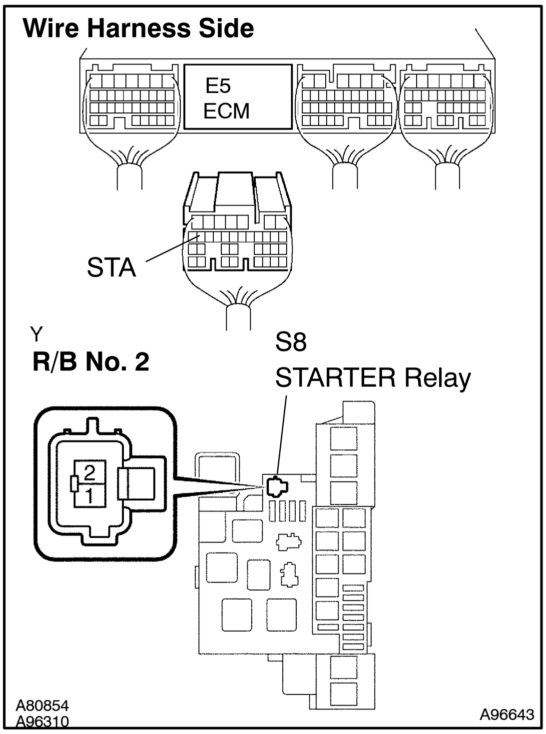


(a) Remove the ST fuse from the R/B No. 1 and J/B No. 1.
(b) Measure the resistance of the fuse.
Standard: Below 1 Ω

NG → **REPLACE FUSE**

OK

3	CHECK WIRE HARNESS (ECM – STARTER RELAY)



(a) Disconnect the E5 ECM connector.
(b) Remove the STARTER relay from the R/B No. 2.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
S8–1 – E5–18 (STA)	Below 1 Ω

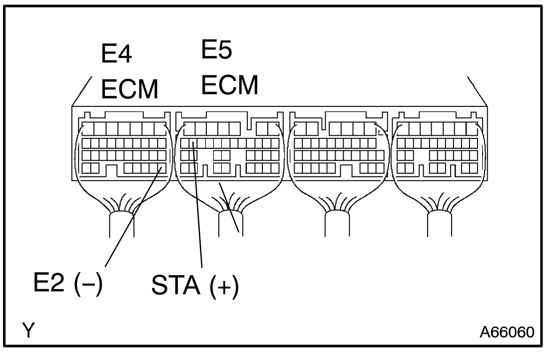
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM (See page 10–10)

When not using hand–held tester:

1	CHECK ECM (STA VOLTAGE)



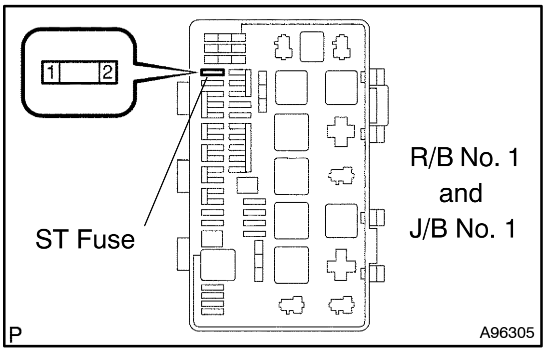
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard:

Tester Connection	Condition	Specified Condition
E5–18 (STA) – E4–28 (E2)	Cranking	18 V or more

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN ON PROBLEM SYMPTOMS TABLE (See page 05–22)**

NG

2 INSPECT FUSE (ST)

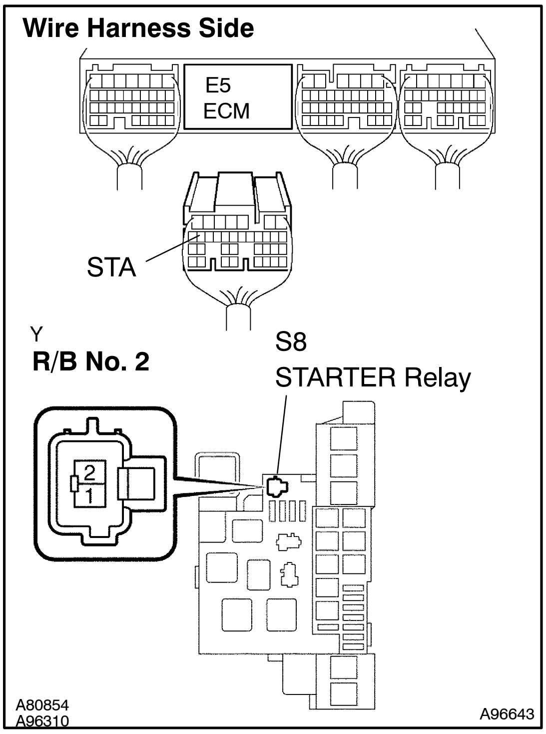


(a) Remove the ST fuse from the R/B No. 1 and J/B No. 1.
(b) Measure the resistance of the fuse.
Standard: Below 1 Ω

NG → **REPLACE FUSE**

OK

3 CHECK WIRE HARNESS (ECM – STARTER RELAY)



(a) Disconnect the E5 ECM connector.
(b) Remove the STARTER relay from the R/B No. 2.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified condition
S8–1 – E5–18 (STA)	Below 1 Ω

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

OK

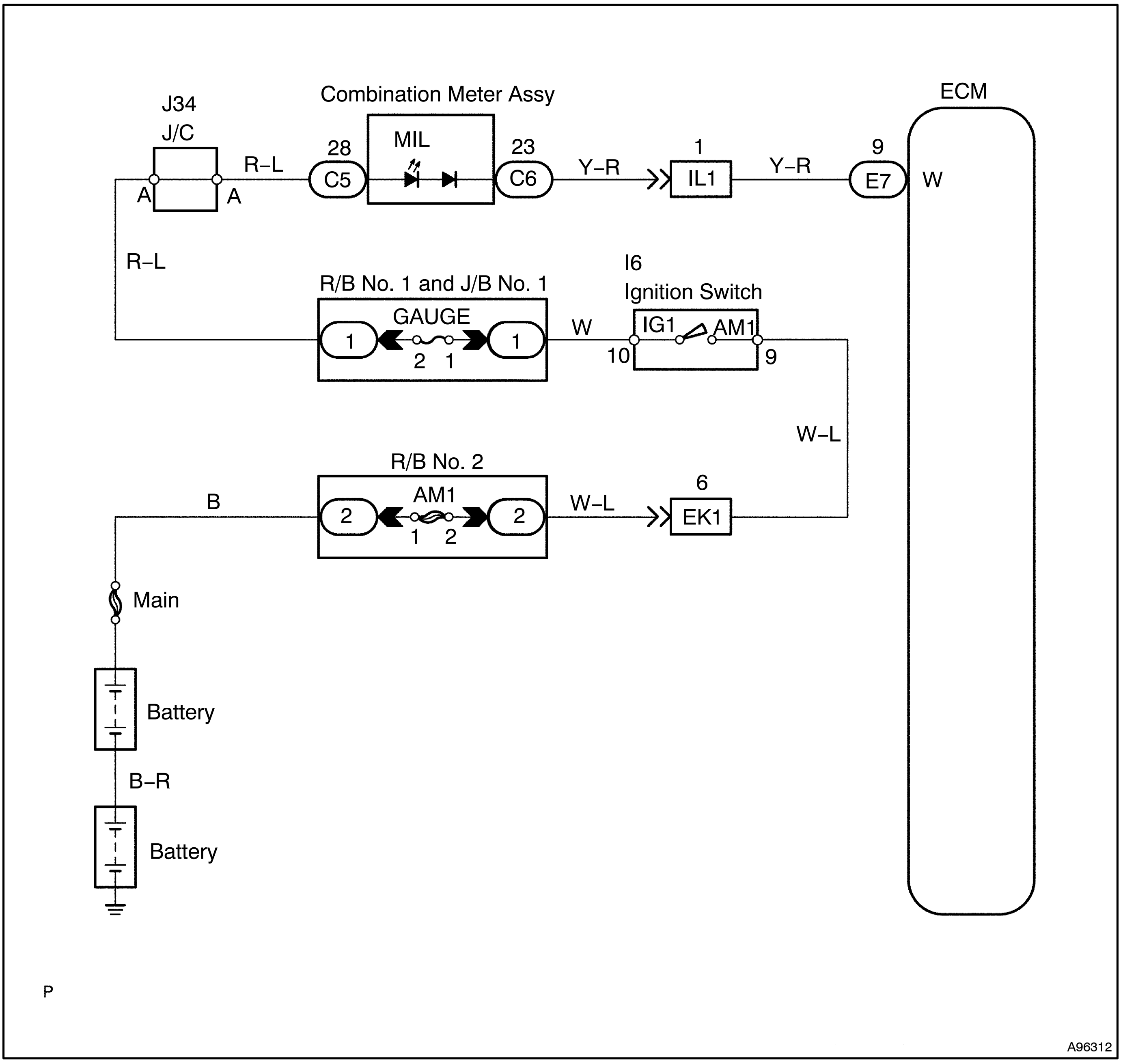
REPLACE ECM (See page 10–10)

MIL CIRCUIT

CIRCUIT DESCRIPTION

If the ECM detects a malfunction, the Malfunction Indicator Lamp (MIL) is illuminated. At this time, the ECM records the DTC in its memory.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Use the chart below to troubleshoot each trouble symptom.

MIL remains on	Start inspection from step 1
MIL is not illuminated	Start inspection from step 3

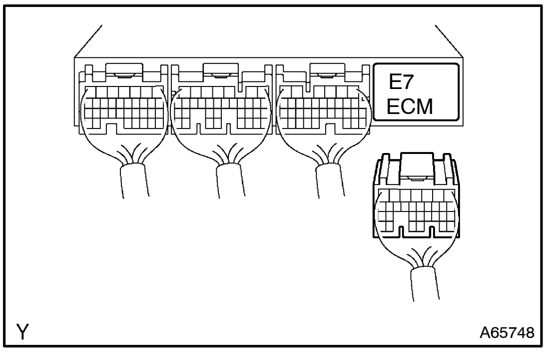
1 CLEAR DTC

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) Check the DTC (see page 05–29).
(d) Clear the DTC (see page 05–29).
(e) Check that the MIL does not illuminate.
OK: MIL does not illuminate

OK **REPAIR CIRCUIT INDICATED BY OUTPUT CODE (See page 05–38)**

NG ↓

2 CHECK WIRE HARNESS (CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the E7 ECM connector.
(b) Turn the ignition switch ON.
(c) Check that the MIL does not illuminate.
OK: MIL does not illuminate

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

OK ↓

REPLACE ECM (See page 10–10)

3 CHECK MIL CONDITION

(a) Check that the MIL illuminates when the ignition switch is turned ON.
OK: MIL illuminates

OK → **SYSTEM IS OK**

NG ↓

4	INSPECT COMBINATION METER ASSY (See Pub. No. S1–YXZE05A, page 71–1)

NG → **REPAIR OR REPLACE BULB OR COMBINATION METER ASSY**

OK

CHECK AND REPLACE HARNESS AND CONNECTOR (COMBINATION METER ASSY – ECM)

BLACK SMOKE

HINT:
Specified values in the following troubleshooting flowchart are the reference information.
Because of resultant values in DATA LIST vary depending on measuring conditions or vehicle's model years. Do not judge the vehicle normal even if the DATA LIST values indicate a standard level. There is a possibility that factors of the malfunction are hiding.

INSPECTION PROCEDURE

1 READ OUTPUT DTCS (RELATED TO ENGINE)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Turn the ignition switch ON and turn the hand–held tester ON.
(c) Enter the following menus: DIAGNOSIS / OBD/MOBD / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed to
Other than engine–related DTCs (see page 05–4)	A
DTCs related to the engine (see page 05–38)	B

B → **REPAIR OR REPLACE ENGINE CONTROL SYSTEM ACCORDING TO DTC OUTPUT (See page 05–38)**

A

2 CHECK INJECTOR COMPENSATION CODE (See page 05–1)

NG → **SET INJECTOR COMPENSATION CODE (See page 05–1)**

OK

3 READ VALUE OF DATA LIST

(a) Start the engine and turn the hand–held tester ON.
(b) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / INJ VOLUME and INJ VOL FB #1 to #4. Read the values.
Standard:

Item	Engine Speed *	Reference Value
INJ VOLUME	Idling (No engine load)	5 to 15 mm^3
INJ VOL FB #1	Idling (No engine load)	–2 to 2 mm^3
INJ VOL FB #2	Idling (No engine load)	–2 to 2 mm^3
INJ VOL FB #3	Idling (No engine load)	–2 to 2 mm^3
INJ VOL FB #4	Idling (No engine load)	–2 to 2 mm^3

HINT:
*: If no conditions are specifically stated for ”Idling”, the A/C switch is OFF and all accessory switches are OFF.

NG > **Go to step 12**

OK

4 PERFORM ENGINE RPM ACCELERATION

HINT:
If exhaust gas contains excessive black smoke, perform the following steps.
(a) Accelerate the engine speed up to the maximum RPM with no load 20 times.
(b) Check the volume of the black smoke in the exhaust gas.
Result:

Result	Proceed to
Black smoke is faded	OK
Black smoke remains in exhaust gas	NG

HINT:
Deposited soot in the exhaust system is a source of the excessive black smoke.

OK > **SYSTEM IS OK**

NG

5 CHECK AIR INTAKE SYSTEM AND EXHAUST SYSTEM

(a) Remove the air cleaner filter.
(b) Inspect the throttle valve (intake shutter) operation.
(1) Start the engine.
(2) Check if the throttle valve (intake shutter) fully opens when accelerating the engine speed.

OK > **CHECK AND REPAIR LOCATION WHERE MALFUNCTION EXIST**

NG

6 READ VALUE OF DATA LIST (MASS AIR FLOW RATE)

(a) Start the engine and turn the hand–held tester ON.
(b) On the hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / MAF. Read the values.

Standard:

Engine Speed Condition	Air Flow Rate (gm/s)
650 rpm	10 to 30

NG → **REPLACE MASS AIR FLOW METER**

OK

7 CHECK TURBOCHARGING PRESSURE (See page 13–3)

NG → **REPLACE TURBOCHARGER SUB–ASSY** **(See page 13–6)**

OK

8	READ VALUE OF DATA LIST

(a) Start the engine and turn the hand–held tester ON.
(b) Enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL.
(c) Select the following items in order and read values displayed on the hand–held tester respectively.
(1) COMMON RAIL PRESS
(2) INJ VOLUME
(3) M–INJ/PILOT ON
(4) M–INJ/PILOT OFF
(5) PILOT–INJ
(6) INJ TIMING
(7) INJ VOL FB #1 to #4

Standard:

Item	Engine Speed *	Standard Value
COMMON RAIL PRESS	Idling	25 to 35 MPa
COMMON RAIL PRESS	2,000 rpm (No engine load)	95 to 105 MPa
COMMON RAIL PRESS	3,000 rpm (No engine load)	80 to 90 MPa
INJ VOLUME	Idling	5 to 15 mm^3
INJ VOLUME	2,000 rpm (No engine load)	10 to 20 mm^3
INJ VOLUME	3,000 rpm (No engine load)	30 to 40 mm^3
M–INJ/PILOT ON	Idling	650 to 800 μs
M–INJ/PILOT OFF	Idling	650 to 750 μs
PILOT–INJ	Idling	500 to 600 μs
INJ TIMING	Idling	0°CA
INJ TIMING	2,000 rpm (No engine load)	–5 to –3°CA
INJ TIMING	3,000 rpm (No engine load)	–8 to –6°CA
INJ VOL FB #1	Idling	–2 to 2 mm^3
INJ VOL FB #2	Idling	–2 to 2 mm^3
INJ VOL FB #3	Idling	–2 to 2 mm^3
INJ VOL FB #4	Idling	–2 to 2 mm^3

HINT:
*: If no conditions are specifically stated for ”Idling”, the A/C switch is OFF and all accessory switches are OFF.

NG → **Go to step 12**

OK

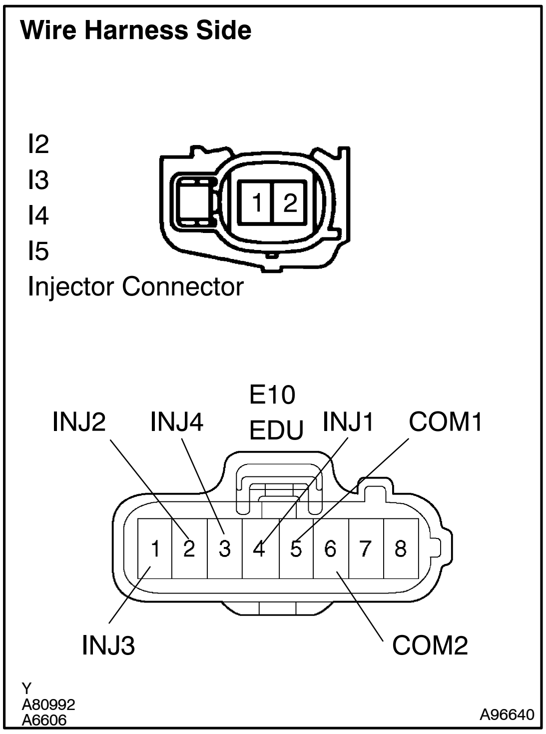
9	INSPECT CYLINDER COMPRESSION PRESSURE (See page 14–1)

NG → **CHECK AND REPAIR ENGINE**

OK

10 CHECK HARNESS AND CONNECTOR (INJECTOR – EDU)

HINT:
DTC P0200/97 (1 trip detection logic) will be present if there is an open or short in the EDU circuit.



(a) Disconnect the I2, I3, I4 or I5 injector connector.
(b) Disconnect the E10 EDU connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
Injector No. 1 (I2–1) – INJ#1 (E10–4) Injector No. 2 (I3–1) – INJ#2 (E10–2) Injector No. 3 (I4–1) – INJ#3 (E10–1) Injector No. 4 (I5–1) – INJ#4 (E10–3) Injector No. 1 (I2–2) – COM1 (E10–5) Injector No. 2 (I3–2) – COM2 (E10–6) Injector No. 3 (I4–2) – COM2 (E10–6) Injector No. 4 (I5–2) – COM1 (E10–5)	Below 1 Ω
Injector No. 1 (I2–1) or INJ#1 (E10–4) – Body ground Injector No. 2 (I3–1) or INJ#2 (E10–2) – Body ground Injector No. 3 (I4–1) or INJ#3 (E10–1) – Body ground Injector No. 4 (I5–1) or INJ#4 (E10–3) – Body ground Injector No. 1 (I2–2) or COM1 (E10–5) – Body ground Injector No. 2 (I3–2) or COM2 (E10–6) – Body ground Injector No. 3 (I4–2) or COM2 (E10–6) – Body ground Injector No. 4 (I5–2) or COM1 (E10–5) – Body ground	10 kΩ or higher

NG **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

11 PERFORM ACTIVE TEST (INJECTOR CUT #1 TO #4)

(a) Start the engine and turn the hand–held tester ON.
(b) Enter the following menus: DIAGNOSIS / OBD/MOBD / ACTIVE TEST / INJECTOR CUT #1 to #4.
(c) Check the engine idling condition while the fuel injection of each cylinder is cut by the hand–held tester.
Result:

Engine Idle Condition	Proceed to
Becomes unstable	A
Does not change	B

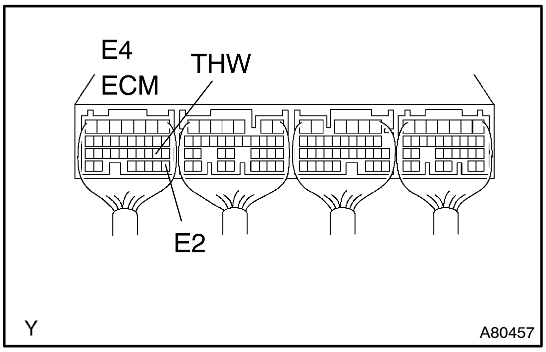
HINT:
Replace the injector mounted on the cylinder that causes rough idling.

B **REPLACE INJECTOR ASSY (See page 11–20)**

A

REPLACE EDU

12 CHECK ECM (THW VOLTAGE)



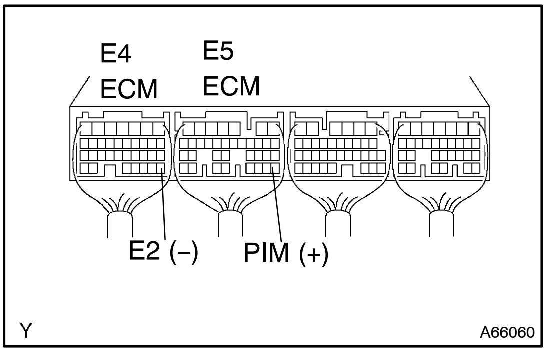
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Condition	Specified Condition
E4 – 19 (THW) – E4 – 28 (E2)	Idling, engine coolant temperature is 80 to 120°C (176 to 248°F)	0.4 to 1.0 V

NG **Go to step 18**

OK

13 CHECK ECM (PIM VOLTAGE)



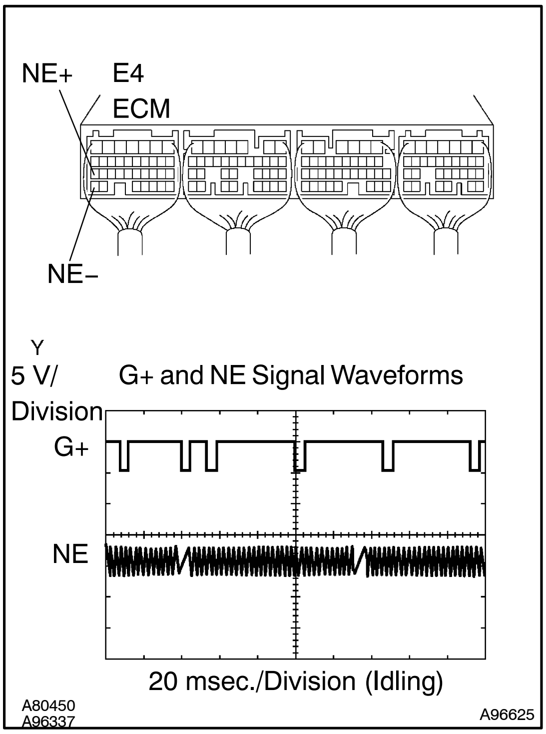
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard:

Tester Connection	Condition	Specified Condition
E5–28 (PIM) – E4–28 (E2)	Negative pressure of 93 kPa (675 mmHg, 27.5 in.Hg) applied	0.25 to 0.4 V
E5–28 (PIM) – E4–28 (E2)	Positive pressure of 150 kPa (1,125 mmHg, 44 in.Hg) applied	1.0 to 1.4 V

NG **Go to step 19**

OK

14 CHECK ECM (NE+ SIGNAL)



(a) Inspect using an oscilloscope.

(1) While the engine is idling, check the waveform of the ECM connector.

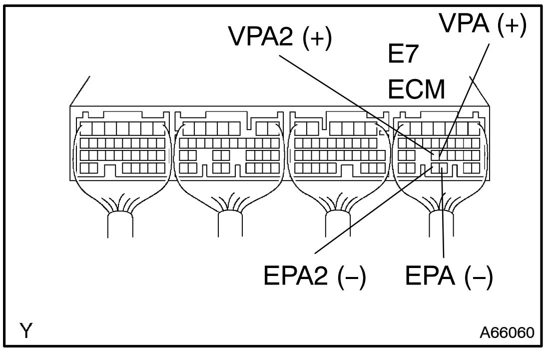
Standard:

Tester Connection	Specified Condition
E4–27 (NE+) – E4–34 (NE–)	Correct waveform is as shown

NG → **Go to step 20**

OK

15 CHECK ECM (VPA, VPA2 VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage of the ECM connector.

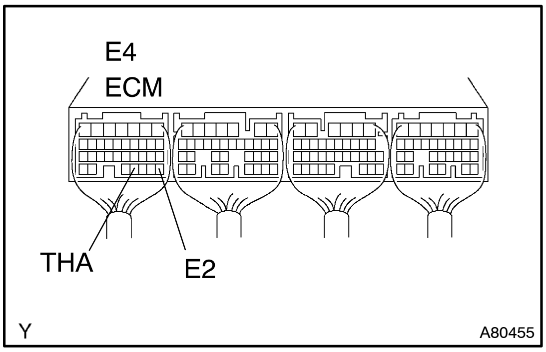
Standard:

Tester Connection	Accelerator Pedal Condition	Specified Condition
E7–22 (VPA) – E7–28 (EPA)	Released	0.5 to 1.1 V
E7–22 (VPA) – E7–28 (VPA)	Depressed	3.0 to 4.6 V
E7–23 (VPA2) – E7–29 (EPA2)	Released	0.9 to 2.3 V
E7–23 (VPA2) – E7–29 (EPA2)	Depressed	3.4 to 5.0 V

NG → **Go to step 21**

OK

16 CHECK ECM (THA VOLTAGE)



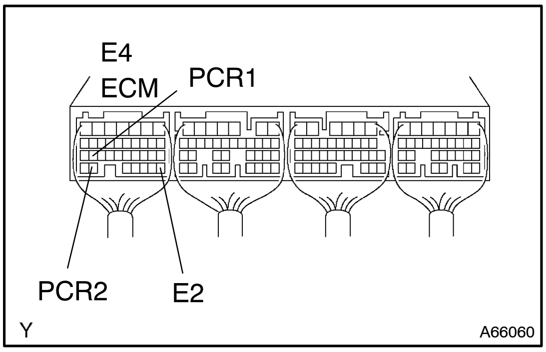
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Condition	Specified Condition
E4 – 31 (THA) – E4 – 28 (E2)	Idling, intake air temperature at 20°C (68°F)	0.5 to 3.4 V

NG → **Go to step 22**

OK

17 CHECK ECM (PCR1, PCR2 VOLTAGE)



(a) Start the engine.
(b) Measure the voltage of the ECM connector.
Standard:

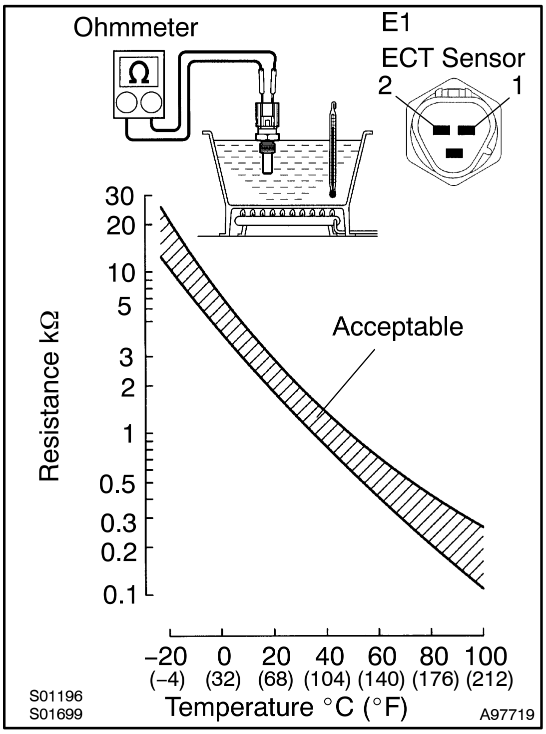
Tester Connection	Condition	Specified Condition
E4 – 26 (PCR1) – E4 – 28 (E2)	Engine is idling	1.7 to 2.2 V
E4 – 33 (PCR2) – E4 – 28 (E2)	Engine is idling	1.2 to 1.6 V

NG → **Go to step 23**

OK

REPLACE ECM (See page 10–10)

18 INSPECT ENGINE COOLANT TEMPERATURE SENSOR



(a) Remove the ECT sensor.

(b) Measure the resistance between the terminals.

Standard:

Tester Connection	Condition	Specified Condition
1 – 2	20°C (68°F)	2.21 to 2.69 kΩ
1 – 2	80°C (176°F)	0.29 to 0.354 kΩ

NOTICE:

If checking the ECT sensor in water, be careful not to allow water to contact the terminals. After checking, dry the sensor.

HINT:

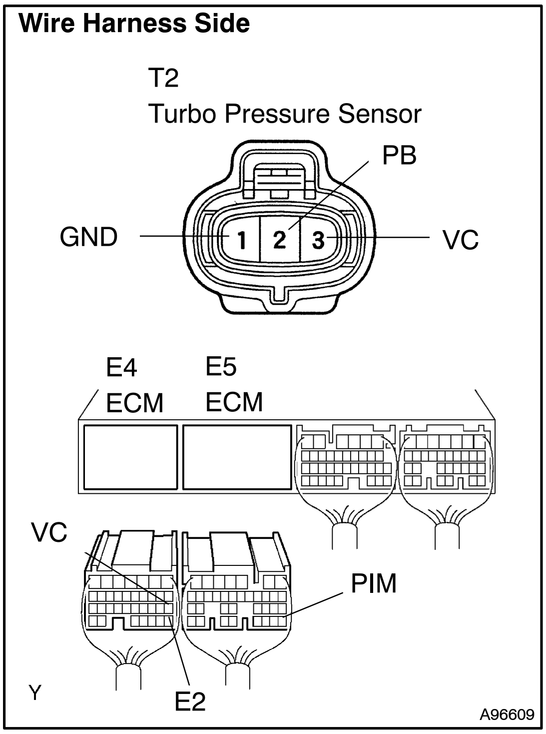
Alternate procedure: Connect an ohmmeter to the installed ECT sensor and read the resistance. Use an infrared thermometer to measure the engine coolant temperature in the immediate vicinity of the sensor. Compare these values to the resistance/temperature graph. Change the ECT (warm up or allow to cool down) and repeat the test.

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

19 CHECK WIRE HARNESS (TURBO PRESSURE SENSOR – ECM)



(a) Disconnect the T2 sensor connector.

(b) Disconnect the E4 and E5 ECM connectors.

(c) Measure the resistance of the wire harness side connectors.

Standard:

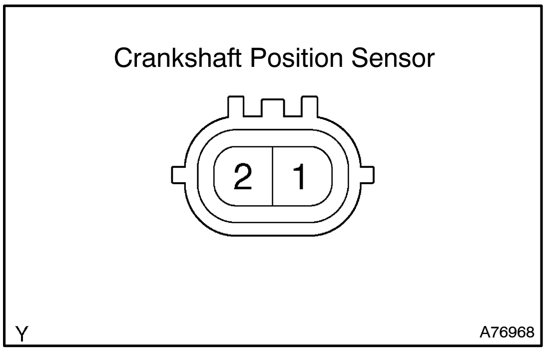
Tester Connection	Specified Condition
T2–2 (PB) – E5–28 (PIM) T2–3 (VC) – E4–18 (VC) T2–1 (GND) – E4–28 (E2)	Below 1 Ω
T2–2 (PB) or E5–28 (PIM) – Body ground T2–3 (VC) or E4–18 (VC) – Body ground T2–1 (GND) or E4–28 (E2) – Body ground	10 kΩ or higher

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

OK

REPLACE TURBO PRESSURE SENSOR

20 INSPECT CRANKSHAFT POSITION SENSOR



(a) Disconnect the C4 sensor connector.
(b) Measure the resistance of the sensor.
Standard:

Tester Connection	Condition	Specified Condition
1 – 2	Cold	1,630 to 2,740 Ω
1 – 2	Hot	2,065 to 3,225 Ω

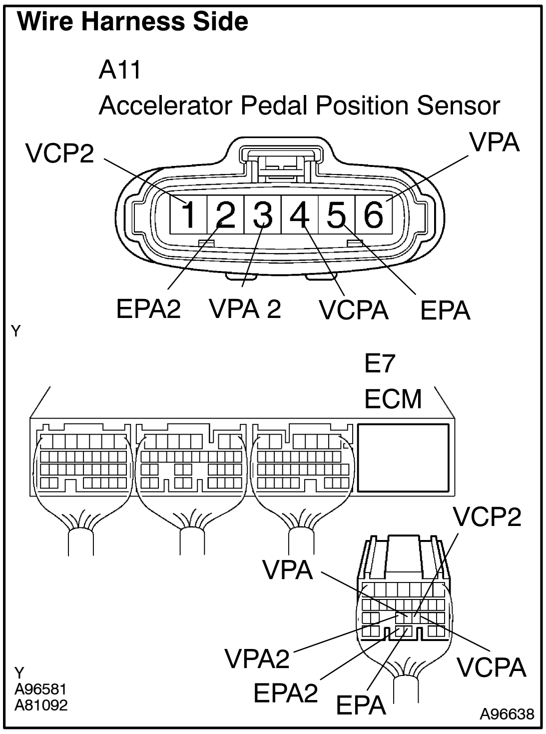
NOTICE:
In the above section, the terms "Cold" and " Hot" refer to the temperature of the coils. "Cold" means approximately –10 to 50°C (14 to 122°F). "Hot" means approximately 50 to 100°C (122 to 212°F).

NG → **REPLACE CRANKSHAFT POSITION SENSOR**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

21 CHECK WIRE HARNESS (ACCELERATOR PEDAL POSITION SENSOR – ECM)



(a) Disconnect the A11 sensor connector.
(b) Disconnect the E7 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
A11–1 (VCP2) – E7–21 (VCP2) A11–2 (EPA2) – E7–29 (EPA2) A11–3 (VPA2) – E7–23 (VPA2) A11–4 (VCPA) – E7–20 (VCPA) A11–5 (EPA) – E7–28 (EPA) A11–6 (VPA) – E7–22 (VPA)	Below 1 Ω
A11–1 (VCP2) or E7–21 (VCP2) – Body ground A11–2 (EPA2) or E7–29 (EPA2) – Body ground A11–3 (VPA2) or E7–23 (VPA2) – Body ground A11–4 (VCPA) or E7–20 (VCPA) – Body ground A11–5 (EPA) or E7–28 (EPA) – Body ground A11–6 (VPA) or E7–22 (VPA) – Body ground	10 kΩ or higher

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

OK

REPLACE ACCELERATOR PEDAL ASSY (ACCELERATOR PEDAL POSITION SENSOR)

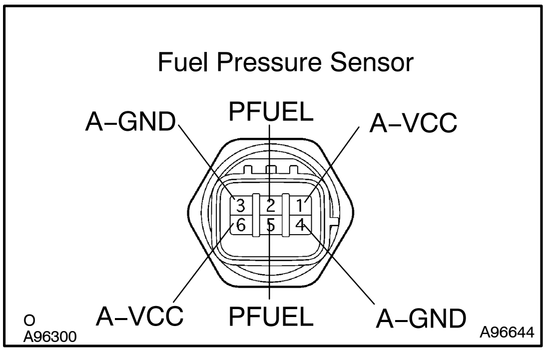
22 INSPECT MASS AIR FLOW METER (See page 10–3)

NG → **REPLACE MASS AIR FLOW METER**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

23 INSPECT COMMON RAIL ASSY (FUEL PRESSURE SENSOR)



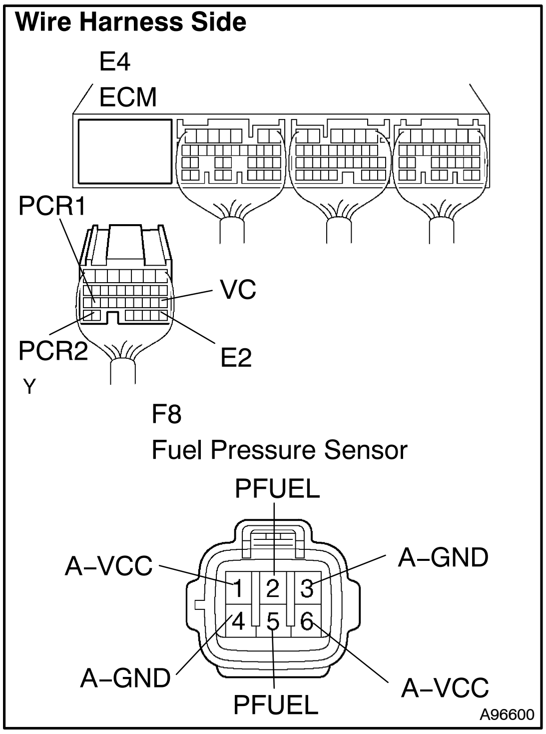
(a) Disconnect the F8 fuel pressure sensor connector.
(b) Measure the resistance of the sensor connector.
Standard:

Tester Connection	Specified Condition
F8–2 (PFUEL) – F8–3 (A–GND)	16.4 kΩ or less
F8–5 (PFUEL) – F8–4 (A–GND)	16.4 kΩ or less
F8–1 (A–VCC) – F8–2 (PFUEL)	3 kΩ or less
F8–6 (A–VCC) – F8–5 (PFUEL)	3 kΩ or less

NG → **REPLACE COMMON RAIL ASSY (FUEL PRESSURE SENSOR) (See page 11–15)**

OK

24 CHECK HARNESS AND CONNECTOR (FUEL PRESSURE SENSOR – ECM)



(a) Disconnect the E4 ECM connectors.
(b) Disconnect the F8 fuel pressure sensor connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
E4–26 (PCR1) – F8–5 (PFUEL) E4–33 (PCR2) – F8–2 (PFUEL) E4–18 (VC) – F8–6 (A–VCC) E4–18 (VC) – F8–1 (A–VCC) E4–28 (E2) – F8–4 (A–GND) E4–28 (E2) – F8–3 (A–GND)	Below 1 Ω
E4–26 (PCR1) or F8–5 (PFUEL) – Body ground E4–33 (PCR2) or F8–2 (PFUEL) – Body ground E4–18 (VC) or F8–6 (A–VCC) – Body ground E4–18 (VC) or F8–1 (A–VCC) – Body ground E4–28 (E2) or F8–4 (A–GND) – Body ground E4–28 (E2) or F8–3 (A–GND) – Body ground	10 kΩ or higher

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

OK

25	REPLACE ECM (See page 10–10)

NG → **REPLACE INJECTION OR SUPPLY PUMP ASSY (See page 11–10)**

OK

END

ABS & BA SYSTEM (N04C–TF)

HOW TO PROCEED WITH TROUBLESHOOTING

057EK–03

HINT:

- Use this procedure to troubleshoot the ABS & BA system.
- The hand–held tester should be used in steps 3, 6 and 8.
- Fail–safe function:
  When a malfunction occurs in the ABS system, the ABS warning lamp is illuminated and the ABS operation is prohibited.

1	**VEHICLE BROUGHT TO WORKSHOP**

2	**CUSTOMER PROBLEM ANALYSIS CHECK AND PROBLEM SYMPTOM CHECK (See page 05–180)**

3	**CHECK AND CLEAR DTCS (See page 05–181)**

4	**PROBLEM SYMPTOM CONFIRMATION**

(a) If the symptom does not occur, proceed to A.
(b) If the symptom occurs, proceed to B.

B	**Go to step 6**

A

5	**SYMPTOM SIMULATION (See page 01–17)**

6	**CHECK FOR DTC**

(a) Check for DTCs.
  (1) If the DTC does not reoccur, proceed to A.
  (2) If the ES starting system DTC reoccurs, proceed to B.
  (3) If the ABS & BA system starting system DTC reoccurs, proceed to C.

B	**Go to EASY & SMOOTH STARTING SYSTEM (See page 05–276)**
C	**Go to step 9**

A

7	PROBLEM SYMPTOMS TABLE (See page 05–199)

(a) If the fault is not listed on the problem symptoms table, proceed to A.
(b) If the fault is listed on the problem symptoms table, proceed to B.

B → **CHECK FOR FLUID LEAKAGE AND Go to step 9**

A

8	OVERALL ANALYSIS AND TROUBLESHOOTING

(a) PRE–CHECK (see page 05–181)
  (1) Inspection with the hand–held tester (DATA LIST)
  (2) Inspection with the hand–held tester (ACTIVE TEST)
(b) On–vehicle inspection (see page 32–5)
(c) Terminals of ECU (see page 05–196)

9	ADJUST, REPAIR OR REPLACE

10	CONFIRMATION TEST

END

057EL–03

CUSTOMER PROBLEM ANALYSIS CHECK

ABS & BA SYSTEM Check Sheet

Inspector's Name :

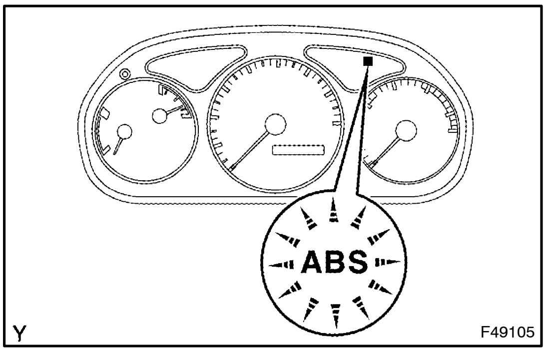
Customer's Name		**VIN**	
		Production Date	/ /
		License Plate No.	
Date Vehicle Brought In	/ /	**Odometer Reading**	km miles

Date Problem First Occurred	/ /
Frequency the Problem Occurs	☐ Continuously ☐ Intermittently (times a day)

Problem Symptoms	☐ ABS does not operate.	
	☐ ABS does not operate efficiently.	
	☐ BA system does not operate.	
	ABS Warning Lamp Abnormal	☐ Remains ON ☐ Does not illuminate

DTC Check	**1st Time**	☐ Normal Code ☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code ☐ Malfunction Code (Code)

05L2P–01

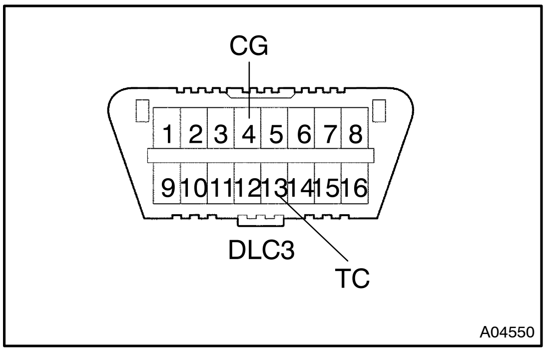


PRE–CHECK

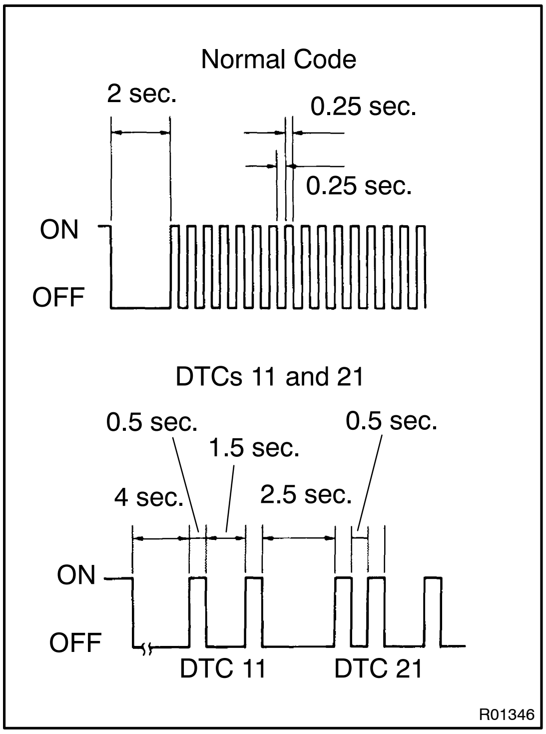
1. DIAGNOSIS SYSTEM

(a) Check the ABS warning lamp.
When the ignition switch is turned ON, check that the ABS warning lamp illuminates for 3 seconds.

HINT:
If the indicator check result is abnormal, proceed to the trouble-shooting for the ABS warning lamp circuit (see page 05–247 or 05–250).



(b) When not using the hand–held tester:
Check the DTC.
(1) Using SST, connect terminals TC and CG of the DLC3.
SST 09843–18040
(2) Turn the ignition switch ON.



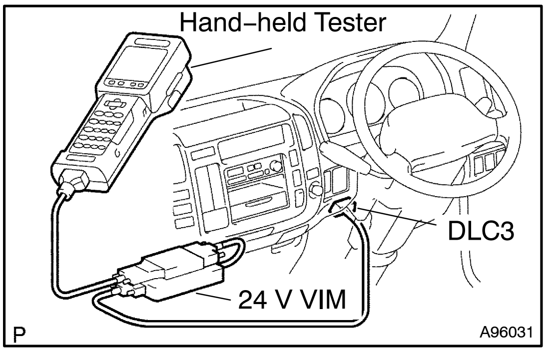
(3) Read the DTC from the ABS warning lamp on the combination meter.

HINT:
- If no code appears, inspect the diagnostic circuit or the ABS warning lamp circuit (see page 05–247 or 05–250).
- As an example, the blinking patterns for the normal code and DTCs 11 and 21 are shown in the illustration.

(4) Check the details of the code using the code table on page 05–191.

If 2 or more DTCS are indicated at the same time, the lowest numbered DTC will be displayed first.

(5) After completing the check, remove the SST from the DLC3.
SST 09843–18040

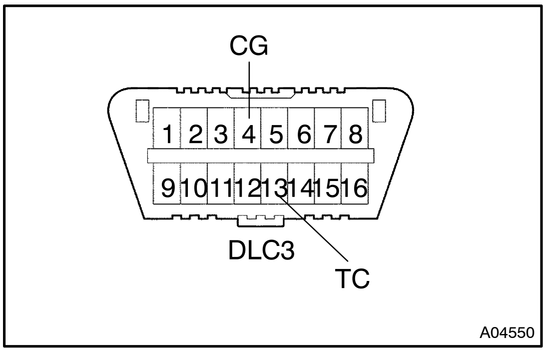


(c) When using the hand–held tester:
Check the DTC.
(1) Connect the hand–held tester (with 24 V VIM) to the DLC3.

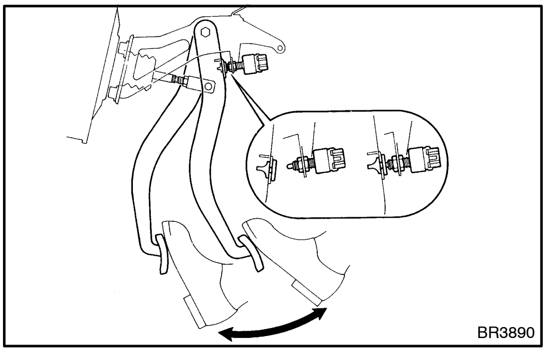
NOTICE:
Be sure to use the 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

(2) Turn the ignition switch ON.
(3) Read the DTC by following the prompts on the tester screen.

HINT:
Refer to the hand–held tester operator's manual for further details.



(d) When not using the hand–held tester:
Clear the DTC.
(1) Using SST, connect terminals TC and CG of the DLC3.
SST 09843–18040
(2) Turn the ignition switch ON.

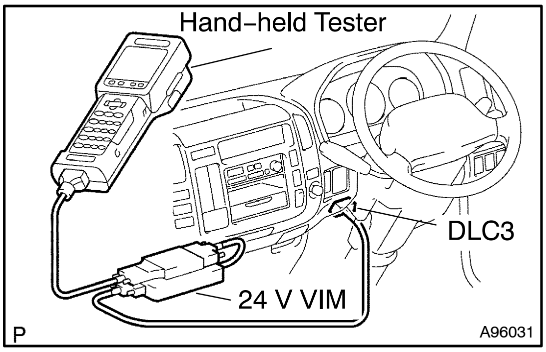


(3) Clear the DTC stored in the ECU by depressing the brake pedal 8 times or more within 5 seconds.
(4) Check that the ABS warning lamp indicates the normal code.
(5) Remove the SST from the DLC3.

HINT:
Disconnection of the battery cable during repairs will not erase the DTC in the ECU.

(e) When using the hand–held tester:
Clear the DTC.
(1) Connect the hand–held tester to the DLC3.
(2) Turn the ignition switch ON.
(3) Use the hand–held tester to erase the codes.

HINT:
Refer to the hand–held tester operator's manual for further details.



2. When using hand–held tester: CHECK SENSOR SIGNAL (TEST MODE)

(a) Check sensor signal.

(1) Connect the hand–held tester (with 24 V VIM) to the DLC3.

NOTICE:
Be sure to use the 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

(2) Check that the steering wheel is in the neutral position and move the shift lever to the P position.

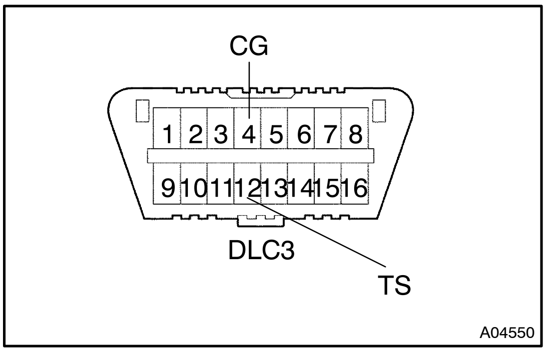
(3) Turn the ignition switch ON.

(4) Change the ECU to signal check with the hand–held tester. Enter the following menus: DIAGNOSIS / (OBD / MOBD) / DYNA / ABS / SIGNAL CHECK. Make sure the ABS warning lamp flashes as shown in the illustration.

(5) Perform step (3–a–(4)) to (3–d–(3)) on the next 2 pages.

(6) Read the DTC by following the prompts on the tester screen (see page 05–191).

HINT:
Refer to the hand–held tester operator's manual for further details.



3. When not using hand–held tester: CHECK SENSOR SIGNAL (TEST MODE)

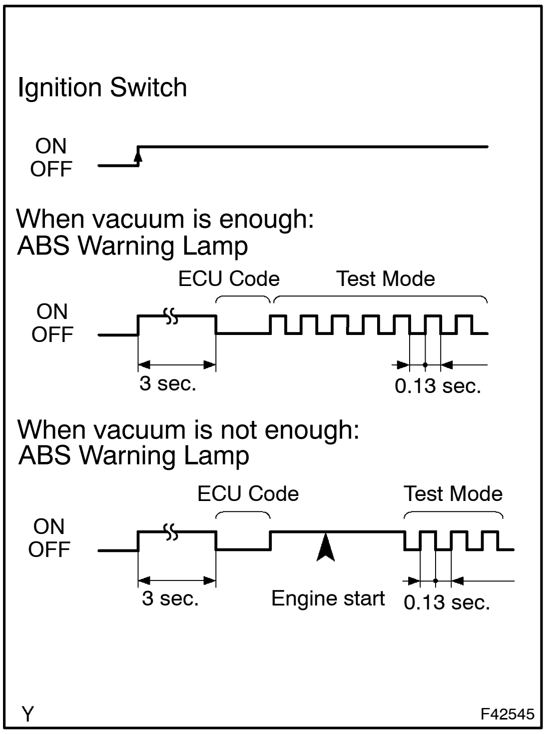
(a) Procedures for the test mode:

(1) Turn the ignition switch OFF.

(2) Using SST, connect terminals TS and CG of the DLC3.

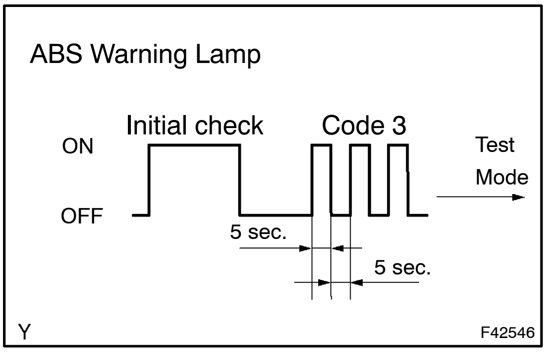
SST 09843–18040

(3) Turn the ignition switch ON.



(4) Check that test mode is entered after the ABS warning lamp is on for 3 seconds (initial value check) and the ECU code is output. Do not depress the brake pedal until test mode is entered.

(5) If the ABS warning lamp remains on even after the ECU code is output, start the engine. Then, check that in several seconds, test mode is entered. Do not depress the brake pedal until the entry of the test mode is confirmed. The way of the lamp indication after the ECU code is output depends on vacuum of the vacuum booster.
When the vacuum is high enough, test mode is entered. When the vacuum is not high enough, the indication lamp remains on.



HINT:

- To prevent a installation of a wrong skid control ECU, output an ECU code when starting test mode. The code varies with the vehicle type to which the ECU is installed, and therefore it is necessary to confirm whether it fits the vehicle type.
- Perform the steps 1 to 4 from the previous page to output ECU code.
- The ABS warning lamp illuminates in the applicable code pattern. The illuminating pattern shown in the illustration on the left is an example of code 3.

ECU code table:

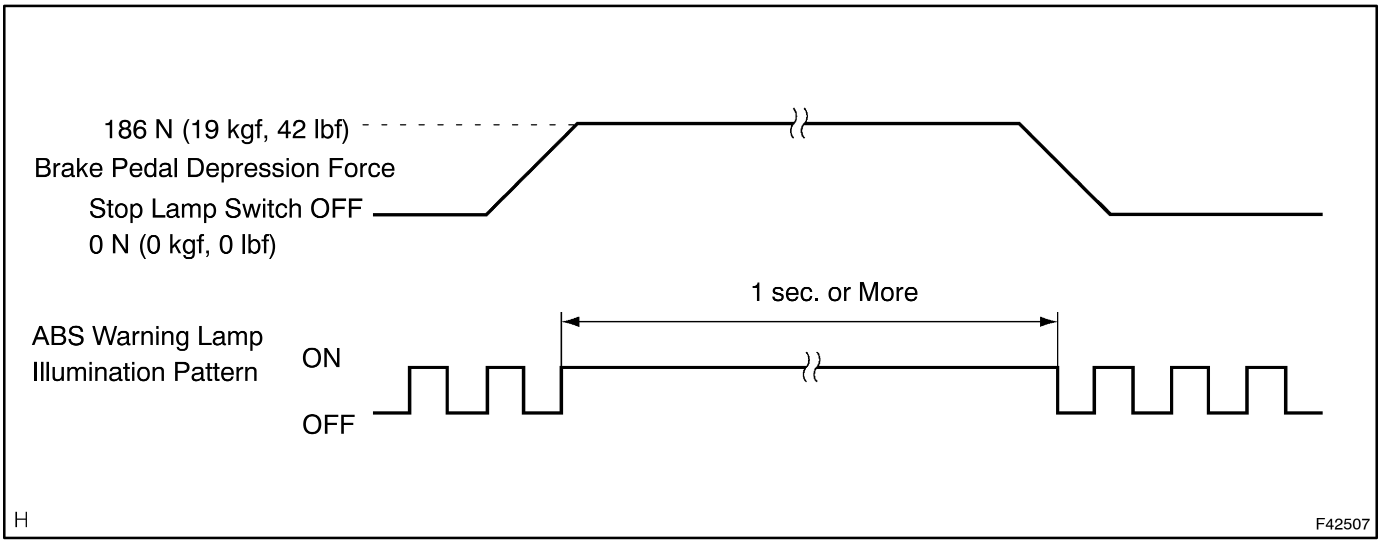
Vehicle Type	Code
Short body w/o ES start system	1
Long body w/o ES start system	2
Short body w/ ES start system	3
Long body w/ ES start system	4

- If the ABS warning lamp does not flash, inspect the ABS warning lamp circuit (see page 05–250).

(b) Check master cylinder pressure sensor.
   (1) Turn the ignition switch OFF and then ON again.

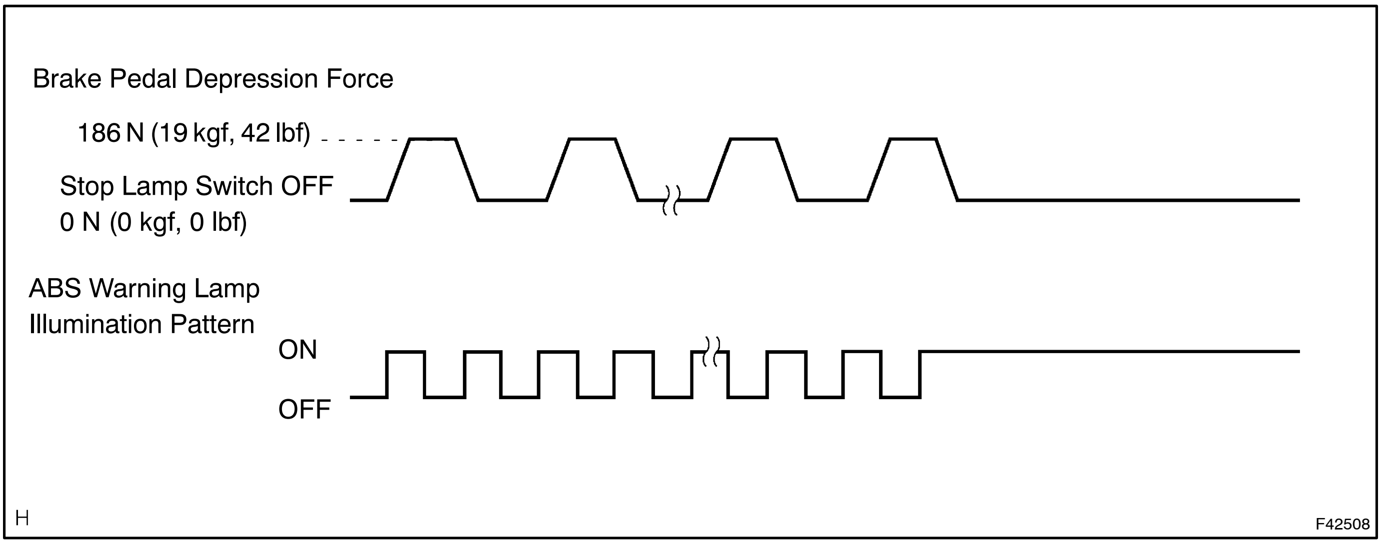
HINT:
Do not start the engine.

   (2) After releasing the brake pedal for 1 second or more, depress it again with a force of 186 N (19 kgf, 42 lbf) or more.
   (3) Check that the ABS warning lamp illuminates.
   (4) Depress the brake pedal for 1 second with the ABS warning lamp illuminated and release it.
   (5) Check that the blinking pattern of the ABS warning lamp returns to the pattern shown in test mode.



HINT:
- Do not depress the brake pedal several times.
- If the ABS warning lamp does not illuminate even though the brake pedal is depressed, the master cylinder pressure sensor may be defective.

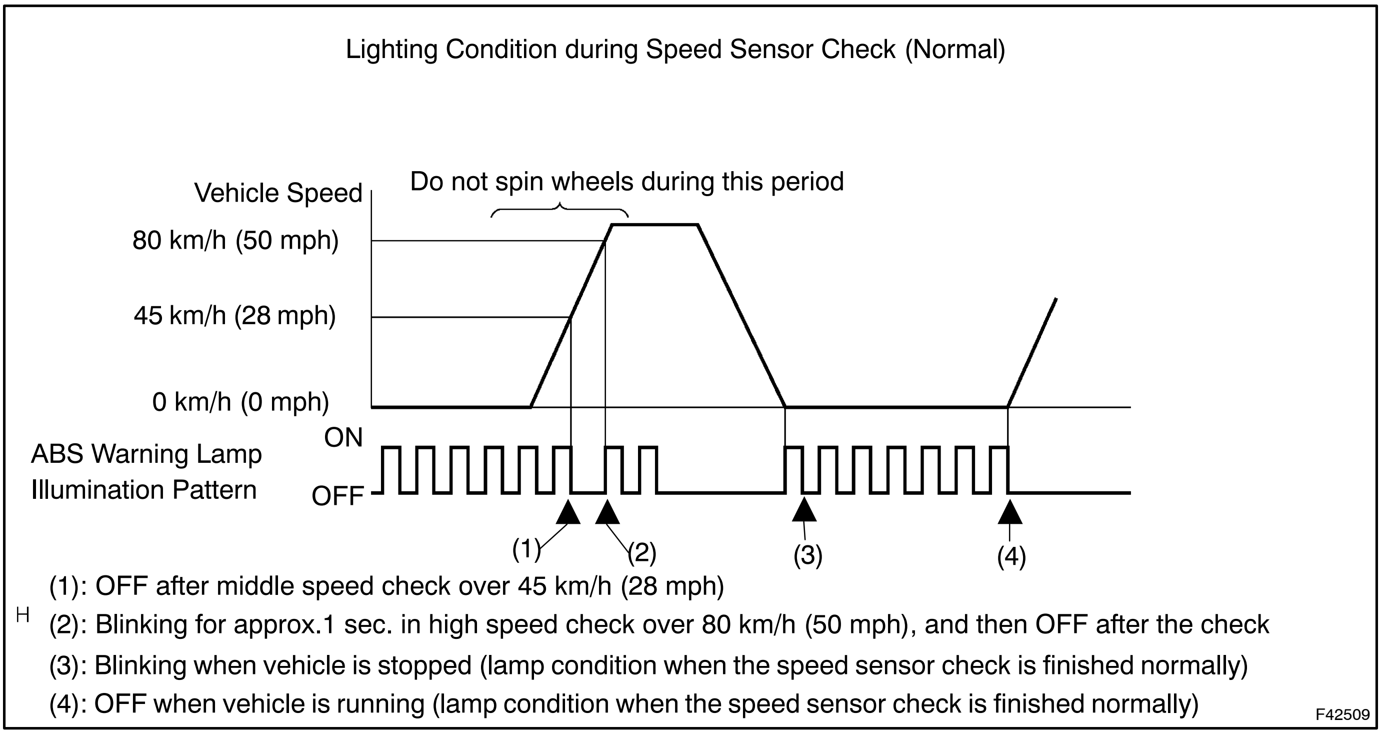
(c) Check vacuum sensor.
   (1) Depress the brake pedal several times.
   (2) Check that the ABS warning lamp illuminates.



HINT:

- If the ABS warning lamp does not illuminate after depressing the brake pedal continuously, the vacuum sensor may be defective.
- When the parking brake is released, the vacuum warning buzzer may sound.
- After the warning lamp changes from blinking to illuminated, stop depressing the brake pedal.

(d) Check speed sensor.
  (1) Start the engine.
  (2) Check that the ABS warning lamp is flashing.
  (3) Drive the vehicle in a straight line.
  When driving the vehicle at 90 km/h (56 mph) for several seconds, check that the ABS warning lamp turns off.



  (4) Stop the vehicle.

HINT:

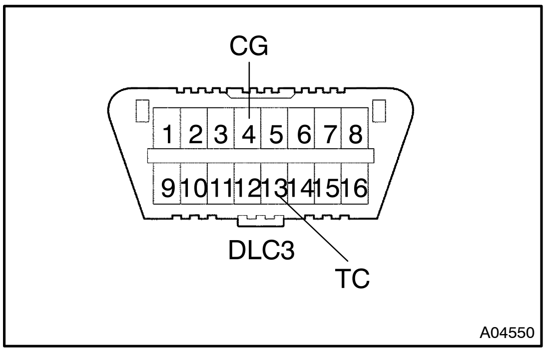
- The sensor check may not complete if the rear wheels are spinning.
- If the sensor check is started while the vehicle is being steered, the warning lamp may not turn off after the check.
- If the sensor is malfunctioning, the illumination pattern of the warning lamp will be different trom the illumination pattern shown in the illustration above.

(e) Check the ABS warning lamp condition after the check is completed.
Lighting condition when the speed sensor check is finished normally:

Vehicle Condition	Lighting Condition of ABS Warning Lamp
Vehicle stopped	Flashing (ON) (It flashes even if test mode is not finished normally)
Vehicle running	Not flashing (OFF)

HINT:
When the sensor check is not finished and the sensor is abnormal:

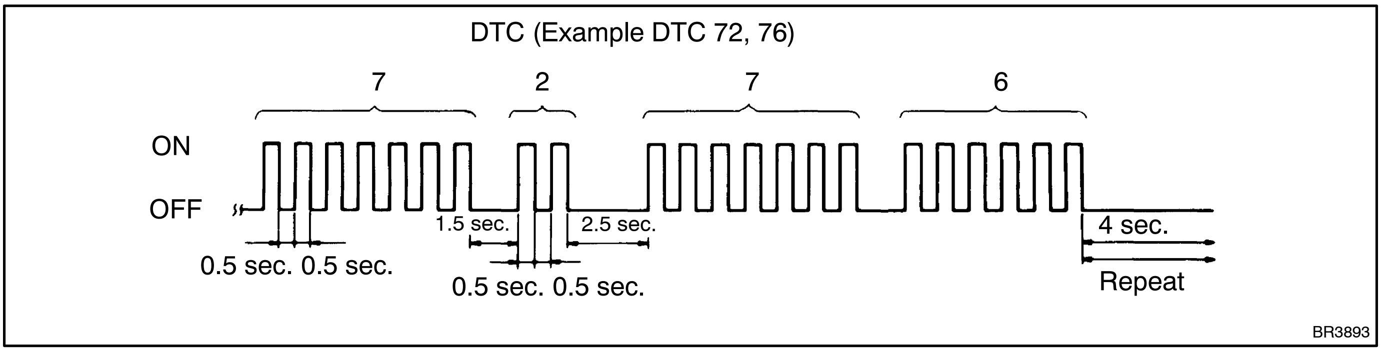
- The warming lamp flashes even while the vehicle is running.
- The ABS will not operate.



(f) Read the DTC.
(1) Using SST, connect terminals TC and CG of the DLC3.
SST 09483–18040
(2) Turn the ignition switch ON.
(3) Read the number of flashes of the ABS warning lamp (see page 05–191).

HINT:

- Check the DTC chart (see page 05–191).
- If all the sensors are normal, a normal code is output (a cycle of 0.25 seconds ON and 0.25 seconds OFF is repeated).
- If 2 or more DTCS are indicated at the same time, the lowest numbered code will be displayed first.



(4) After performing the check, turn the ignition switch OFF and disconnect the SST from the DLC3.

4. DATA LIST

Using the hand–held tester's DATA LIST allows switch, sensor, actuator and other item values to be read witchout removing any parts. Reading the DATA LIST early in troubleshooting is one way to save time.

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

(b) Turn the ignition switch ON.

(c) Read the DATA LIST.

Skid control ECU assy:

Item	Measurement Item/ Range (Display)	Normal Condition	Diagnostic Note
ABS MOT RELAY	ABS motor relay / ON or OFF	–	–
SOL RELAY	Solenoid relay / ON or OFF	–	–
STOP LIGHT SW	Stop lamp switch / ON or OFF	ON: Brake pedal depressed OFF: Brake pedal released	–
PKB SW	Parking brake switch / ON or OFF	ON: Parking brake applied OFF: Parking brake released	–
ABS OPERT FR	ABS operation (FR) / BEFORE or OPERATE	BEFORE: No ABS operation (FR) OPERATE: During ABS operation (FR)	–
ABS OPERT FL	ABS operation (FL) / BEFORE or OPERATE	BEFORE: No ABS operation (FL) OPERATE: During ABS operation (FL)	–
ABS OPERT RR	ABS operation (RR) / BEFORE or OPERATE	BEFORE: No ABS operation (RR) OPERATE: During ABS operation (RR)	–
ABS OPERT RL	ABS operation (RL) / BEFORE or OPERATE	BEFORE: No ABS operation (RL) OPERATE: During ABS operation (RL)	–
WHEEL SPD FR	Wheel speed sensor (FR) reading / Min.: 0 km/h (0 mph) Max.: 255 km/h (158 mph)	Actual wheel speed	Speed indicated on speedometer
WHEEL SPD FL	Wheel speed sensor (FL) reading / Min.: 0 km/h (0 mph) Max.: 255 km/h (158 mph)	Actual wheel speed	Speed indicated on speedometer
WHEEL SPD RR	Wheel speed sensor (RR) reading / Min.: 0 km/h (0 mph) Max.: 255 km/h (158 mph)	Actual wheel speed	Speed indicated on speedometer
WHEEL SPD RL	Wheel speed sensor (RL) reading / Min.: 0 km/h (0 mph) Max.: 255 km/h (158 mph)	Actual wheel speed	Speed indicated on speedometer
IG VOLTAGE	ECU power supply voltage / UNDER / NORMAL / OVER	OVER: 32 V NORMAL: 20 to 32 V UNDER: Below 19 V	–
SFRR	ABS solenoid (SFRR) ON / OFF	–	–
SFRH	ABS solenoid (SFRH) ON / OFF	–	–
SMR	ABS solenoid (SMR) ON / OFF	–	–
SMF (BA–SOL)	ABS solenoid (SMF(BASOL)) ON / OFF	–	–
SRMR (SMCR, STR)	ABS solenoid (SRMR (SMCR, STR)) ON / OFF	–	–
SRMF (SMCF, SA3)	ABS solenoid (SRMF (SMCF, SA3)) ON / OFF	–	–
SRCR (SA2)	ABS solenoid (SRCR (SA2)) ON / OFF	–	–
ENGINE SPD	Engine speed reading/Min.: 255 km/h (158 mph)	Engine speed	Speed indicated on tachometer

Item	Measurement Item/ Range (Display)	Normal Condition	Diagnostic Note
DECELERAT SEN	G sensor (GLT) open detection	Open: Momentary interruption	–
DECELERAY SEN2	G sensor (GL2) open detection	Open: Momentary interruption	–
BSVUUM SENS 1	Vacuum sensor 1 detection	NORMAL: Min. 0 V Max.: 5 V	–
VACUUM SENS 2	Vacuum sensor 2 detection	NORMAL: Min. 0 V Max.: 5 V	–
SFLR	ABS solenoid (SFLR) ON / OFF	–	–
SFLH	ABS solenoid (SFLH) ON / OFF	–	–
SRRR (SRR)	ABS solenoid (SRRR (SRR)) ON / OFF	–	–
SRRH (SRH)	ABS solenoid (SRRH (SRH)) ON / OFF	–	–
SRLR	ABS solenoid (SRLR) ON / OFF	–	–
SRLH	ABS solenoid (SRLH) ON / OFF	–	–
MAS CYL PRESS 1	Master cylinder pressure sensor 1 reading / Min.: 0 V, Max.: 5 V	When brake pedal is released : 0.3 to 0.7 V	Reading increases when brake pedal is depressed
TEST MODE	Test mode / NORMAL or TEST	NORMAL: Normal mode TEST: During test mode	–
#CODES	Number of DTC recorded / Min.: 0, Max.: 255	Min.: 0, Max.: 24	–

5. ACTIVE TEST

HINT:

Performing the hand–held tester's ACTIVE TEST allows relay, VSV actuator and other items to be operated without removing any parts. Preforming the ACTIVE TEST early in troubleshooting is one way to save time. The DATA LIST can be displayed during the ACTIVE TEST.

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

(b) Turn the ignition switch ON.

(c) Perform the ACTIVE TEST.

Skid control ECU assy:

Item	Vehicle Condition / Test Details	Diagnostic Note
SFRR	ABS solenoid (SFRR) ON/OFF	Operation of solenoid (clicking sound) can be heard
SFRH	ABS solenoid (SFRH) ON/OFF	Operation of solenoid (clicking sound) can be heard
SFLR	ABS solenoid (SFLR) ON/OFF	Operation of solenoid (clicking sound) can be heard
SFLH	ABS solenoid (SFLH) ON/OFF	Operation of solenoid (clicking sound) can be heard
SRRR	ABS solenoid (SRRR) ON/OFF	Operation of solenoid (clicking sound) can be heard
SRRH	ABS solenoid (SRRH) ON/OFF	Operation of solenoid (clicking sound) can be heard
SRLR	ABS solenoid (SRLR) ON/OFF	Operation of solenoid (clicking sound) can be heard
SRLH	ABS solenoid (SRLH) ON/OFF	Operation of solenoid (clicking sound) can be heard
SMF (BA – SOL)	TRC solenoid (SMF (BA – SOL)) ON/OFF	Operation of solenoid (clicking sound) can be heard
SRMR (SMCR, STR)	TRC solenoid (SRMR (SMCR, STR)) ON/OFF	Operation of solenoid (clicking sound) can be heard
SRMF (SMCF, SA3)	TRC solenoid STMF (SRCF (SMCF, SA3)) ON/OFF	Operation of solenoid (clicking sound) can be heard
SRCR (SR2)	TRC solenoid (SRCR (SR2)) ON/OFF	Operation of solenoid (clicking sound) can be heard
SMR	TRC solenoid (SMR) ON/OFF	Operation of solenoid (clicking sound) can be heard
ABS MOT RELAY	Turns ABS motor relay ON / OFF	Operation of motor can be heard
SOL RELAY	Solenoid relay ON/OFF	Operation of solenoid (clicking sound) can be heard
EXHAUST CUT	Exhaust cut relay ON/OFF	Observe combination meter
SLIP INDI LIGHT	SLIP indicator lamp ON/OFF	Observe combination meter
ABS WARN LIGHT	Turns ABS warning lamp ON/OFF	Observe combination meter
BRAKE WRN LIGHT	Turns BRAKE warning lamp ON/OFF	Observe combination meter

057EM–04

DIAGNOSTIC TROUBLE CODE CHART

NOTICE:
When removing any parts, turn the ignition switch OFF.

HINT:

- Using SST 09843–18040, connect terminals TC and CG of the DLC3.
- If no abnormality is found when inspecting the parts, inspect the ECU.
- If a DTC is displayed during the DTC check, check the circuit listed for that code. For the details of each code, refer to the page number under the DTC.

DTC No. (See Page)	Detection Item	Trouble Area
C0200/31* (05–200)	Right Front Speed Sensor Circuit	• Right front speed sensor • Right front speed sensor circuit • Speed sensor rotor • Sensor installation
C0205/32* (05–200)	Left Front Speed Sensor Circuit	• Left front speed sensor • Left front speed sensor circuit • Speed sensor rotor • Sensor installation
C0210/33* (05–206)	Right Rear Speed Sensor Circuit	• Right rear speed sensor • Right rear speed sensor circuit • Speed sensor rotor • Sensor installation
C0215/34* (05–206)	Left Rear Speed Sensor Circuit	• Left rear speed sensor • Left rear speed sensor circuit • Speed sensor rotor • Sensor installation
C0226/21 (05–212)	SFR Solenoid Circuit	• ABS actuator • SFRH or SFRR circuit
C0236/22 (05–212)	SFL Solenoid Circuit	• ABS actuator • SFLH or SFLR circuit
C0246/23 (05–212)	SRR Solenoid Circuit	• ABS actuator • SRRH or SRRR circuit
C0256/24 (05–212)	SRL Solenoid Circuit	• ABS actuator • SRLH or SRLR circuit
C0273/13 (05–216)	Open Circuit in ABS Motor Relay Circuit	• ABS MTR relay • ABS MTR relay circuit • Battery
C0274/14 (05–216)	B+ Short Circuit in ABS Motor Relay Circuit	• ABS MTR relay • ABS MTR relay circuit • Battery
C0278/11 (05–220)	Open Circuit in ABS Solenoid Relay Circuit	• ABS SOL relay • ABS SOL relay circuit
C0279/12 (05–220)	Short Circuit in ABS Solenoid Relay Circuit	• ABS SOL relay • ABS SOL relay circuit
C1225/25 (05–212)	SM Solenoid Circuit	• ABS actuator • SMCF or SMCR circuit
C1227/27 (05–212)	SRM Solenoid Circuit	• ABS actuator • SRCF or SRCR circuit
C1235/35 (05–200)	Foreign matter is attached on tip of right front sensor	• Right front speed sensor • Sensor rotor
C1236/36 (05–200)	Foreign matter is attached on tip of right front sensor	• Left front speed sensor • Sensor rotor

C1238/38 (05–206)	Foreign matter is attached on tip of right front sensor	• Right rear speed sensor • Sensor rotor
C1239/39 (05–206)	Foreign matter is attached on tip of right front sensor	• Left rear speed sensor • Sensor rotor
C1241/41 (05–225)	Low Battery Positive Voltage Or Abnormally High Battery Positive Voltage	• Battery • Charging system • Power source circuit
C1246/46 (05–228)	Malfunction in Master Cylinder Pressure Sensor	• Stop lamp switch assy • Master cylinder pressure sensor • Master cylinder pressure sensor circuit
C1249/49 (05–232)	Open Circuit in Stop Lamp Switch Circuit	• Stop lamp bulb • Stop lamp switch assy • Stop lamp switch circuit
C1251/51 (05–236)	Pump Motor is Locked/ Open Circuit in Pump Motor Ground	• ABS actuator • ABS actuator circuit
C1265/65 (05–240)	Vacuum Sensor Malfunction	• Vacuum sensor • Vacuum sensor circuit
C1266/66 (05–244)	Exhaust Retarder Prevention Signal Circuit	• EXO circuit • Skid control ECU assy • ECM
Always ON (05–247)	Malfunction in ABS ECU	• Battery • Fuse • ABS warning lamp circuit • Charging system • Power source circuit • Skid control ECU assy
Always OFF (05–250)	Malfunction in ABS ECU	• Battery • Fuse • ABS warning lamp circuit • Charging system • Power source circuit • Skid control ECU assy

HINT:

*: For this DTC, repairing the systems listed under ”Trouble Area” in the chart will not turn off the ABS warning lamp. To deactivate the ABS:

(1) Drive the vehicle at 10 km/h (6 mph) for 15 seconds or more, and check that the ABS warning lamp turns OFF.

(2) Clear the DTC (see page 05–181).
There is a case that the hand–held tester cannot be used when the ABS warning lamp remains on.

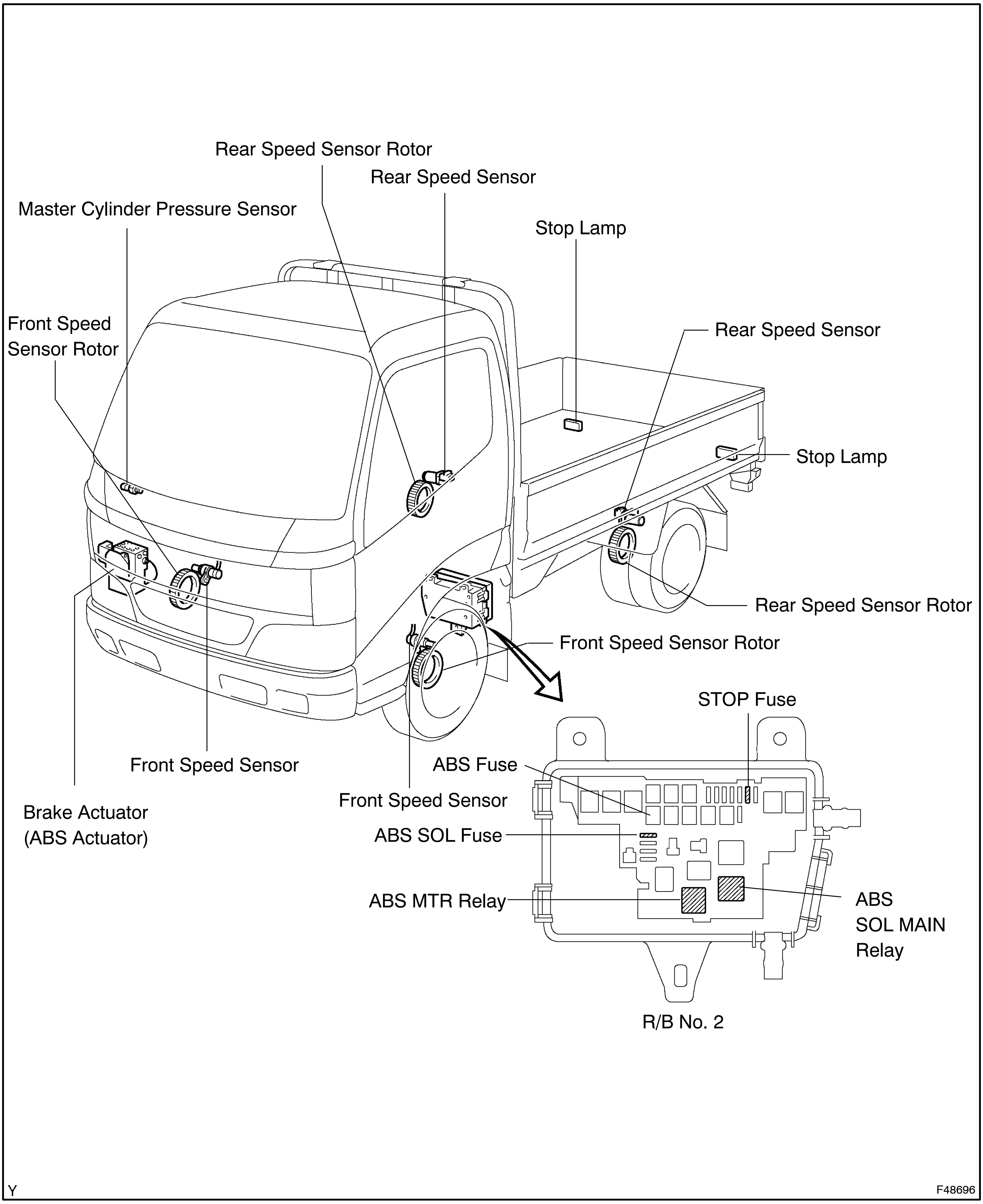
DTC of sensor check function:

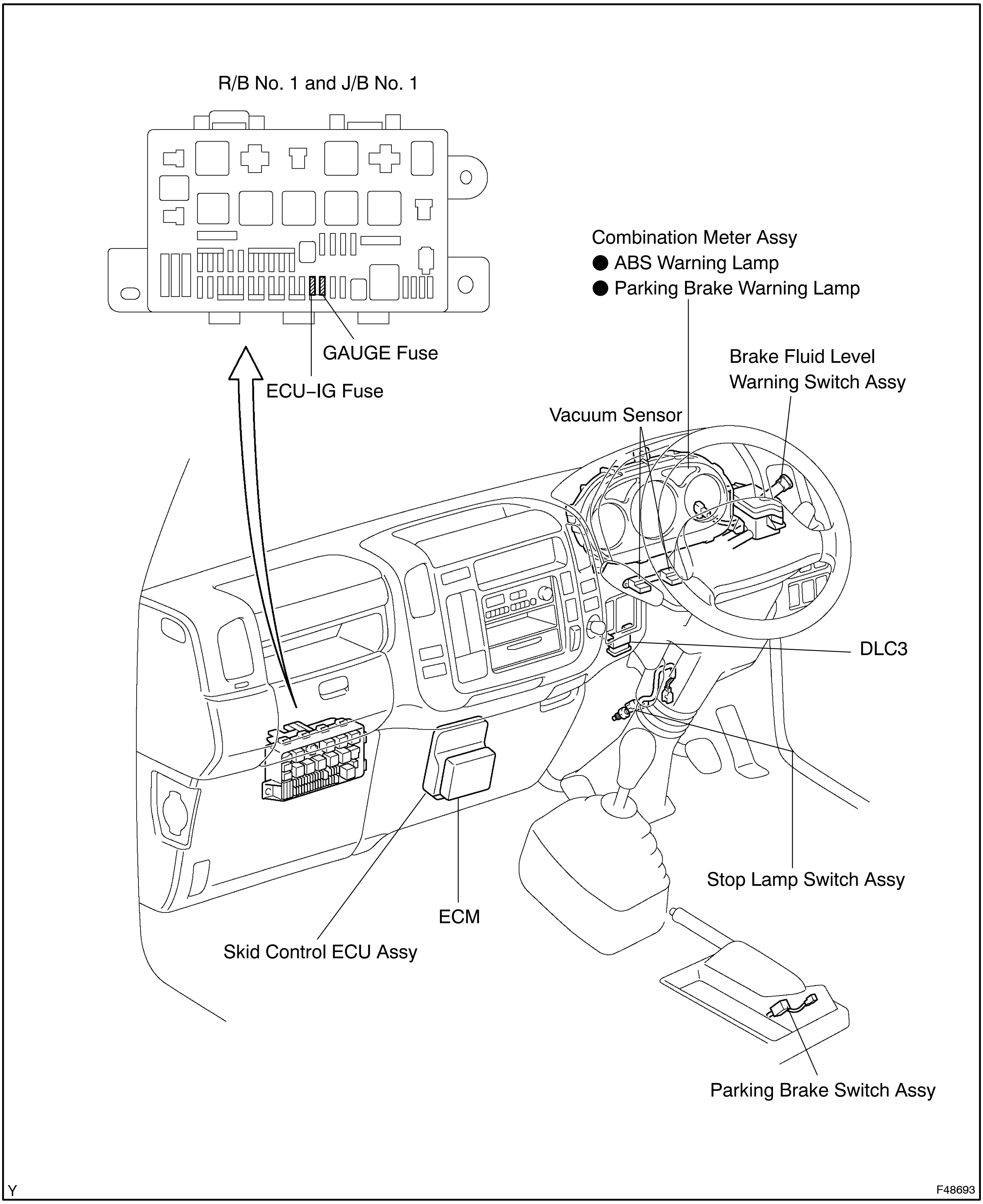
Code No.	Diagnosis	Trouble Area
C1271/71	Low Output Voltage of Right Front Speed Sensor	• Right front speed sensor • Sensor installation • Right front speed sensor rotor • Right front speed sensor circuit
C1272/72	Low Output Voltage of Left Front Speed Sensor	• Left front speed sensor • Sensor installation • Left front speed sensor rotor • Left front speed sensor circuit
C1273/73	Low Output Voltage of Right Front Speed Sensor	• Right rear speed sensor • Sensor installation • Right rear speed sensor rotor • Right rear speed sensor circuit

C1274/74	Low Output Voltage of Left Rear Speed Sensor	• Left rear speed sensor • Sensor installation • Left rear speed sensor rotor • Left rear speed sensor circuit
C1275/75	Abnormal Change in Output Voltage of Right Front Speed Sensor	• Right front speed sensor rotor • Right front speed sensor
C1276/76	Abnormal Change in Output Voltage of Left Front Speed Sensor	• Left front speed sensor rotor • Left front speed sensor
C1277/77	Abnormal Change in Output Voltage of Right Rear Speed Sensor	• Right rear speed sensor rotor • Right rear speed sensor
C1278/78	Abnormal Change in Output Voltage of Left Rear Speed Sensor	• Left rear speed sensor rotor • Left rear speed sensor
C1281/81	Abnormal Change in Output Signal of Master Cylinder Pressure Sensor	• Master cylinder pressure sensor • Master cylinder pressure sensor circuit
C1285/85	Abnormal Change in Output Signal of Vacuum Sensor	• Vacuum sensor • Vacuum sensor circuit

05L2Q–01

LOCATION




R/B No. 1 and J/B No. 1
GAUGE Fuse
ECU–IG Fuse
Combination Meter Assy
● ABS Warning Lamp
● Parking Brake Warning Lamp
Brake Fluid Level
Warning Switch Assy
Vacuum Sensor
DLC3
Stop Lamp Switch Assy
ECM
Skid Control ECU Assy
Parking Brake Switch Assy
Y
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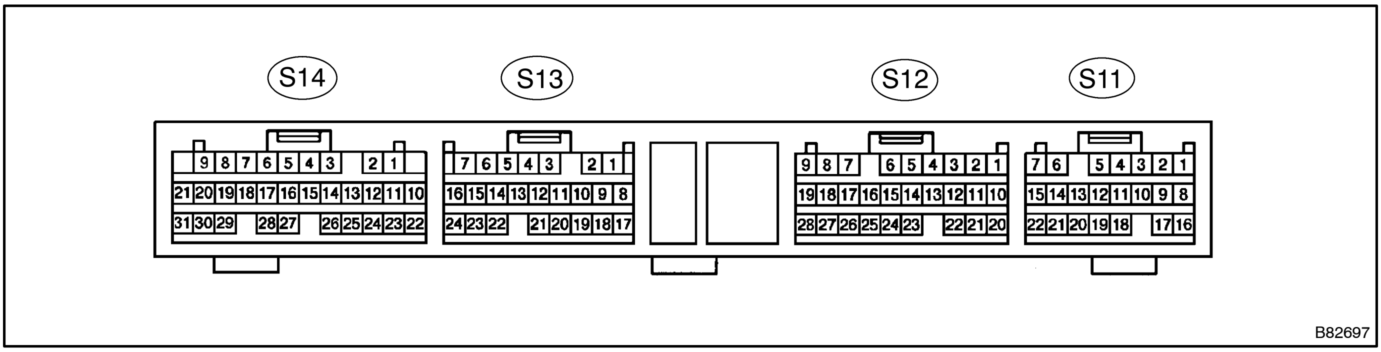
057F3–04

TERMINALS OF ECU

1. CHECK SKID CONTROL ECU ASSY



Symbols (Terminals No.)	Wiring Color	Condition	Specified Condition
SRLH (S11–7) – GND1 (S14–2)	L–O – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 32 V
SRLR (S11–1) – GND1 (S14–2)	R–Y – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 32 V
MT (S14–18) – GND1 (S14–2)	BR–W – W–B	Ignition switch ON (ABS MTR relay is OFF)	Below 2.0 V
RSS (S13–24) – GND1 (S14–2)	BR – W–B	Ignition switch OFF	Below 1 V
SRRH (S14–20) – GND1 (S14–2)	R–G – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 32 V
SFLH (S14–8) – GND1 (S14–2)	LG–B – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 32 V
SM1+ (S11–3) – GND1 (S14–2)	B–Y – W–B	Ignition switch ON, ABS warning lamp OFF	Below 2 V
SM1– (S11–2) – GND1 (S14–2)	W–R – W–B	Ignition switch ON, ABS warning lamp OFF	Below 2 V
AST (S11–6) – GND1 (S14–2)	BR–B – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 32 V
SM2+ (S11–5) – GND1 (S14–2)	W–G – W–B	Ignition switch ON, ABS warning lamp OFF	Below 2 V
SFLR (S14–9) – GND1 (S14–2)	R–G – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 28 V
SFRH (S11–16) – GND1 (S14–2)	Y – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 32 V
SFRR (S11–8) – GND1 (S14–2)	R–W – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 32 V
RR– (S13–15) – GND1 (S14–2)	BR – W–B	Ignition switch OFF	Below 1 V
RR+ (S13–16) – GND1 (S14–2)	Y – W–B	Drive vehicle at about 30 km/h (19 mph)	Pulse generation
RL– (S13–23) – GND1 (S14–2)	L – W–B	Ignition switch OFF	Below 1 V
RL+ (S13–22) – GND1 (S14–2)	P – W–B	Drive vehicle at about 30 km/h (19 mph)	Pulse generation
SM2– (S11–4) – GND1 (S14–2)	W–L – W–B	Ignition switch ON, ABS warning lamp OFF	Below 2 V
SRRR (S14–30) – GND1 (S14–2)	LG – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 32 V
VCM (S12–24) – GND1 (S14–2)	B – W–B	Ignition switch ON, ABS warning lamp OFF	4.75 to 5.25 V
E2 (S12–15) – GND1 (S14–2)	R – W–B	Ignition switch OFF	Below 1 Ω
VCP (S12–21) – GND1 (S14–2)	B – W–B	Ignition switch ON, ABS warning lamp OFF	4.75 to 5.25 V
PIM (S12–10) – GND1 (S14–2)	W – W–B	Engine idling	0.5 to 4 V

E4 (S12–11) – GND1 (S14–2)	R – W–B	Ignition switch OFF	Below 1 Ω
ISS (S12–20) – GND1 (S14–2)	Shielded – W–B	Ignition switch OFF	Below 1 V
PMC (S12–25) – GND1 (S14–2)	W – W–B	Ignition switch ON, Stop lamp switch OFF	0.3 to 0.7 V
PSS (S12–14) – GND1 (S14–2)	Shielded – W–B	Ignition switch OFF	Below 1 Ω
VCP2 (S12–22) – GND1 (S14–2)	O – W–B	Ignition switch ON, ABS warning lamp OFF	4.75 to 5.25 V
PIM2 (S12–23) – GND1 (S14–2)	LG – W–B	Engine idling	0.5 to 1.5 V
E5 (S12–13) – GND1 (S14–2)	V – W–B	Ignition switch OFF	Below 1 Ω
ISS2 (S12–12) – GND1 (S14–2)	Shielded – W–B	Ignition switch OFF	Below 1 Ω
TC (S13–19) – GND1 (S14–2)	R–L – W–B	Ignition switch ON, DLC3 terminals TC and CG short → open	Below 2 V→ 10 V or more
FR– (S14–25) – GND1 (S14–2)	W – W–B	Ignition switch OFF	Below 1 V
FR+ (S14–26) – GND1 (S14–2)	B – W–B	Drive vehicle at about 30 km/h (19 mph)	Pulse generation
FL– (S14–28) – GND1 (S14–2)	G – W–B	Ignition switch OFF	Below 1 V
FL+ (S14–27) – GND1 (S14–2)	R – W–B	Drive vehicle at about 30 km/h (19 mph)	Pulse generation
TS (S13–18) – GND1 (S14–2)	P – W–B	Ignition switch ON, DLC3 terminals TS and CG short → open	Below 3 V→ 10 V or more
FSS (S14–29) – GND1 (S14–2)	BR – W–B	Ignition switch OFF	Below 1 V
BRL (S13–14) – GND1 (S14–2)	P–B – W–B	Ignition switch ON, Parking brake switch ON	10 to 18 V
BRL (S13–14) – GND1 (S14–2)	P–B – W–B	Ignition switch ON, Parking brake switch OFF	7 V for approx. 3 sec. → below 2.0 V
WA (S13–6) – GND1 (S14–2)	R–Y – W–B	Ignition switch OFF → ON	7 V for approx. 3 sec. → below 2.0 V
SR (S14–24) – GND1 (S14–2)	R–G – W–B	Ignition switch ON, ABS warning lamp OFF	Below 2.0 V
MR (S14–12) – GND1 (S14–2)	B–O – W–B	Ignition switch ON, ABS motor stops	20 to 32 V
STP (S13–1) – GND1 (S14–2)	R – W–B	Stop lamp switch pushed in	20 to 32 V
STP (S13–1) – GND1 (S14–2)	R – W–B	Stop lamp switch released	Below 2.0 V
IG1 (S13–7) – GND1 (S14–2)	B–R – W–B	Ignition switch OFF → ON	Below 2 V → 20 to 32 V
D/G (S14–13) – GND1 (S14–2)	W – W–B	Using hand–held tester	Communication possible
EXO (S13–10) – GND1 (S14–2)	V–R – W–B	Ignition switch ON, ABS warning lamp OFF	18 to 32 V
PKB1 (S13–21) – GND1 (S14–2)	B–Y – W–B	Ignition switch ON, Parking brake switch ON	Below 3 V

PKB1 (S13–21) – GND1 (S14–2)	B–Y – W–B	Ignition switch ON, Parking brake switch OFF	10 V or more
R+ (S14–1) – GND1 (S14–2)	V–G – W–B	Ignition switch ON, ABS warning lamp OFF	20 to 32 V

If the result is not as specified, the ECU may have a malfunction.

057EO–04

PROBLEM SYMPTOMS TABLE

If a normal code is displayed during the DTC check but the problem still occurs, check the circuits for each problem symptom in the order given in the table below and proceed to the relevant troubleshooting page.

NOTICE:

When replacing the skid control ECU, sensor, wire harness and other electrical components, turn the ignition switch OFF.

Symptom	Suspected Area	See Page
* ABS does not operate	1. Check DTC reconfirming that normal code is output 2. Ignition power source circuit 3. Speed sensor circuit	05–181 05–225 05–206 05–206
* ABS does not operate efficiently	1. Check DTC reconfirming that the normal code is output 2. Speed sensor circuit 3. Stop lamp switch circuit	05–181 05–200 05–206 05–232
* BRAKE ASSIST	1. Master cylinder pressure sensor 2. Vacuum sensor 3. Stop lamp switch circuit	05–228 05–228 05–232
ABS warning lamp abnormality	1. ABS warning lamp circuit 2. Skid control ECU assy 3. Combination meter and power source	05–250 01–27 –
* DTC check cannot be performed	1. ABS warning lamp circuit 2. Tc terminal circuit	05–250 05–261
Speed sensor signal check cannot be performed	1. TS terminal circuit 2. Skid control ECU assy	05–263 01–27

HINT:

*: Only replace the skid control ECU assy if all the suspected areas are functioning normally but the problem still occurs.

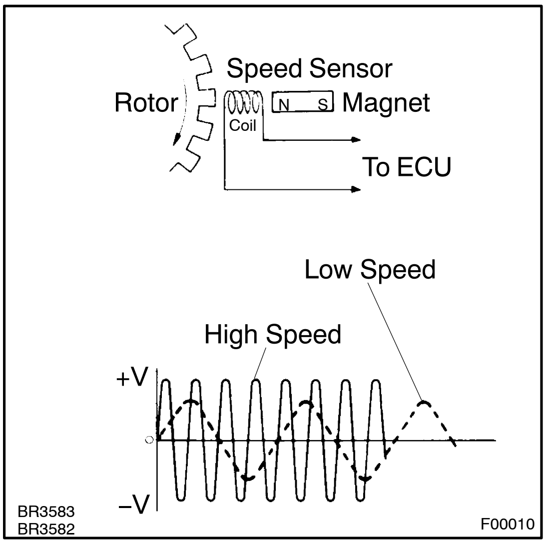
DTC	C0200/31	RIGHT FRONT SPEED SENSOR CIRCUIT

DTC	C0205/32	LEFT FRONT SPEED SENSOR CIRCUIT

DTC	C1235/35	FOREIGN MATTER IS ATTACHED ON TIP OF RIGHT FRONT SENSOR

DTC	C1236/36	FOREIGN MATTER IS ATTACHED ON TIP OF LEFT FRONT SENSOR

CIRCUIT DESCRIPTION



The speed sensor detects the wheel speed and sends the appropriate signals to the ECU. These signals are used to control the ABS control systems. Each of the front and rear rotors has 48 serrations.

When the rotors rotate, the magnetic field emitted by the permanent magnet in the speed sensor generates an AC voltage. Since the frequency of this AC voltage changes in direct proportion to the speed of the rotor, the frequency is used by the ECU to detect the speed of each wheel.

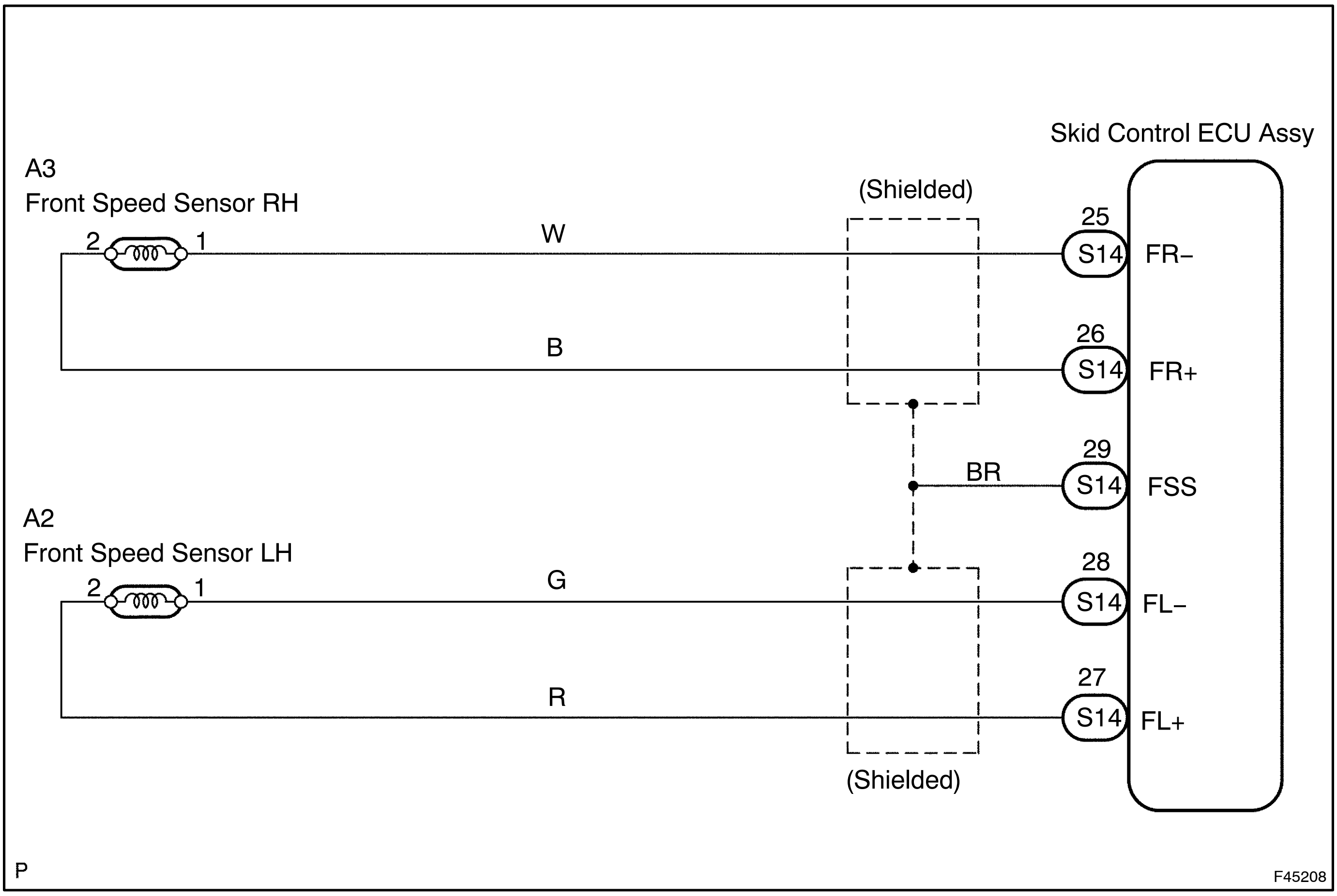
DTC No.	DTC Detection Condition	Trouble Area
C0200/31 C0205/32	Detection of any of conditions 1 to 4: 1. Vehicle speed is 10 km/h (6 mph) or more, and open or short circuit in signal circuit of each vehicle speed sensor have continued for 15 sec. or more 2. Momentary interruption of each vehicle speed sensor signal has occurred more than 7 times 3. Open circuit condition of vehicle speed sensor signal circuit has continued for more than 0.5 sec. 4. Vehicle speed is higher than 20 km/h (12 mph) and noise on abnormal wheel sensor signal continues for 5 sec. or more	• Left front speed sensor • Right front speed sensor • Each speed sensor circuit • Speed sensor rotor • Sensor installation
C1235/35 C1236/36	Continuous noise occurs for 5 seconds or more in speed sensor signals with vehicle speed at 20 km/h (12 mph) or more.	• Left front speed sensor • Right front speed sensor • Speed sensor rotor

HINT:

- DTC No. C0200/31 and C1235/35 are for the right front speed sensor.
- DTC No. C0205/32 and C1236/36 are for the left front speed sensor.
- Fail–safe function:
  If any trouble occurs in the speed sensor circuit, the ECU will prohibit ABS controls.

- For abnormality in 1 or 2 wheels, BRAKE ASSIST can be performed under the condition that the brake system is normal.
- For abnormality in 3 or 4 wheels, the ECU cuts off current to the solenoid relay and BRAKE ASSIST is prohibited. If the brake pedal is depressed firmly, the brake force may be lower than when BRAKE ASSIST was available.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Start the inspection from step 1 if using the hand–held tester. If not, start from step 2.

1 READ VALUE OF HAND–HELD TESTER (FRONT SPEED SENSOR)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Start the engine.
(c) Select the DATA LIST mode on the hand–held tester.
(d) Check that there is no difference between the speed value output from the speed sensor displayed on the tester screen and the speed value displayed on the speedometer when driving the vehicle.

Skid control ECU assy:

Item	Measurement Item/ Range (Display)	Normal Condition	Diagnostic Note
WHEEL SPD FR	Wheel speed sensor (FR) reading / Min.: 0 km/h (0 mph), Max.: 255 km/h (158 mph)	Actual wheel speed	Speed indicated on speed meter
WHEEL SPD FL	Wheel speed sensor (FL) reading / Min.: 0 km/h (0 mph), Max.: 255 km/h (158 mph)	Actual wheel speed	Speed indicated on speed meter

OK:
There is almost no difference in the speed value of the speed sensor and the speedometer.

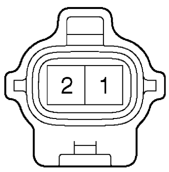
HINT:
There is a tolerance of ± 10 % in the speedometer indication.

NG **Go to step 4**

OK

2 INSPECT FRONT SPEED SENSOR

Front Speed Sensor RH, LH



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(a) Disconnect the sensor connector.
(b) Measure the resistance according to the table below.

Standard:

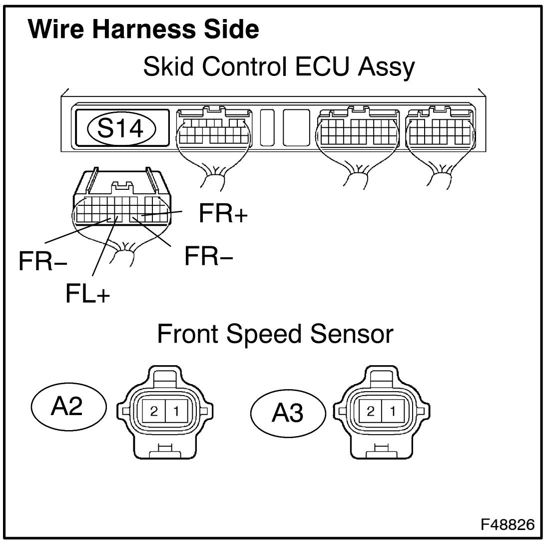
Tester Connection	Specified Condition
1 – 2	0.92 to 1.22 kΩ at 20°C (68°F)
1 – Body ground	10 kΩ or higher
2 – Body ground	10 kΩ or higher

NOTICE:
Check the speed sensor signal last (see page 05–181).

NG **REPLACE FRONT SPEED SENSOR**

OK

3	CHECK WIRE HARNESS (SKID CONTROL ECU ASSY – FRONT SPEED SENSOR)



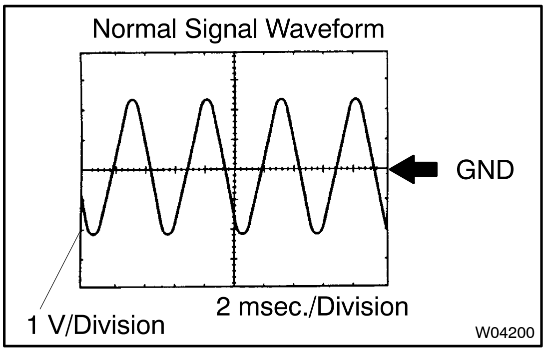
(a) Disconnect the S14 ECU connector.
(b) Disconnect the A2 and A3 sensor connectors.
(c) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
S14–26 (FR+) – A3–1 (FR+)	Below 1Ω
S14–27 (FL+) – A2–1 (FL+)	Below 1Ω
S14–25 (FR–) – A3–2 (FR–)	Below 1Ω
S14–28 (FL–) – A2–2 (FL–)	Below 1Ω
A3–1 (FR+) – Body ground	10 kΩ or higher
A2–1 (FL+) – Body ground	10 kΩ or higher
A3–2 (FR–) – Body ground	10 kΩ or higher
A2–2 (FL–) – Body ground	10 kΩ or higher

NG **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

4	CHECK SPEED SENSOR AND SENSOR ROTOR SERRATIONS



(a) Connect an oscilloscope to terminals FR+, FL+ and GND of the skid control ECU connector.
(b) Drive the vehicle at about 30 km/h (19 mph) and check the signal waveform.
OK:
The waveform shown in the illustration is output.

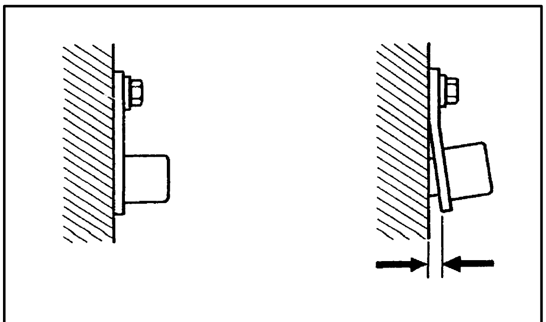
HINT:
- As the vehicle speed (wheel revolution speed) increases, the signal's wavelength shortens and amplitude (output voltage) increases.
- When noise is present in the waveform, the speed sensor rotor may have scratches, be loose, have foreign objects or be broken. If so, error signals will be generated.
- When noise is present in the waveform, error signals are generated. The speed sensor rotor may have scratches, be loose or have foreign objects.

NG **Go to step 5**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

5 INSPECT SPEED SENSOR TIP



BR3795

(a) Check the speed sensor installation.

OK:

The installation bolt is tightened properly and there is no clearance between the sensor and front steering knuckle.

Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)

NOTICE:

Check the speed sensor signal last (see page 05–181).

NG	REPLACE SPEED SENSOR FRONT

OK

6 INSPECT SPEED SENSOR TIP

(a) Remove the front speed sensor (see Pub. No. S1–YXZE05A, page 32–91).

(b) Check the sensor tip.

OK: No scratches or foreign objects on the sensor tip.

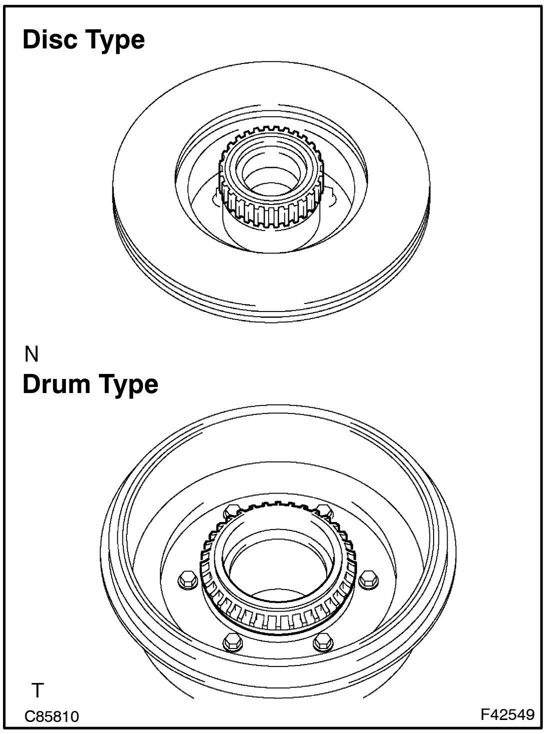
NOTICE:

Check the speed sensor signal last (see page 05–181).

NG	CLEAN OR REPLACE SPEED SENSOR

OK

7 INSPECT SPEED SENSOR ROTOR



(a) Remove the front speed sensor rotor (see Pub. No. S1–YXZE05A, page 32–91).

(b) Check the sensor rotor serrations.

Standard:

No scratches, missing teeth or foreign objects.

HINT:

If a foreign object is present, remove it and check the output waveform after reassembling.

NOTICE:

Check the speed sensor signal last (see page 05–181).

NG > **CLEAN OR REPLACE SENSOR ROTOR**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

05L2S–01

DTC	C0210/33	RIGHT REAR SPEED SENSOR CIRCUIT

DTC	C0215/34	LEFT REAR SPEED SENSOR CIRCUIT

DTC	C1238/38	FOREIGN MATTER IS ATTACHED ON TIP OF RIGHT REAR SENSOR

DTC	C1239/39	FOREIGN MATTER IS ATTACHED ON TIP OF LEFT REAR SENSOR

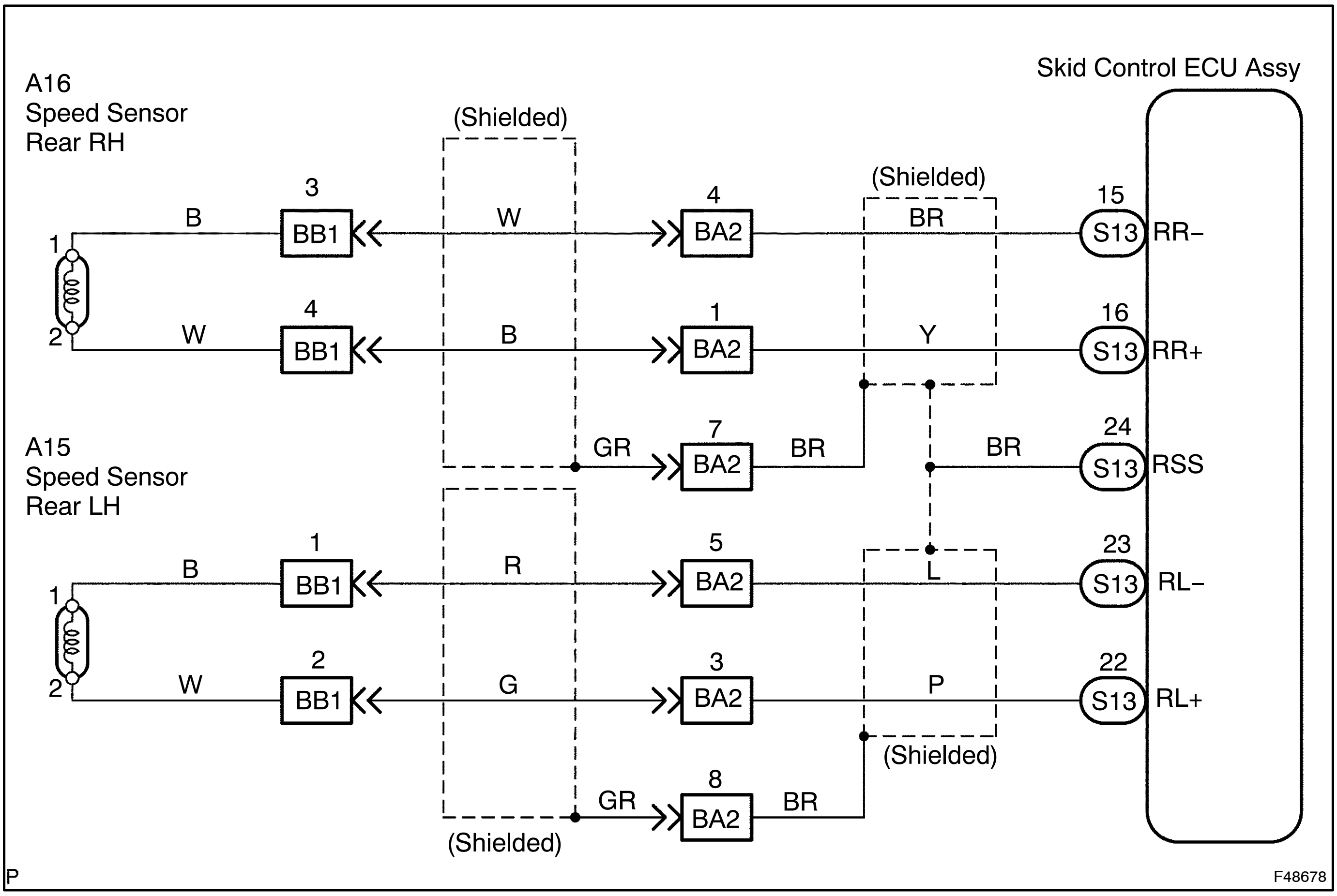
CIRCUIT DESCRIPTION

Refer to DTC C0200/31, C0205/32, C1235/35, C1236/36 on page 05–200.

DTC No.	DTC Detection Condition	Trouble Area
C0210/33 C0215/34	Detection of any of conditions 1 to 4: 1. Vehicle speed is 10km/h (6 mph) or more, and open or short circuit in the signal circuit of each vehicle speed sensor has continued for 15 sec. or more 2. Momentary interruption of each vehicle speed sensor signal has occurred more than 7 times 3. Vehicle speed is higher than 20 km/h (12 mph) and noise on the abnormal wheel sensor signal continues for 5 sec. or more 4. Open circuit condition of the vehicle speed sensor signal circuit has continued for more than 0.5 sec.	• Left rear speed sensor • Right rear speed sensor • Each speed sensor circuit • Speed sensor rotor • Sensor installation
C1238/38 C1239/39	Continuous noise occurs for 5 seconds or more in speed sensor signals with the vehicle speed at 20 km/h (12 mph) or more.	• Left rear speed sensor • Right rear speed sensor • Speed sensor rotor

HINT:
- DTC No. C0210/33 and C1238/38 are for the right rear speed sensor.
- DTC No. C0215/34 and C1239/39 are for the left rear speed sensor.
- Fail–safe function:
  If any trouble occurs in the speed sensor circuit, the ECU will prohibit ABS controls.
- For abnormality in 1 or 2 wheels, BRAKE ASSIST can be performed under the condition that the brake system is normal.
- For abnormality in 3 or 4 wheels, the ECU cuts off current to the solenoid relay and BRAKE ASSIST is prohibited. If the brake pedal is depressed firmly, the brake force may be lower than when BRAKE ASSIST was available.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Start the inspection from step 1 if using the hand–held tester. If not start from step 2.

1	READ VALUE OF HAND–HELD TESTER (REAR SPEED SENSOR)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Start the engine.
(c) Select the DATA LIST mode on the hand–held tester.
(d) Check that there is no difference between the speed value output from the speed sensor displayed on the tester screen and the speed value displayed on the tester screen when driving the vehicle.
Skid control ECU assy:

Item	Measurement Item/ Range (Display)	Normal Condition	Diagnostic Note
WHEEL SPD RR	Wheel speed sensor (RR) reading/ Min.: 0 km/h (0 mph, Max.: 255 km/h (158 mph)	Actual wheel speed	Speed indicated on speed meter
WHEEL SPD RL	Wheel speed sensor (RL) reading/ Min.: 0 km/h (0 mph, Max.: 255 km/h (158 mph)	Actual wheel speed	Speed indicated on speed meter

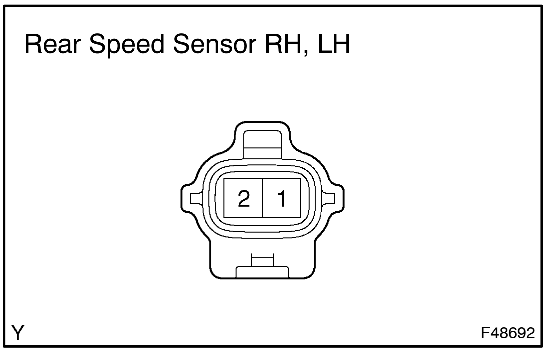
OK:
There is almost no difference in the speed value of the speed sensor and the speed meter.

HINT:
There is a tolerance of ± 10 % in the speedometer indication.

NG → **Go to step 4**

OK

2 INSPECT REAR SPEED SENSOR



(a) Disconnect the sensor connector.
(b) Measure the resistance according to table below.
Standard:

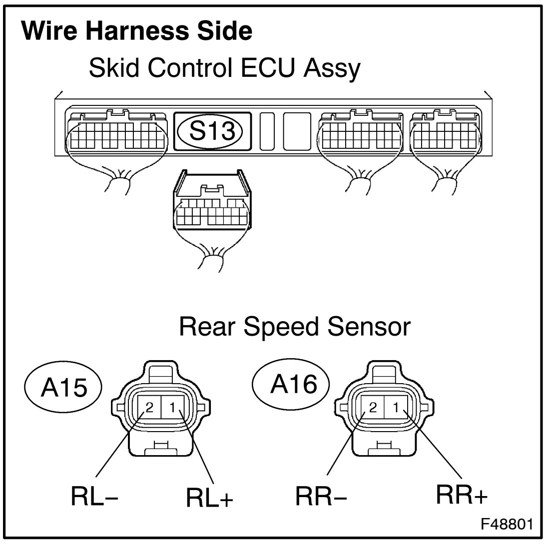
Tester Connection	Specified Condition
1 – 2	1.03 to 1.07 kΩ at 25°C (85°F)
1 – Body ground	10 kΩ or higher
2 – Body ground	10 kΩ or higher

NOTICE:
Check the speed sensor signal last (see page 05–181).

NG **REPLACE REAR SPEED SENSOR**

OK

3 CHECK WIRE HARNESS (SKID CONTROL ECU ASSY – REAR SPEED SENSOR)



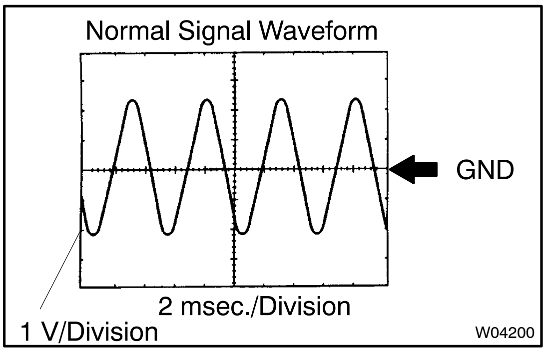
(a) Disconnect the S13 ECU connector.
(b) Disconnect the A15 and A16 sensor connectors.
(c) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
S13–16 (RR+) – A16–1 (RR+)	Below 1 Ω
S13–22 (RL+) – A15–1 (RL+)	Below 1 Ω
S13–15 (RR–) – A16–2 (RR–)	Below 1 Ω
S13–23 (RL–) – A15–2 (RL–)	Below 1 Ω
A16–1 (RR+) – Body ground	10 kΩ or higher
A15–1 (RL+) – Body ground	10 kΩ or higher
A16–2 (RR–) – Body ground	10 kΩ or higher
A15–2 (RL–) – Body ground	10 kΩ or higher

NG **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

4 CHECK SPEED SENSOR AND SENSOR ROTOR SERRATIONS



(a) Connect an oscilloscope to terminals RR+, RL+ and GND of the skid control ECU.
(b) Drive the vehicle at about 30 km/h (19 mph), and check the signal waveform.
OK:
The waveform shown in the illustration is output.

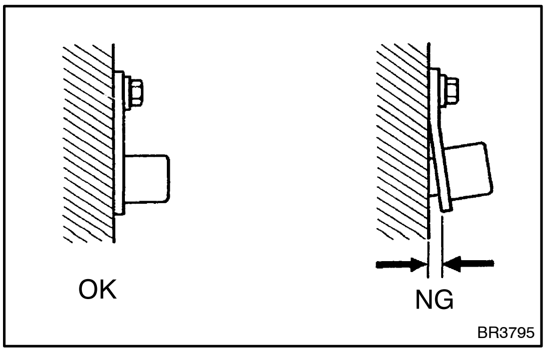
HINT:
- As the vehicle speed (wheel revolution speed) increases, the signal's wavelength shortens and amplitude (output voltage) increases.
- When noise is present in the waveform, the speed sensor rotor may have scratches, be loose, have foreign objects or be broken. If so, error signals will be generated.
- When noise is present in the waveform, error signals are generated. The speed sensor rotor may have scratches, be loose or have foreign objects.

NG ▷ **Go to step 5**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

5 INSPECT REAR SPEED SENSOR INSTALLATION



(a) Check the speed sensor installation.
OK:
The installation bolt is tightened properly and there is no clearance between the sensor and rear axle carrier.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)

NOTICE:
Check the speed sensor signal last (see page 05–181).

NG ▷ **REPLACE REAR SPEED SENSOR**

OK

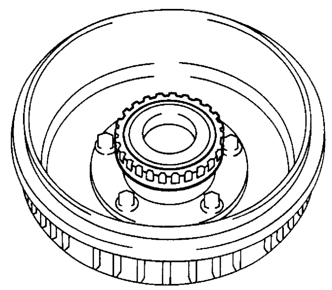
6 INSPECT SPEED SENSOR ROTOR TIP

(a) Remove the speed sensor (see Pub. No. S1–YXZE05A, page 32–92).
(b) Check the sensor tip.
OK: No scratches or foreign objects on the sensor tip.

NG ▷ **CLEAN OR REPLACE SENSOR ROTOR**

OK

7 INSPECT SPEED SENSOR ROTOR


F42550

(a) Remove the rear axle hub (see Pub. No. S1–YXZE05A, page 30–62).
(b) Check the sensor rotor serrations.
OK:
No scratches, missing teeth or foreign objects.

HINT:
If a foreign object is present, remove it and check the output waveform after reassembling.

NOTICE:
Check the speed sensor signal last (see page 05–181)

NG > **CLEAN OR REPLACE SENSOR ROTOR**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

DTC C0226/21 SFR SOLENOID CIRCUIT

DTC C0236/22 SFL SOLENOID CIRCUIT

DTC C0246/23 SRR SOLENOID CIRCUIT

DTC C0256/24 SRL SOLENOID CIRCUIT

DTC C1225/25 SM SOLENOID CIRCUIT

DTC C1227/27 SRM SOLENOID CIRCUIT

CIRCUIT DESCRIPTION

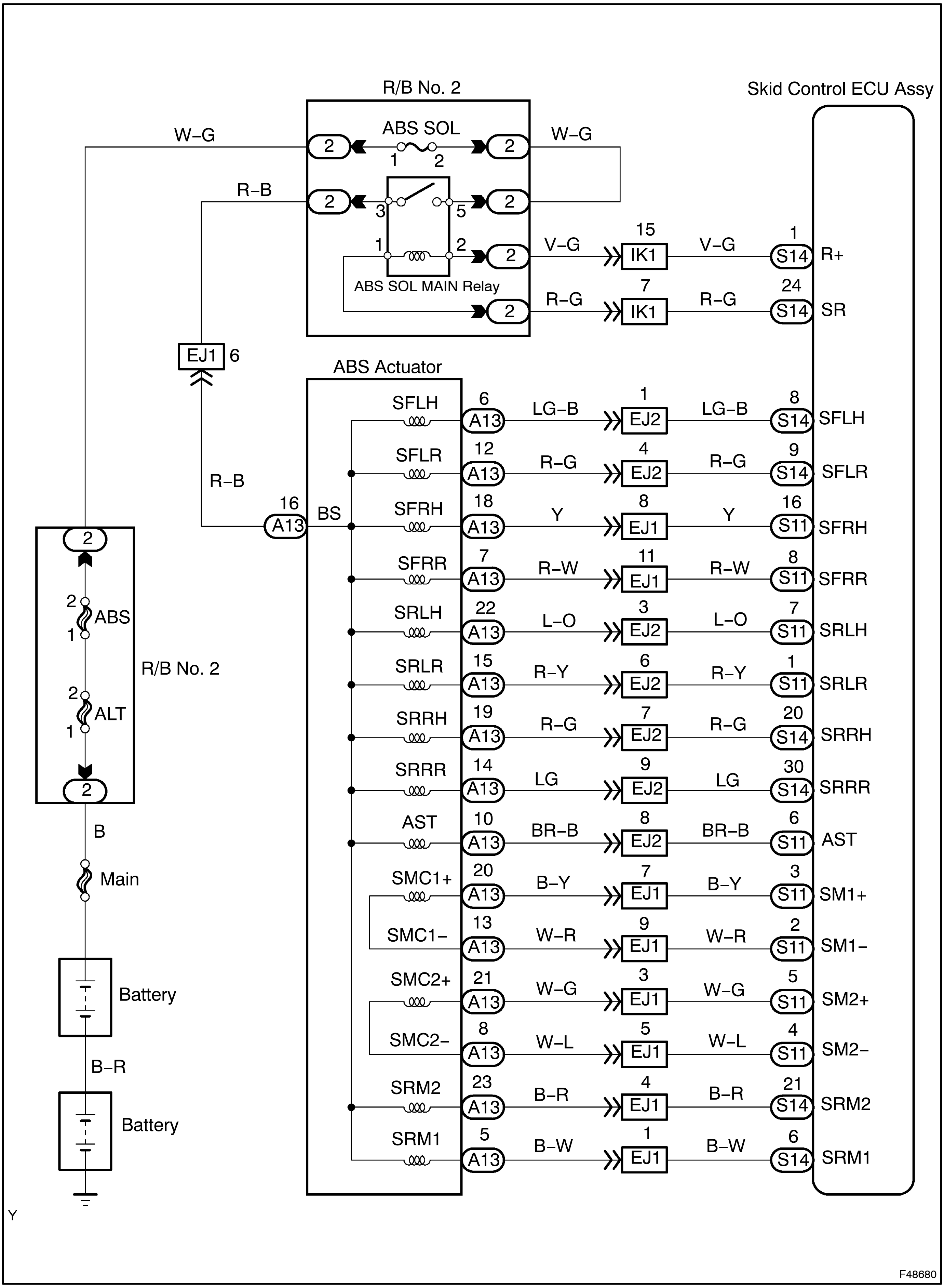
This solenoid turns on when signals are received from the ECU and controls brake force by the pressure acting on the wheel cylinders.

DTC No.	DTC Detection Condition	Trouble Area
C0226/21	Open or short circuit for SFRH or SFRR circuit continues for 0.05 sec. or more at normal power voltage condition	• ABS actuator • SFRH or SFRR circuit • ABS fuse
C0236/22	Open or short circuit for SFLH or SFLR circuit continues for 0.05 sec. or more at normal power voltage condition	• ABS actuator • SFLH or SFLR circuit • ABS fuse
C0246/23	Open or short circuit for SRRH or SRRR circuit continues for 0.05 sec. or more at normal power voltage condition	• ABS actuator • SRRH or SRRR circuit • ABS fuse
C0256/24	Open or short circuit for SRLH or SRLR circuit continues for 0.05 sec. or more at normal power voltage condition	• ABS actuator • SRLH or SRLR circuit • ABS fuse
C1225/25	Open or short circuit for SMC1 or SMC2 circuit continues for 0.05 sec. or more at normal power voltage condition	• ABS actuator • SMC1 or SMC2 circuit • ABS fuse
C1227/27	Open or short circuit for SRM1 or SRM2 circuit continues for 0.05 sec. or more at normal power voltage condition	• ABS actuator • SRM1 or SRM2 circuit • ABS fuse

HINT:

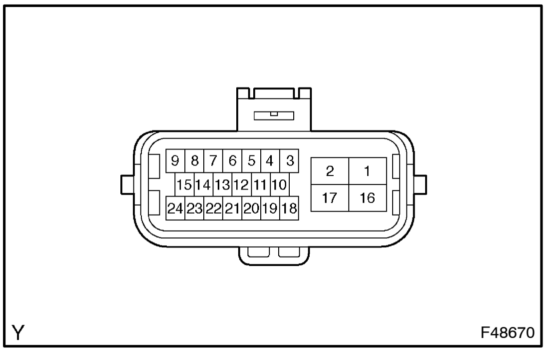
- If the brake pedal is depressed firmly, the brake force may be lowered.
- Fail–safe function:
  If any trouble occurs in the actuator solenoid circuit, the ECU will cut off current to the ABS SOL MAIN relay and prohibit ABS controls and BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT ABS ACTUATOR



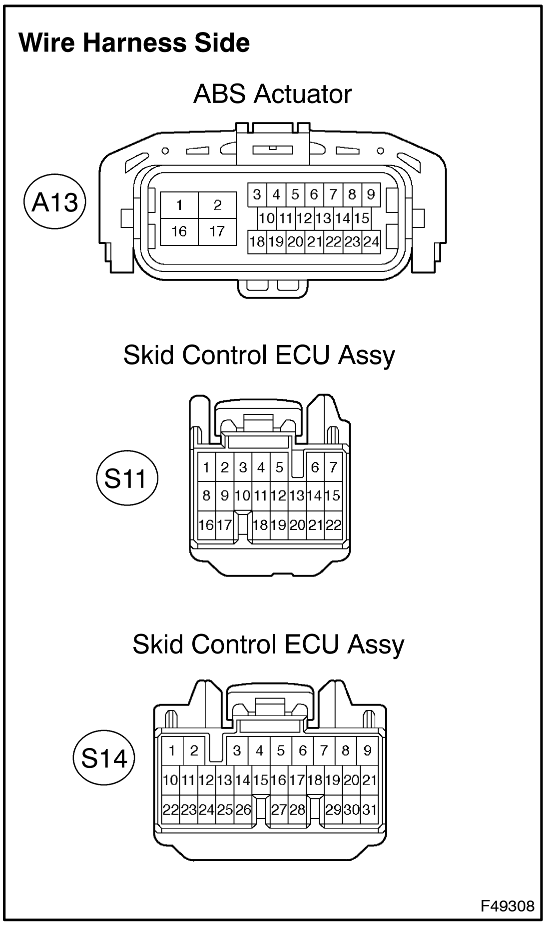
(a) Disconnect the actuator connector.
(b) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
A13–16 (BS) – A13–6 (SFLH)	31.7 to 35.7 Ω
A13–16 (BS) – A13–7 (SFRR)	15.9 to 17.9 Ω
A13–16 (BS) – A13–10 (AST)	Below 1 Ω
A13–16 (BS) – A13–12 (SFLR)	15.9 to 17.9 Ω
A13–16 (BS) – A13–14 (SRRR)	15.9 to 17.9 Ω
A13–16 (BS) – A13–15 (SRLR)	15.9 to 17.9 Ω
A13–16 (BS) – A13–18 (SFRH)	31.7 to 35.7 Ω
A13–16 (BS) – A13–19 (SRRH)	31.7 to 35.7 Ω
A13–16 (BS) – A13–22 (SRLH)	31.7 to 35.7 Ω
A13–20 (SMC1+) – A13–13 (SMC1–)	20.5 to 23.5 Ω
A13–21 (SMC2+) – A13–8 (SMC2–)	20.5 to 23.5 Ω

NG **REPLACE ABS ACTUATOR**

OK

2 CHECK WIRE HARNESS (ABS ACTUATOR – SKID CONTROL ECU ASSY)



(a) Disconnect the A13 actuator connector.
(b) Disconnect the S11 and S14 ECU connectors.
(c) Measure the resistance according to the table below.
Standard:

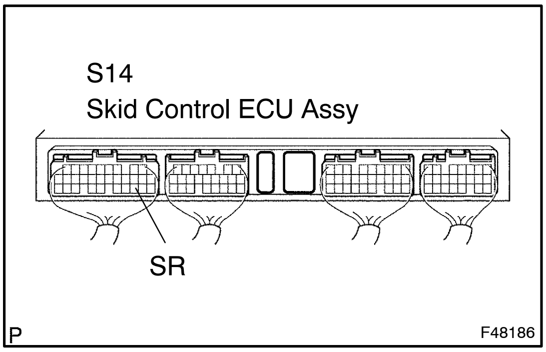
Tester Connection	Specified Condition
S11–1 (SRLR) – A13–15 (SRLR)	Below 1 Ω
S11–2 (SM1–) – A13–13 (SMC1–)	Below 1 Ω
S11–3 (SM1+) – A13–20 (SMC1+)	Below 1 Ω
S11–4 (SM2–) – A13–8 (SMC2–)	Below 1 Ω
S11–5 (SM2+) – A13–21 (SMC2+)	Below 1 Ω
S11–6 (AST) – A13–10 (AST)	Below 1 Ω
S11–7 (SRLH) – A13–22 (SRLH)	Below 1 Ω
S11–8 (SFRR) – A13–7 (SFRR)	Below 1 Ω
S11–16 (SFRH) – A13–18 (SFRH)	Below 1 Ω
S14–6 (SRM1) – A13–5 (SRM1)	Below 1 Ω
S14–8 (SFLH) – A13–6 (SFLH)	Below 1 Ω
S14–9 (SFLR) – A13–12 (SFLR)	Below 1 Ω
S14–18 (MT) – A13–3 (MT)	Below 1 Ω
S14–20 (SRRH) – A13–19 (SRRH)	Below 1 Ω
S14–21 (SRM2) – A13–23 (SRM2)	Below 1 Ω
S14–30 (SRRR) – A13–14 (SRRR)	Below 1 Ω
S11–1 (SRLR) – Body ground	10 kΩ or higher
S11–2 (SM1–) – Body ground	10 kΩ or higher
S11–3 (SM1+) – Body ground	10 kΩ or higher
S11–4 (SM2–) – Body ground	10 kΩ or higher
S11–5 (SM2+) – Body ground	10 kΩ or higher

Tester Connection	Specified Condition
S11–6 (AST) – Body ground	10 kΩ or higher
S11–7 (SRLH) – Body ground	10 kΩ or higher
S11–8 (SFRR) – Body ground	10 kΩ or higher
S11–16 (SFRH) – Body ground	10 kΩ or higher
S14–6 (SRM1) – Body ground	10 kΩ or higher
S14–8 (SFLH) – Body ground	10 kΩ or higher
S14–9 (SFLR) – Body ground	10 kΩ or higher
S14–20 (SRRH) – Body ground	10 kΩ or higher
S14–21 (SRM2) – Body ground	10 kΩ or higher
S14–30 (SRRR) – Body ground	10 kΩ or higher

NG **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

3 CHECK SKID CONTROL ECU ASSY (SR VOLTAGE)



(a) Remove the skid control ECU but do not disconnect the connectors.
(b) Turn the ignition switch ON.
(c) Measure the voltage according to the table below.
Standard:

Tester Connection	Specified Condition
S14–24 (SR) – Body ground	Below 1 V

NG **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

4 RECONFIRM DTC

(a) Check the DTC (see page 05–191).
HINT:
After erasing the DTC and driving the vehicle at more than 7 km/h (4 mph), check for DTCs.

A	Malfunction Code
B	No DTC code output

B **NO PROBLEM**

A

5 CHECK CONTACT CONDITION (EACH CONNECTION)

NG **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

05L2U–01

DTC C0273/13 OPEN CIRCUIT IN ABS MTR RELAY CIRCUIT

DTC C0274/14 B+ SHORT CIRCUIT IN ABS MTR RELAY CIRCUIT

CIRCUIT DESCRIPTION

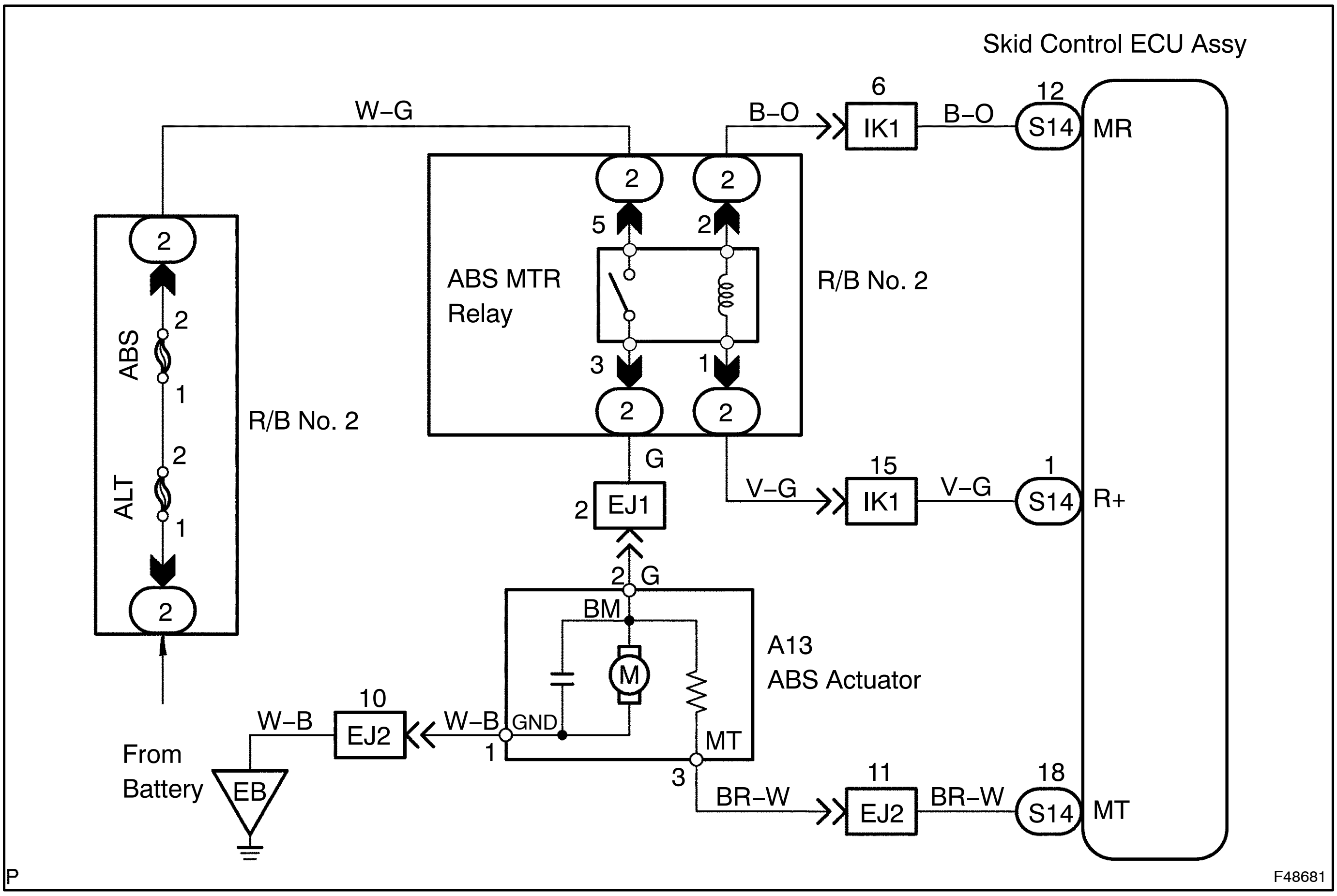
The ABS MTR relay supplies power to the ABS pump motor. While the ABS is activated, the ECU turns the motor relay ON and operates the ABS pump motor.

DTC No.	DTC Detection Condition	Trouble Area
C0273/13	Conditions 1 and 2 continue for 0.2 sec. or more: 1. ECU terminal IG1 voltage is 19 to 36 V in initial check or ABS operation, and motor relay is ON; however, contact point of motor relay is OFF. 2. ECU terminal IG1 is 19 V or less, and motor relay is ON; however, contact point of motor relay does not become ON.	• ABS MTR relay • ABS MTR relay circuit • Battery
C0274/14	When motor relay is OFF and terminal MT open for 4 sec. or more, contact point of motor relay is ON for 4 sec. or more.	• ABS MTR relay • ABS MTR relay circuit • Battery

HINT:

- If the brake pedal is depressed firmly, the brake force may become lowered.
- Fail–safe function:
  If any trouble occurs in the ABS MTR relay circuit, the ECU will cut off current to the ABS SOL MAIN relay and prohibit ABS controls and BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Start the inspection from step 1 if using the hand–held tester. If not, start from step 2.

1	PERFORM ACTIVE TEST BY HAND–HELD TESTER (ABS MTR RELAY OPERATION)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.

(b) Start the engine.

(c) Select the ACTIVE TEST on the hand–held tester.

(d) Check the operation of the ABS MTR relay and operating sound of the ABS motor.

Skid control ECU assy:

Item	Vehicle Condition / Test Details	Diagnostic Note
ABS MOT RELAY	ABS motor relay / ON or OFF	–

Result:

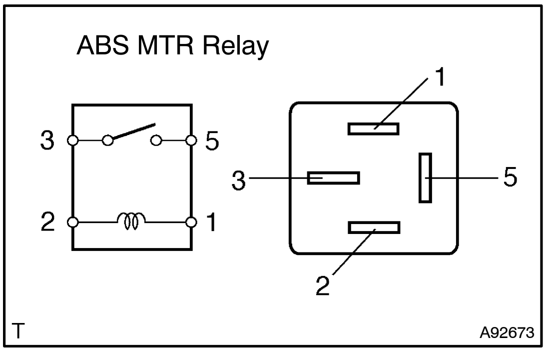
Result	Proceed To
ABS MTR Relay does not operate but operation sound of the ABS pump motor is heard	A
ABS MTR relay operates but operation sound of the ABS pump motor is not heard	B
ABS MTR relay operates and operation sound of the ABS pump motor is heard	C

B > Go to step 3

C > Go to step 4

A

2 INSPECT RELAY (Marking: ABS MTR)



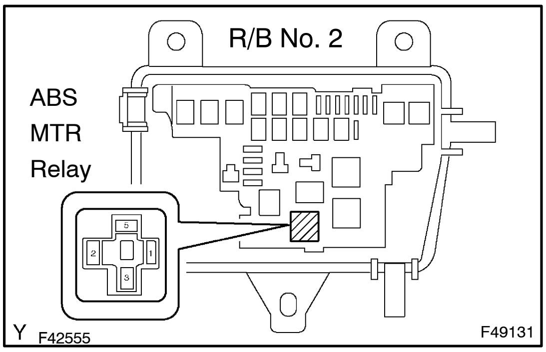
(a) Measure the resistance according to the tale below.
Standard:

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG > **REPLACE RELAY**

OK

3 CHECK ABS MTR RELAY (VOLTAGE)



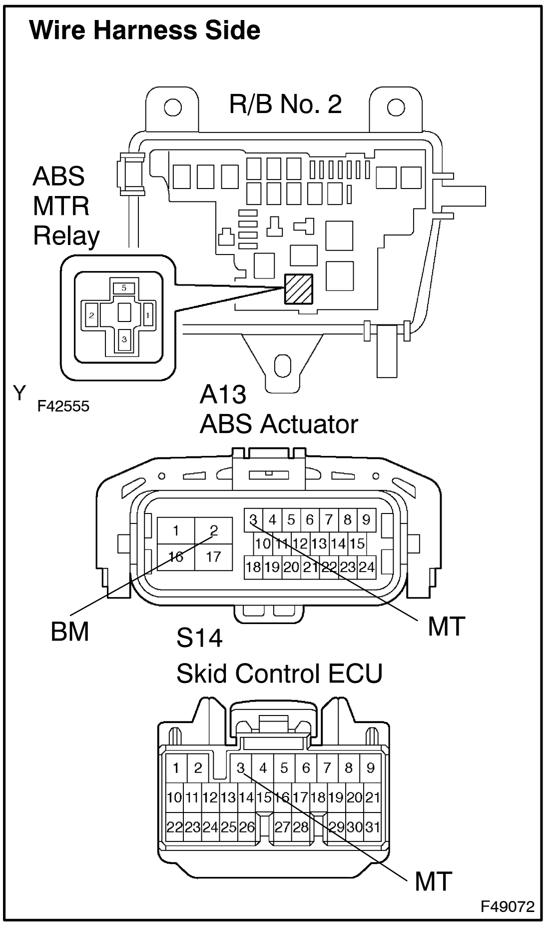
(a) Remove the ABS MTR relay from the R/B No. 2.
(b) Measure the voltage according to the table below.
Standard:

Tester Connection	Specified Condition
Terminals 5 – Body ground	20 to 32 V

NG > **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

4 CHECK WIRE HARNESS (ABS MTR RELAY – SKID CONTROL ECU ASSY)



(a) Remove the ABS MTR relay.
(b) Disconnect the S14 ECU connector.
(c) Disconnect the A13 actuator connector.
(d) Measure the resistance according to the table below.

Standard:

Tester Connection	Specified Condition
R/B No.2 ABS MTR relay terminals 3 – A13–2 (+BM)	Below 1 Ω
A13–3 (MT) – S14–18 (MT)	Below 1 Ω
A13–2 (BM) – A13–3 (MT)	33 ± 1.65 Ω

HINT:
There is a resistance of 33 ± 1.65 Ω between terminals A13–2 and 3 of the ABS actuator.

NG **REPAIR OR REPLACE HARNESS, CONNECTOR AND ABS ACTUATOR**

OK

5 CHECK CONDITION (EACH CONNECTION)

(a) Check if the same code is still output after the DTC is deleted. Then check the condition of each connection.

NG **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

DTC	C0278/11	OPEN CIRCUIT IN ABS SOLENOID RELAY CIRCUIT

DTC	C0279/12	SHORT CIRCUIT IN ABS SOLENOID RELAY CIRCUIT

CIRCUIT DESCRIPTION

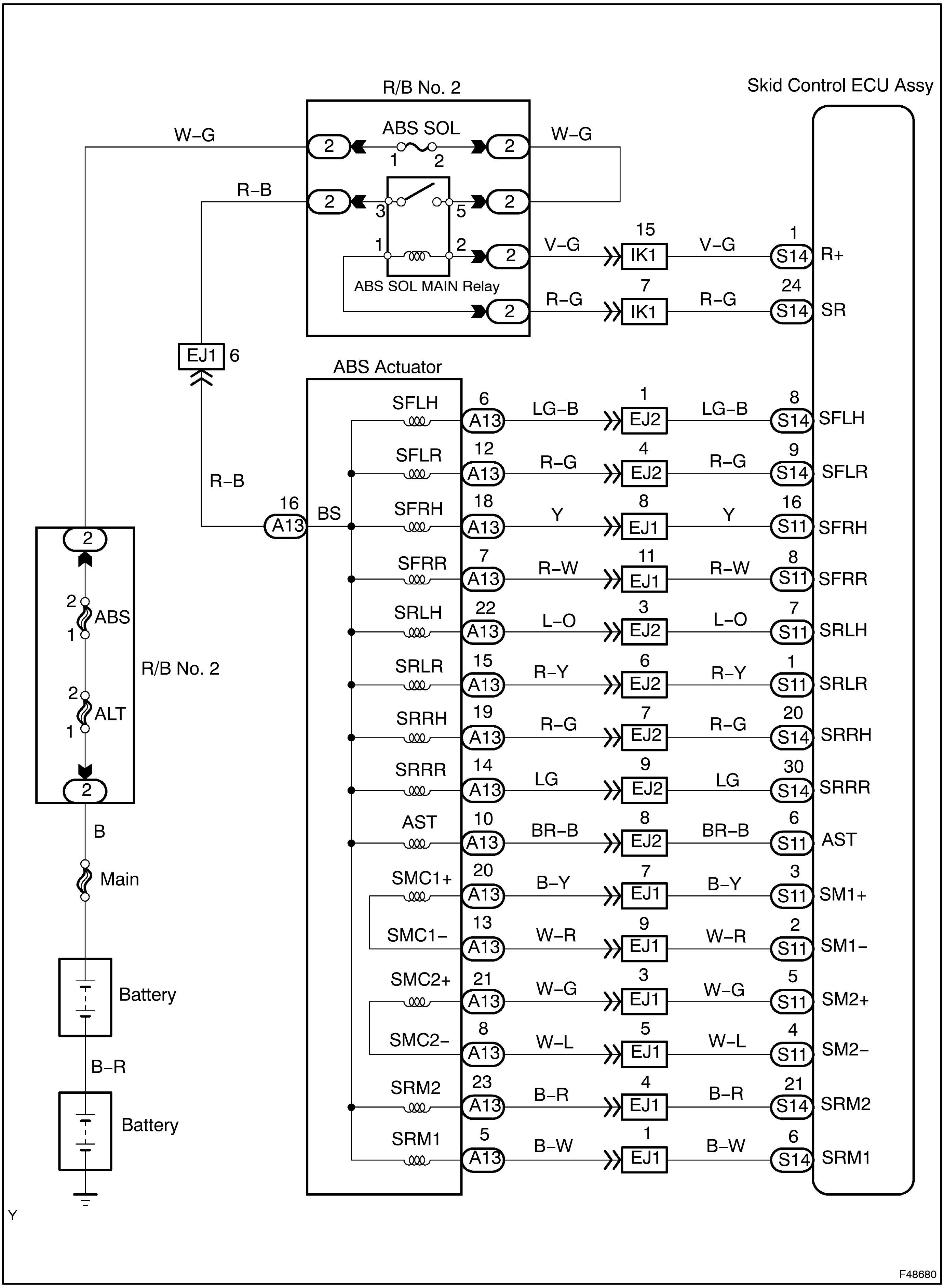
This relay supplies power to each ABS solenoid. After the ignition switch is turned ON, if the initial check is OK, the relay will turn ON.

DTC No.	DTC Detection Condition	Trouble Area
C0278/11	Conditions 1 and 2 continue for 0.2 sec. or more: 1. ECU terminal IG1 voltage is 19 to 36 V and solenoid relay is ON; however, contact point of solenoid relay is OFF. 2. With solenoid relay ON driving, ECU terminal IG1 voltage becomes 19 V or less and contact point of solenoid relay does not become ON.	• ABS SOL MAIN relay • ABS SOL MAIN relay circuit • ABS SOL fuse
C0279/12	Immediately after ECU terminal IG1 is ON, solenoid relay is OFF; however, contact point of solenoid relay is ON for 0.2 sec. or more.	• ABS SOL MAIN relay • ABS SOL MAIN relay circuit • ABS SOL fuse

HINT:

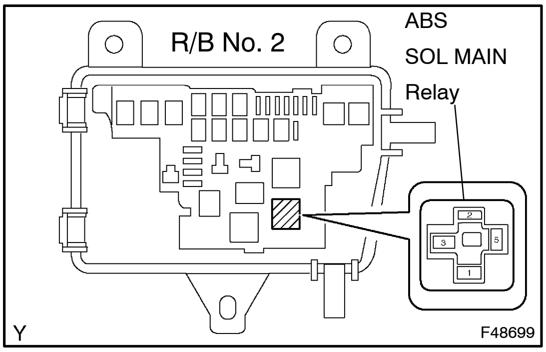
- If the brake pedal is depressed firmly, the brake force may be lowered.
- Fail–safe function:
  If any trouble occurs in the ABS SOL relay circuit, the ECU will cut off current to the ABS SOL MAIN relay and prohibit ABS control and BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK RELAY (Marking: ABS SOL MAIN) (VOLTAGE)



(a) Remove the relay from the R/B No. 2.

(b) Measure the voltage according to the table below.

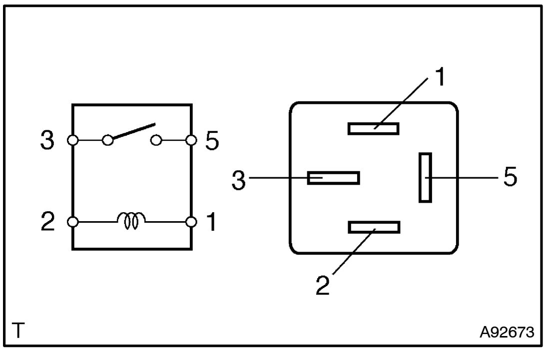
Standard:

Tester Connection	Specified Condition
Terminal 5 – Body ground	20 to 32 V

NG → **Go to step 5**

OK

2	INSPECT RELAY (Marking: ABS SOL MAIN)



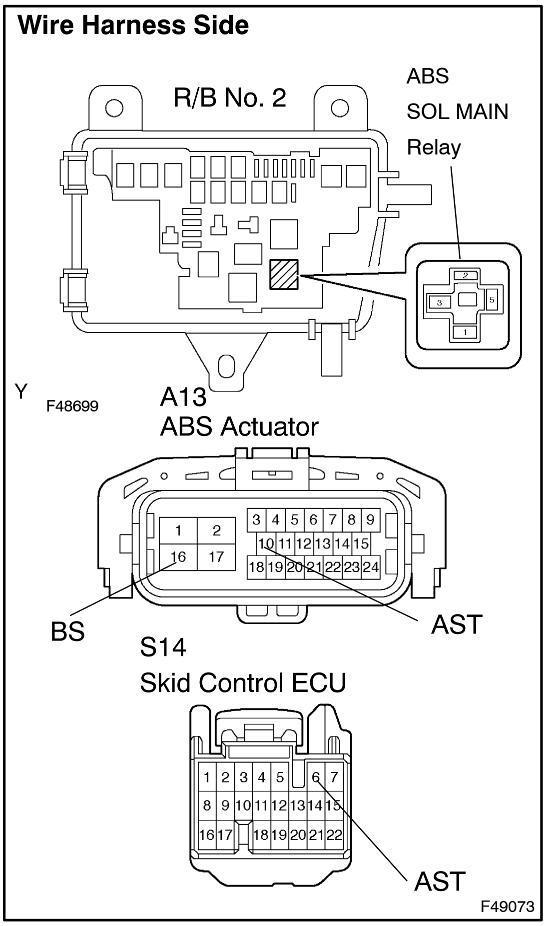
(a) Measure the resistance according to the table below.

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → **REPLACE RELAY**

OK

3 CHECK WIRE HARNESS (ABS SOL MAIN RELAY – SKID CONTROL ECU ASSY)



(a) Remove the relay from the R/B No. 2.
(b) Disconnect the A13 actuator connector.
(c) Disconnect the S11 ECU connector.
(d) Measure the resistance according to the table below.

Standard:

Tester Connection	Specified Condition
R/B No. 2 ABS SOL MAIN Relay terminal 2 – S14–1 (R+)	Below 1 Ω
R/B No. 2 ABS SOL MAIN Relay terminal 1 – S14–24 (SR)	Below 1 Ω
R/B No. 2 ABS SOL MAIN Relay terminal 3 – A13–16 (BS)	Below 1 Ω
A13–16 (BS) – A13–10 (AST)	Below 1 Ω
A13–10 (AST) – S11–6 (AST)	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR OR ABS ACTUATOR**

OK

4 CHECK CONTACT CONDITION (EACH CONNECTION)

(a) Check if the same code is still output after the DTC is deleted. Then check the condition of each connection.

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

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

5	INSPECT FUSE (ABS SOL)

(a) Remove the ABS SOL fuse from the R/B No. 2.
(b) Measure the resistance.
Standard: Below 1 Ω

NG → **REPLACE FUSE**

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

DTC	C1241/41	LOW BATTERY POSITIVE VOLTAGE OR ABNORMALLY HIGH BATTERY POSITIVE VOLTAGE

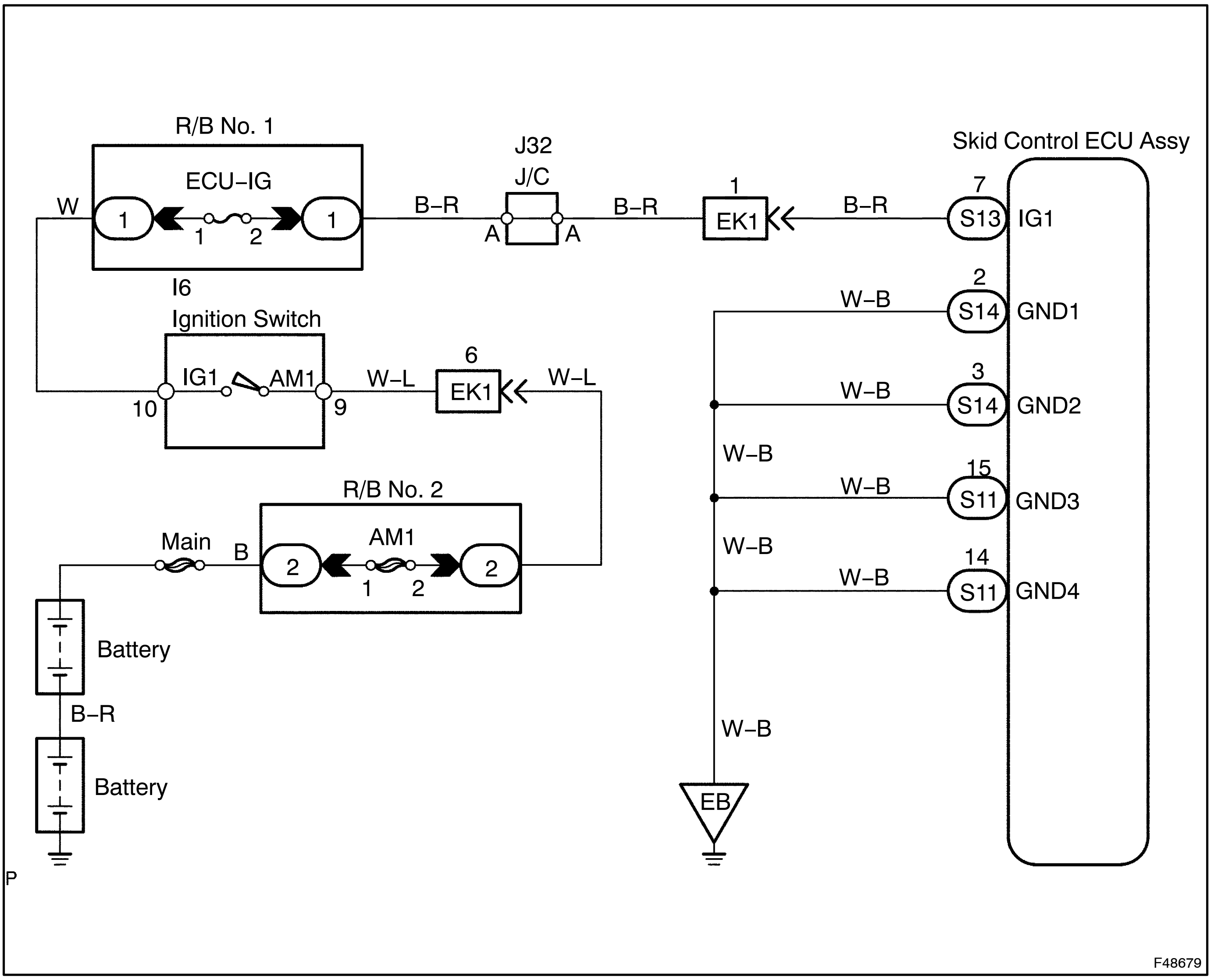
CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
C1241/41	Vehicle speed is 3 km/h (1.9 mph) or more and voltage of ECU terminal IG1 remains below 19 V for more than 10 sec.	• Battery • Charging system • Power source circuit

HINT:

- If the brake pedal is depressed firmly, the brake force may be lowered.
- Fail–safe function:
  If any trouble occurs in the power source circuit, the ECU will cut off current to the ABS SOL MAIN relay and prohibit ABS controls and BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT BATTERY

(a) Check battery voltage.
Standard: 20 to 32 V

NG → **CHECK AND REPAIR CHARGING SYSTEM**

OK

2 INSPECT FUSE (ECU–IG)

(a) Remove the ECU–IG fuse from the R/B No. 1.
(b) Measure the resistance.
Standard: Below 1Ω

NG → **REPLACE FUSE**

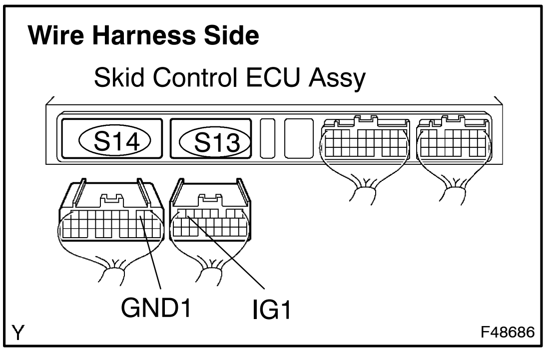
OK

3 INSPECT SKID CONTROL ECU (IG1 VOLTAGE)

When using hand–held tester:
(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Start the engine.
(c) Select the DATA LIST on the hand–held tester.
(d) Check the voltage condition output from the ECU displayed on the hand–held tester.
Skid control ECU assy:

Item	Measurement Item/ Range (Display)	Normal Condition	Diagnostic Note
IG VOLTAGE	ECU power supply voltage / UNDER / NORMAL / OVER	OVER: 32 V NORMAL: 20 to 32 V UNDER: Below 19 V	–

OK: "NORMAL" is displayed.



When not using the hand–held tester:
(e) Disconnect the S13 and S14 ECU connectors.
(f) Turn the ignition switch ON.
(g) Measure the voltage according to the table below.
Standard:

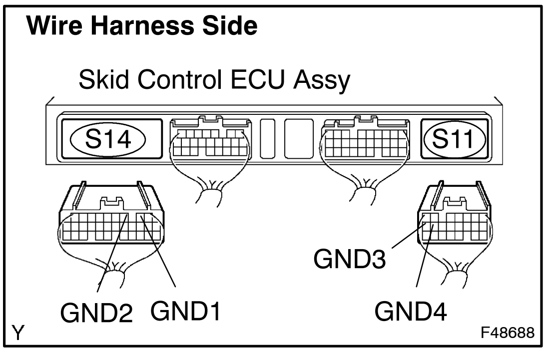
Tester Connection	Specified Condition
S13–7 (IG1) – S14–2 (GND1)	20 to 32 V

NG → **Go to step 4**

OK

Go to step 5

4 CHECK WIRE HARNESS (SKID CONTROL ECU ASSY – BODY GROUND)



(a) Disconnect the S11 and S14 ECU connectors.
(b) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
S11–14 (GND4) – Body ground	Below 1 Ω
S11–15 (GND3) – Body ground	Below 1 Ω
S14–3 (GND2) – Body ground	Below 1 Ω
S14–2 (GND1) – Body ground	Below 1 Ω

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

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

5 RECONFIRM DTC

(a) Check the DTC (see page 05–191).
HINT:
After erasing the DTC and driving the vehicle at more than 3 km/h (1.8 mph), check for DTCs.

A	Malfunction Code
B	No DTC code output

B → **NO PROBLEM**

A

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

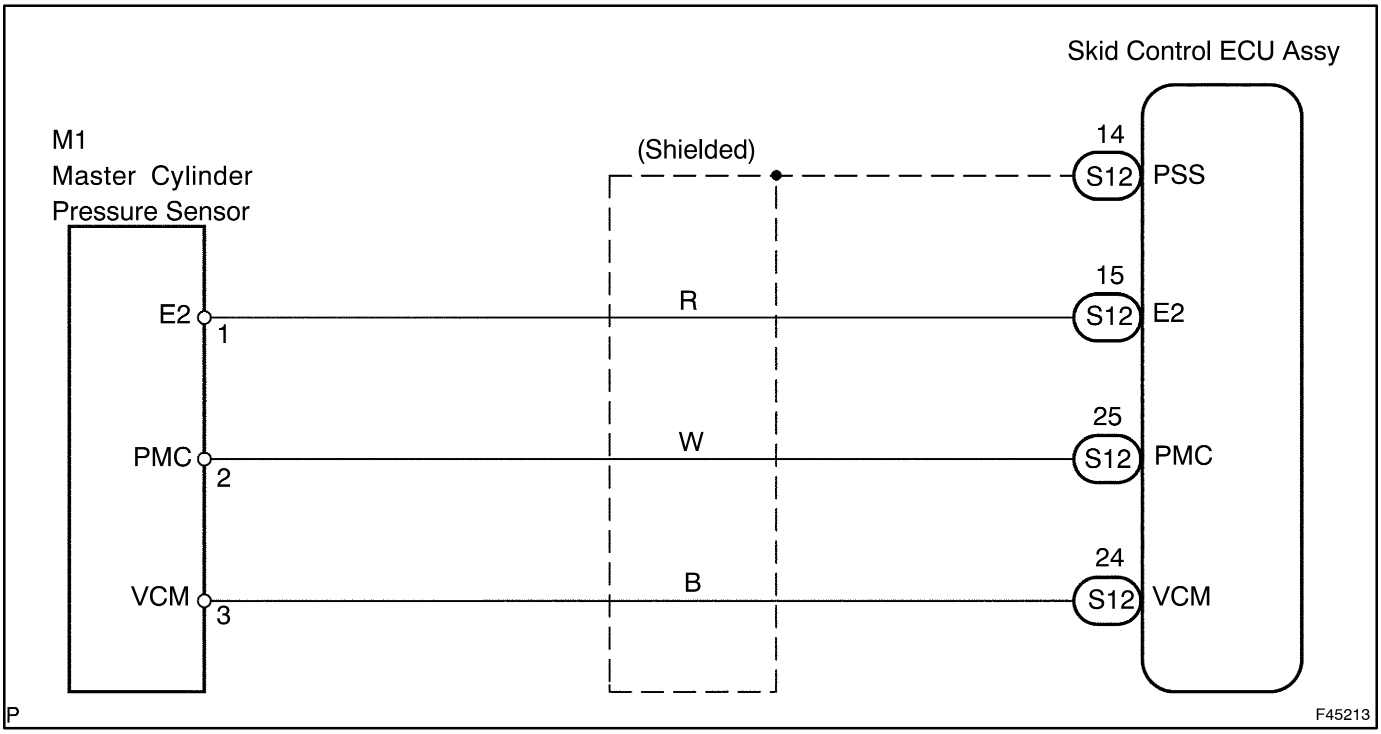
DTC	C1246/46	MALFUNCTION IN MASTER CYLINDER PRESSURE SENSOR

CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
C1246/46	1, 2, 3, 4 or 5 is detected: 1. Condition that IG1 terminal voltage is 19 to 32 V and VCM terminal voltage is 4.3 to 5.8 V (out of range) for 1.2 sec. or more 2. Condition that PMC terminal voltage is 0.14 to 4.75 V (out of range) for 1.2 sec. or more 3. Vehicle speed is 10 km/h (6.2 mph) or more, condition that stop lamp switch is OFF and, for 5 sec. or more, PMC terminal voltage is more than 0.86 V, or less than 0.3 V 4. Vehicle speed is 7 km/h (4 mph) or more, for 60 sec. or more, PMC terminal voltage is 0.86 V to 1 V (out of range), for 30 sec. PMC terminal voltage is 1 V or more, and voltage fluctuation is within 0.008 V. 5. When vehicle speed is 10 km/h (6.2 mph) or more, PMC terminal receives noise 7 times or more within 5 sec.	• Stop lamp switch assy • Master cylinder pressure sensor • Master cylinder pressure sensor circuit

HINT:
- If the brake pedal is depressed firmly, the brake force may be lowered.
- Fail–safe function:
  If any trouble occurs in the master cylinder pressure sensor circuit, the ECU will prohibit BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Start the inspection from step 1 if using the hand–held tester. If not, start from step 2.

1	READ VALUE OF HAND–HELD TESTER (MASTER CYLINDER PRESSURE SENSOR OUTPUT VALUE)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Select the DATA LIST mode on the hand–held tester.
(c) Check that brake fluid pressure value of the master cylinder pressure sensor changes when the brake pedal is depressed.

Skid control ECU assy:

Item	Measurement Item/ Range (Display)	Normal Condition	Diagnostic Note
MAS CYL PRESS 1	Master cylinder pressure sensor 1 reading / Min.: 0 V, Max.: 5 V	When brake pedal is released: 0.3 to 0.7 V	Reading increases when brake pedal is depressed

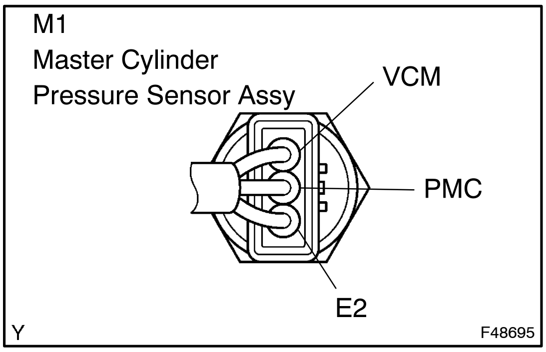
OK: Brake fluid pressure value (voltage) changes when brake pedal is depressed.

OK → **Go to step 2**

NG

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

2	CHECK MASTER CYLINDER PRESSURE SENSOR ASSY



(a) Measure the voltage between terminals VCM and E2 of the M1 connector.

Standard:

Tester Connection	Specified Condition
M1–3 (VCM) – M1–1 (E2)	4.75 to 5.25 V

(b) Install the LSPV gauge to the front caliper bleeder plug portion and bleed the LSPV gauge.
(c) Start the engine and depress the brake pedal, and,with the M1 connector still connected, then check the relation between the fluid pressure and voltage between the PMC and E2 terminals of the sensor.

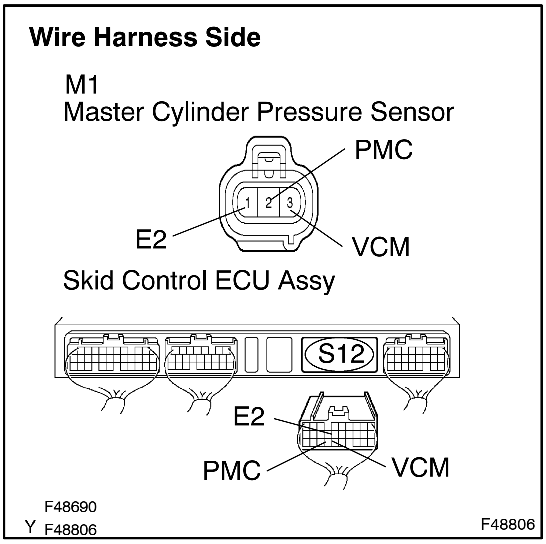
Standard:

Tester Connection	Front Brake Caliper Fluid Pressure	Voltage
M1–2 (PMC) – M1–1 (E2)	0 MPa (0 kgf/cm^2, 0 psi)	0.5 V
M1–2 (PMC) – M1–1 (E2)	9.8 MPa (100 kgf/cm^2, 1,422 psi)	2.5 V
M1–2 (PMC) – M1–1 (E2)	19.6 MPa (200 kgf/cm^2, 2,844 psi)	4.5 V

NG → **REPLACE MASTER CYLINDER PRESSURE SENSOR ASSY**

OK

3	CHECK WIRE HARNESS (MASTER CYLINDER PRESSURE SENSOR – SKID CONTROL ECU ASSY)



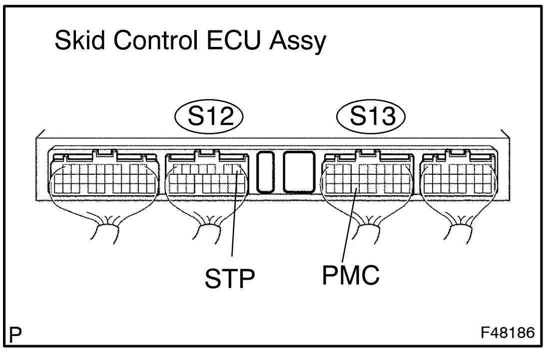
(a) Disconnect the M1 sensor connector.
(b) Disconnect the S12 ECU connector.
(c) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
S12–15 (E2) – M1–1 (E2)	Below 1 Ω
S12–24 (VCM) – M1–3 (VCM)	Below 1 Ω
S12–25 (PMC) – M1–2 (PMC)	Below 1 Ω
S12–15 (E2) – Body ground	10 kΩ or higher
S12–24 (VCM) – Body ground	10 kΩ or higher
S12–25 (PMC) – Body ground	10 kΩ or higher

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

OK

4 CHECK SKID CONTROL ECU ASSY (STP, PMC VOLTAGE)



(a) Remove the ECU but do not disconnect the connectors.

(b) Measure the voltage between terminal STP of the S13 ECU connector and the body ground when the brake pedal is depressed.

Standard:

Tester Connection	Specified Condition
S13–11 (STP) – Body ground	20 to 32 V

(c) Measure the voltage between terminal STP of the S13 ECU connector and the body ground when the brake pedal is released.

Standard:

Tester Connection	Specified Condition
S13–1 (STP) – Body ground	Below 2 V

(d) Check whether or not the STP input's voltage changes when the stop lamp switch is turned on and off.

(e) Measure the voltage between terminal PMC of the S12 ECU connector and the body ground when the stop lamp switch is turned on and off before STP ON.

Standard:

Tester Connection	Specified Condition
S12–25 (PMC) – Body ground	0.3 V < PMC Voltage before STP ON < 0.86 V

NG → **CHECK STOP LAMP SWITCH CIRCUIT**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

DTC	C1249/49	OPEN CIRCUIT IN STOP LIGHT SWITCH CIRCUIT

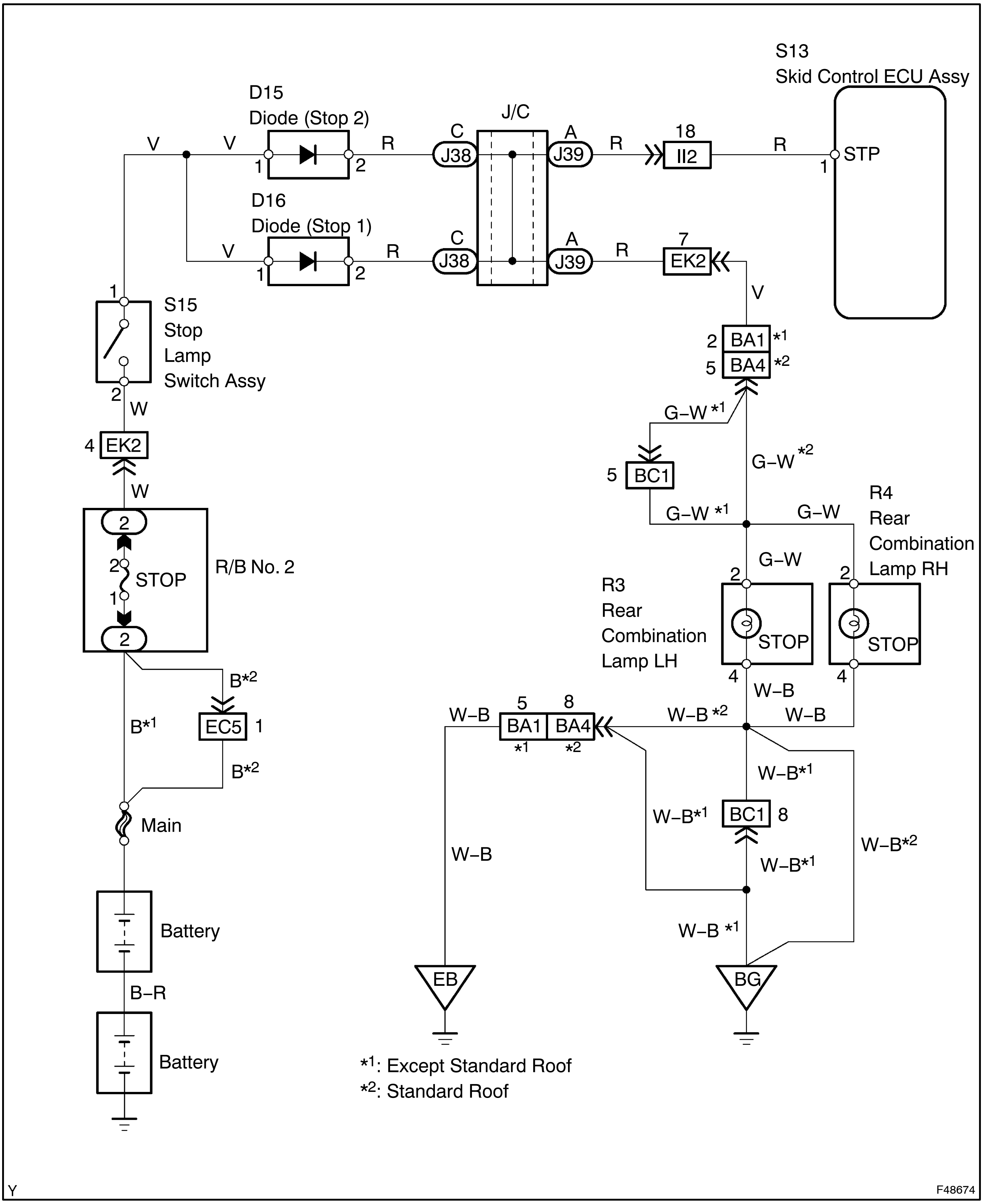
CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
C1249/49	ECU terminal IG1 voltage is 19 to 36 V and ABS is not operating, and open circuit in stop lamp switch circuit continues for 0.3 sec. or more	• Stop lamp bulb • Stop lamp switch assy • Stop lamp switch circuit

HINT:

- If the brake pedal is depressed firmly, the brake force may become lowered.
- Fail–safe function:
  If any trouble occurs in the stop lamp switch circuit, the ECU will cut off current to the ABS SOL MAIN relay and prohibit ABS controls and BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

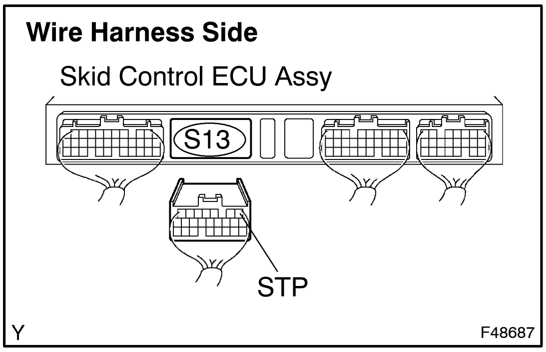
1 CHECK STOP LAMP SWITCH ASSY (OPERATION)

(a) Check that the stop lamp illuminates when the brake pedal is depressed and turns off when the brake pedal is released.
OK: Stop lamp switch function normal.

NG → **Go to step 3**

OK

2 INSPECT SKID CONTROL ECU (STP VOLTAGE)



(a) Disconnect the S13 ECU connector.
(b) Measure the voltage according to the table below.
Standard:

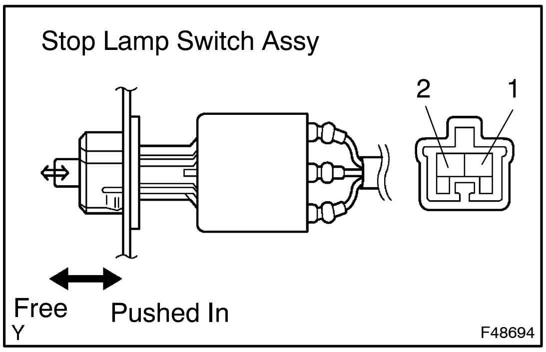
Tester Connection	Condition	Specified Condition
S13–1 (STP) – Body ground	Brake pedal depressed	20 to 32 V
S13–1 (STP) – Body ground	Brake pedal released	Below 1 V

NG → **Go to step 4**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

3 INSPECT STOP LAMP SWITCH ASSY



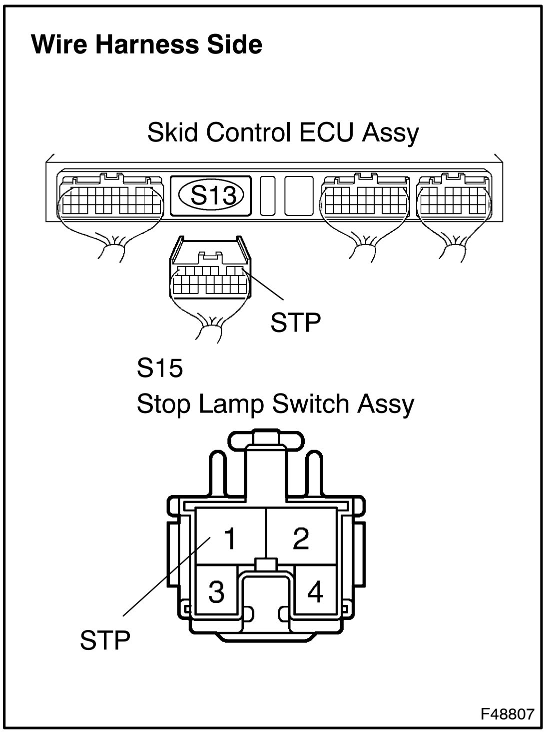
(a) Disconnect the stop lamp switch connector.
(b) Measure the resistance according to the table below.
Standard:

Tester Condition	Switch Condition	Specified Condition
1 – 2	Switch pin free	Below 1 Ω
1 – 2	Switch pin pushed in	10 kΩ or higher

NG → **REPLACE STOP LAMP SWITCH ASSY**

OK

4 CHECK HARNESS (SKID CONTROL ECU ASSY – STOP LAMP SWITCH ASSY, BATTERY AND BODY GROUND)



(a) Disconnect the S15 switch connector.
(b) Disconnect the S13 ECU connector.
(c) Measure the resistance and voltage according to the table below.
Standard:

Tester Connection	Specified Condition
S13–1 (STP) – S15–1	Below 1 Ω
S13–1 (STP) – Body ground	10 kΩ or higher
S15–2 – Body ground	20 to 32 V

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

OK

REPAIR OR REPLACE HARNESS AND CONNECTOR

DTC	C1251/51	PUMP MOTOR IS LOCKED/OPEN CIRCUIT IN PUMP MOTOR GROUND

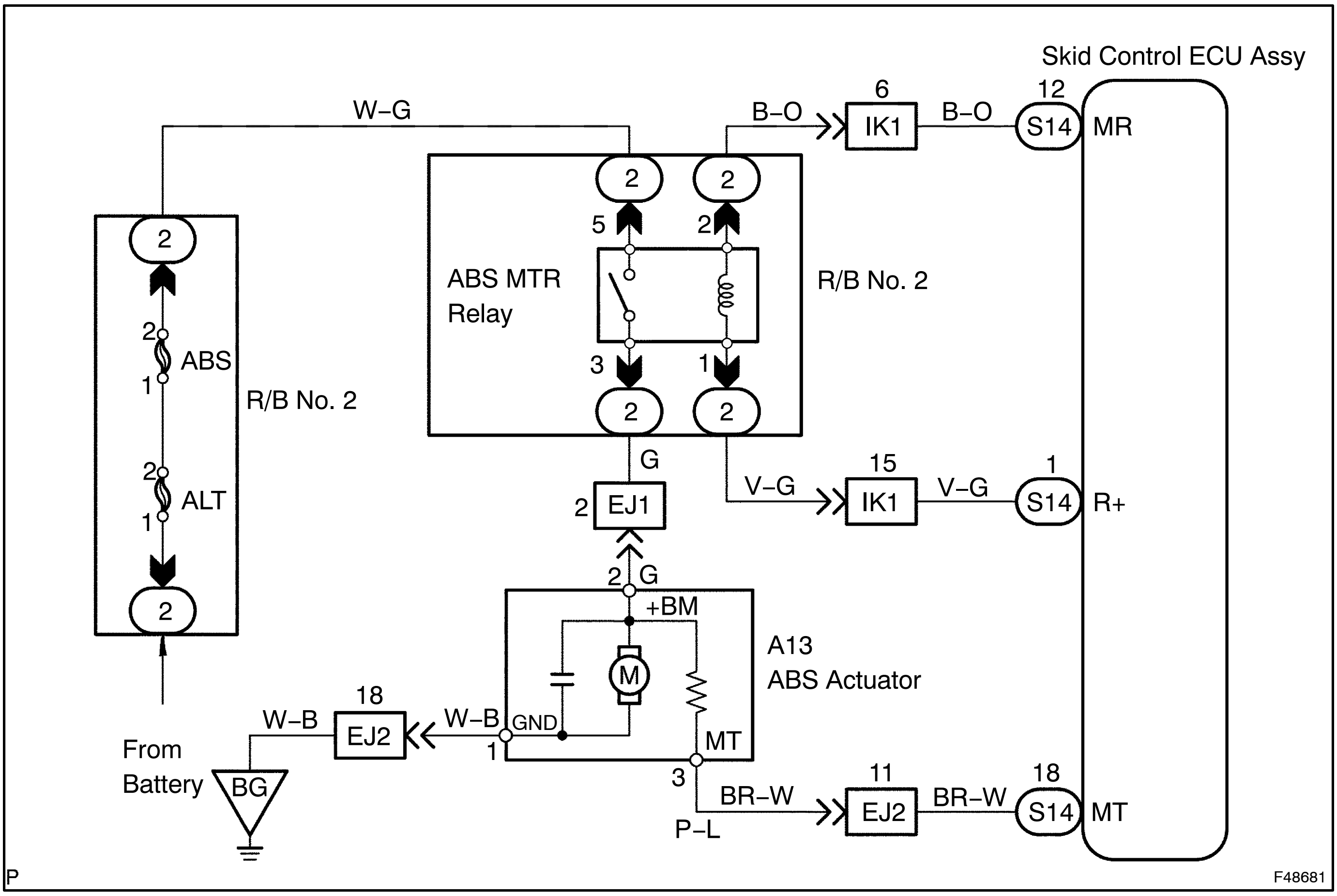
CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
C1251/51	Actuator pump motor does not operate correctly	• ABS actuator • ABS actuator circuit

HINT:

- If the brake pedal is depressed firmly, the brake force may be lowered.
- Fail–safe function:
  If any trouble occurs in the ABS pump motor, the ECU will cut off current to the ABS SOL MAIN relay and prohibit ABS controls and BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Start the inspection from step 1 if using the hand–held tester. If not, start from step 2.

1	PERFORM ACTIVE TEST BY HAND–HELD TESTER (ABS PUMP MOTOR OPERATION)

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Start the engine.
(c) Select the ACTIVE TEST on the hand–held tester.
(d) Operate only the ABS motor. Check the operating sound of the ABS motor.
Skid control ECU assy:

Item	Measurement Item/ Range (Display)	Normal Condition	Diagnostic Note
ABS MOT RELAY	ABS motor relay / ON or OFF	–	–

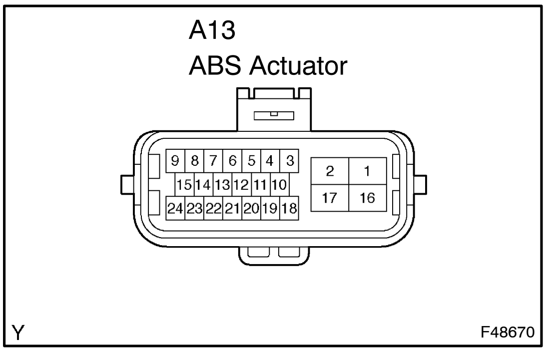
OK: The operation sound of the ABS motor is heard.

NG → **Go to step 2**

OK

REPLACE SKID CONTROL ECU ASSY

2	INSPECT ABS ACTUATOR (ABS PUMP MOTOR OPERATION)

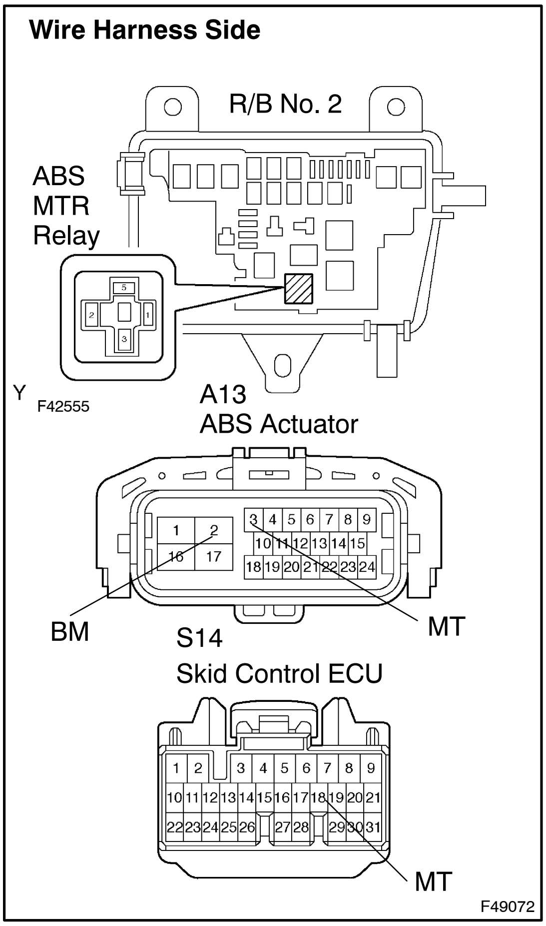


(a) Disconnect the A13 actuator connector.
(b) Connect the battery's positive (+) lead to terminal A13–2 (+BM) and the negative (–) lead to terminal A13–1 (GND) of the A13 actuator connector. Then check that the ABS pump motor is operating.
OK:
The operation sound of the ABS pump motor is heard.

NG → **REPLACE ABS ACTUATOR**

OK

3	CHECK WIRE HARNESS (ABS MTR RELAY – ABS ACTUATOR – SKID CONTROL ECU ASSY)



(a) Remove the ABS MTR relay from the R/B No. 2.
(b) Disconnect the A13 ABS actuator connector.
(c) Disconnect the S14 ECU connector.
(d) Measure the resistance according to the table below.

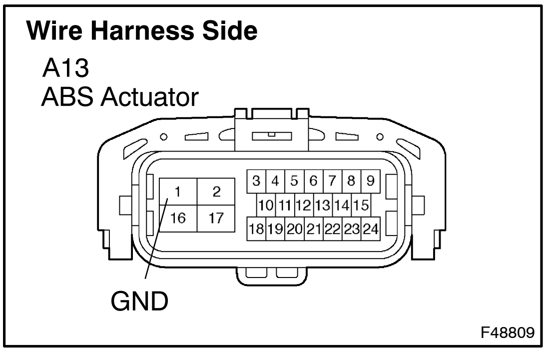
Standard:

Tester Connection	Specified Condition
R/B No. 2 ABS MTR relay terminal 3 – A13–2 (BM)	Below 1 Ω
A13–3 (MT) – S14–18 (MT)	Below 1 Ω

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

OK

4	CHECK WIRE HARNESS (ABS ACTUATOR – BODY GROUND)



(a) Disconnect the A13 actuator connector.
(b) Measure the resistance according to the table below.

Standard:

Tester Connection	Specified Condition
A13–1 (GND) – Body ground	Below 1 Ω

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

OK

5 RECONFIRM DTC

(a) Check the DTC (see page 05–191).

HINT:

After erasing the DTC and driving the vehicle at more than 7 km/h (4 mph), check for DTCs.

A	Malfunction Code
B	No DTC code output

A → **NO PROBLEM**

B ↓

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

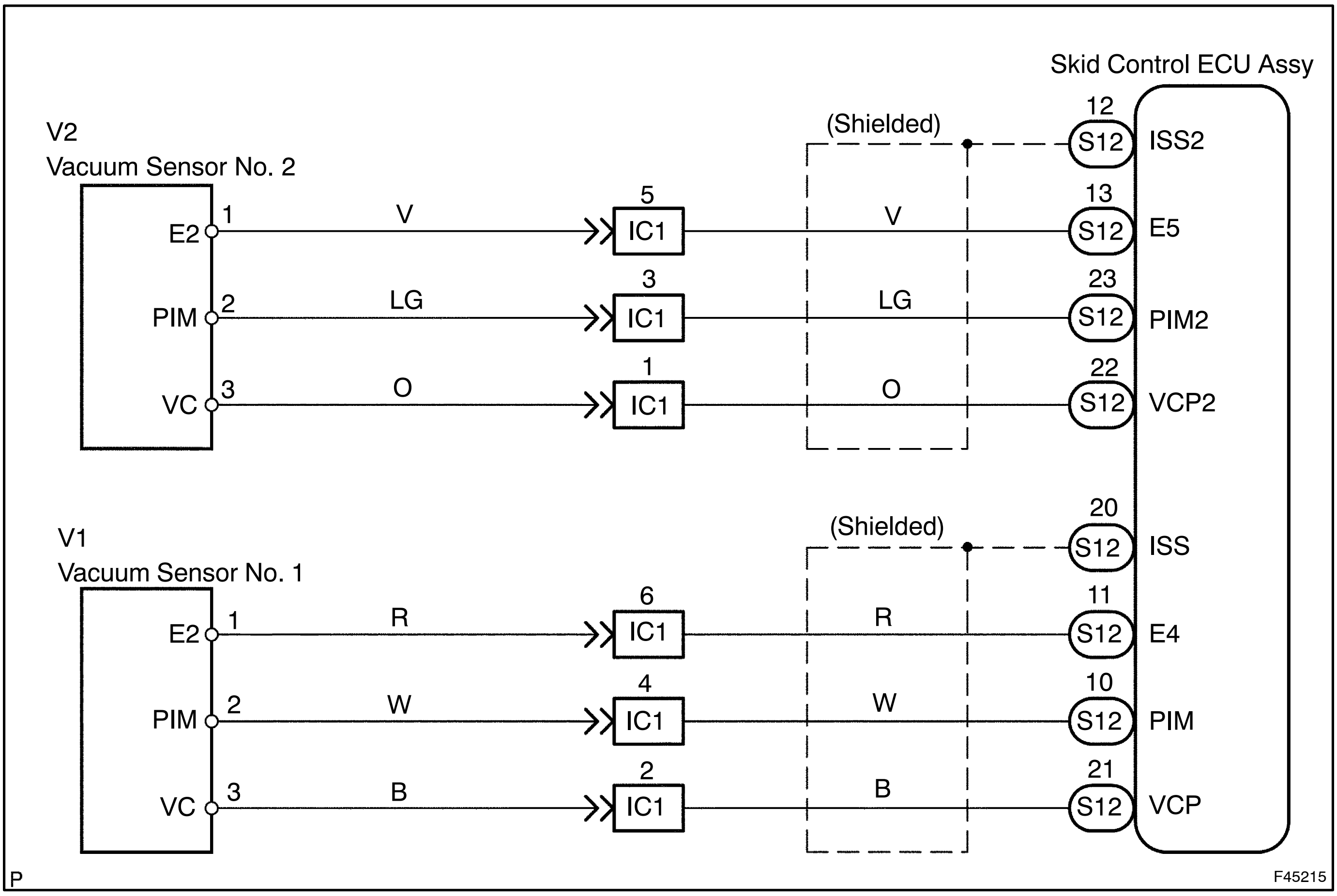
DTC | C1265/65 | VACUUM SENSOR MALFUNCTION

CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
C1265/65	1, 2, 3, 4 or 5 is detected: 1. When ignition switch is ON and VCP (VCP2) terminal voltage is within range of 4.3 to 5.8 V, PIM terminal voltage is 0.4 to 4.5 V (out of range) for 1.2 sec. 2. When VCP (VCP2) terminal voltage is within range of 4.3 to 5.8 V, PIM (PIM2) terminal voltage is 0.4 to 4.5 V (out of range) continues for 1.2 sec. 3. With engine running, depress brake pedal with 19 kgf and release it. In 1 sec., change amount of PIM (PIM2) terminal voltage becomes less than 0.01 V 5 times or more 4. PIM or PIM2 terminal receives noise 7 times or more within 5 sec. 5. When PIM (PIM2) terminal voltage is 1.46 V or more, condition that voltage difference between terminals PIM and PIM2 is 344 mV or more continues for 10 sec. or more	• Vacuum sensor • Vacuum sensor circuit

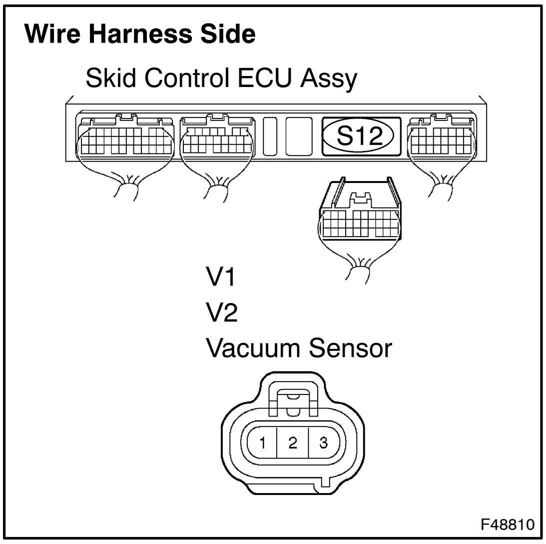
HINT:
- If the brake pedal is depressed firmly, the brake force may be lowered.
- Fail safe function:
  If any trouble occurs in the vacuum sensor circuit, the ECU will prohibit BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 CHECK WIRE HARNESS (VACUUM SENSOR – SKID CONTROL ECU ASSY)



(a) Disconnect the S12 ECU connector.
(b) Disconnect the V1 and V2 sensor connectors.
(c) Measure the resistance according to the table below.

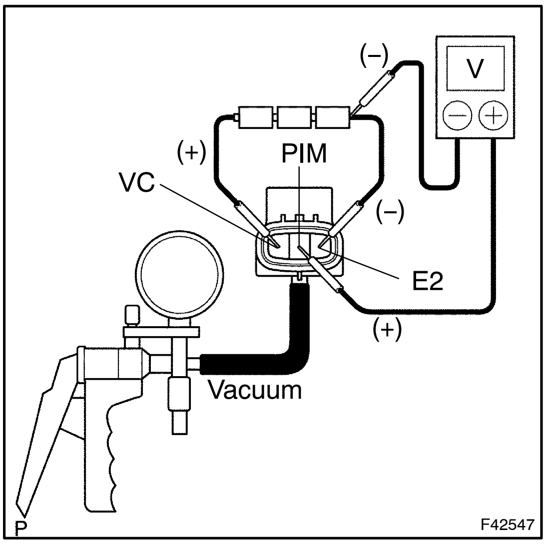
Standard:

Tester Connection	Specified Condition
V1–1 (E2) – S12–11 (E4)	Below 1 Ω
V1–2 (PIM) – S12–10 (PIM)	Below 1 Ω
V1–3 (VC) – S12–21 (VCP)	Below 1 Ω
V2–1 (E5) – S12–13 (E5)	Below 1 Ω
V2–2 (PIM) – S12–23 (PIM2)	Below 1 Ω
V2–3 (VC) – S12–22 (VCP2)	Below 1 Ω
V1–1 (E2) – Body ground	10 kΩ or higher
V1–2 (PIM) – Body ground	10 kΩ or higher
V1–3 (VC) – Body ground	10 kΩ or higher
V2–1 (E5) – Body ground	10 kΩ or higher
V2–2 (PIM) – Body ground	10 kΩ or higher
V2–3 (VC) – Body ground	10 kΩ or higher

NG — **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

2 INSPECT VACUUM SENSOR (NO. 1, NO. 2)



(a) Check the vacuum sensor No. 1 and No. 2.

HINT:

Before checking vacuum sensor, check for cracks or damage on the vacuum hoses.

(1) Connect 3 dry batteries of 1.5 V in series.

(2) Connect the VC terminal to the battery's positive (+) terminal and the E2 terminal to the battery's negative (–) terminal. Then apply about 4.5 V between the VC and E2 terminals.

NOTICE:

Do not apply 6 V or more to terminals VC and E2.

(3) Connect a voltmeter to terminals PIM and E2 of the ECU, and measure the output voltage at atmospheric pressure.

(4) Apply a vacuum to the vacuum sensor in 20 kPa (150 mmHg, 5.91 in.Hg) increments to 100 kPa (750 mmHg, 29.53 in.Hg).

(5) Measure the voltage drop and check the results in the table below.

Standard:

Front Brake Caliper Fluid Pressure	Voltage
80 kPa (150 mmHg, 5.91 in.Hg)	1.2 V
40 kPa (450 mmHg, 17.71 in.Hg)	2.4 V
0 kPa (750 mmHg, 29.53 in.Hg)	3.6 V

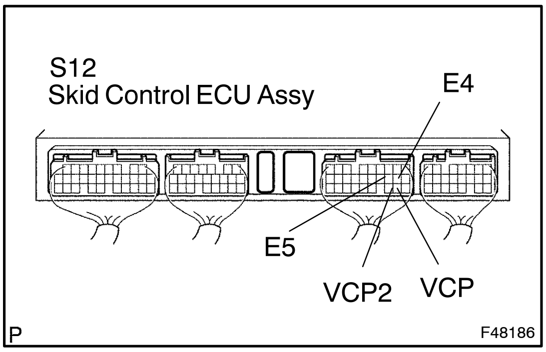
(6) Check the difference of voltage between the vacuum sensors.

Standard: Difference is 340 mV or more

NG → **REPLACE VACUUM SENSOR**

OK

3 CHECK SKID CONTROL ECU ASSY (VCP, VCP2 VOLTAGE)



(a) Remove the ECU but not disconnect the connectors.
(b) Turn the ignition switch ON.
(c) Measure the voltage according to the table below.
Standard:

Tester Connection	Specified Condition
S12–21 (VCP) – S12–11 (E4)	4.75 to 5.25 V
S12–22 (VCP2) – S12–13 (E5)	4.75 to 5.25 V

NG → **REPLACE SKID CONTROL ECU ASSY (See page 01–27)**

OK

NO PROBLEM

05L30–01

DTC C1266/66 EXHAUST RETARDER PREVENTION SIGNAL CIRCUIT

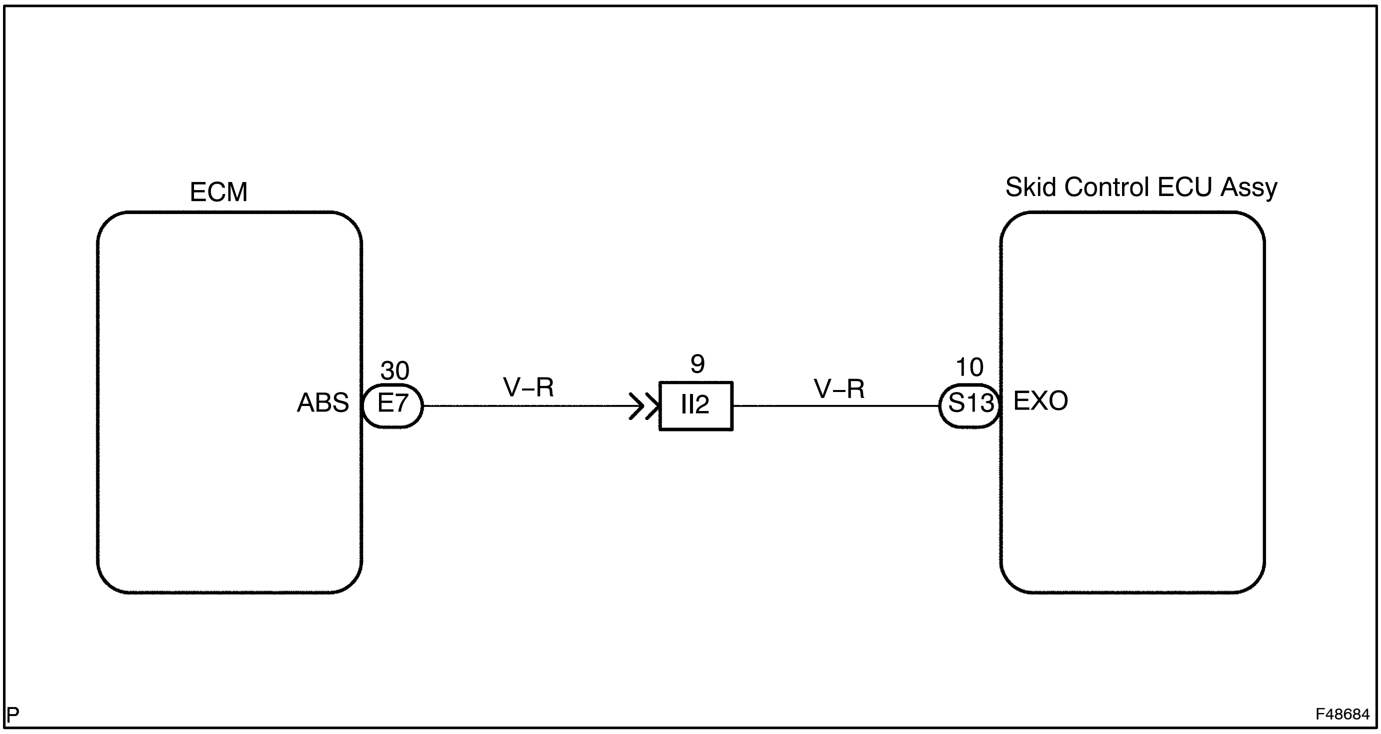
CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
C1266/66	With vehicle speed of 6 km/h (4 mph) or more, open or short circuit of signal circuit continues for 0.3 sec. or more	• EXO circuit • Skid control ECU assy • ECM

HINT:

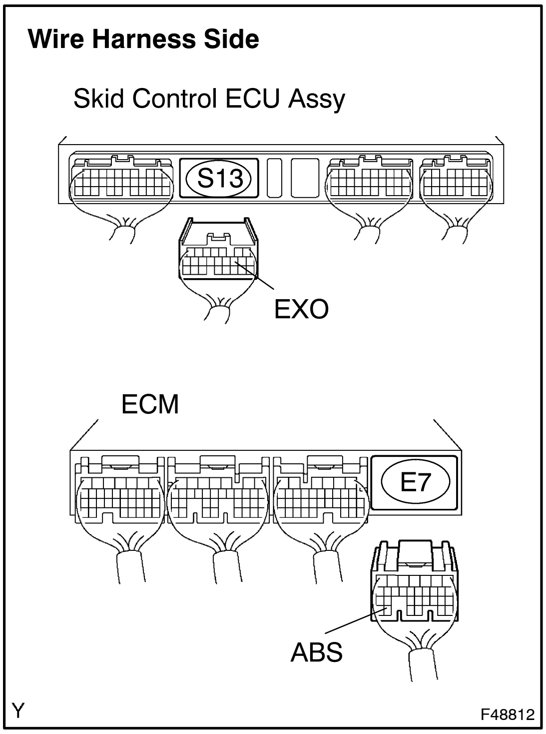
- There is a case that the hand–held tester cannot be used if the ECU is abnormal.
- Fail–safe function:
  If any trouble occurs in the EXO signal circuit, the ECU will cut off current to the ABS SOL MAIN relay and prohibit the ABS controls and BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 CHECK WIRE HARNESS (SKID CONTROL ECU ASSY – ECM)



(a) Disconnect the S13 ECU connector.
(b) Disconnect the E7 ECM connector.
(c) Measure the resistance according to the table below.

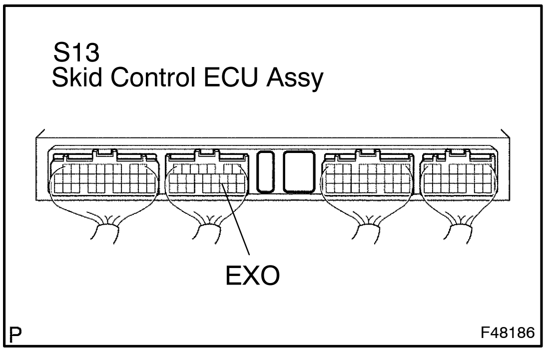
Standard:

Tester Connection	Specified Condition
E7–30 (ABS) – S13–10 (EXO)	Below 1 Ω
E7–30 (ABS) – Body ground	10 kΩ or higher

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

OK

2 CHECK SKID CONTROL ECU ASSY (EXO VOLTAGE)



(a) Remove the ECU but do not disconnect the connectors.
(b) Turn the ignition switch ON.
(c) Measure the voltage according to the table below.

Standard:

Tester Connection	Specified Condition
S13–10 (EXO) – Body ground	20 to 32 V

NG → **Go to step 4**

OK

3 RECONFIRM DTC

(a) Check the DTC (see page 05–191).

HINT:

After erasing the DTC and driving the vehicle at more than 7 km/h (4 mph), check for DTCs.

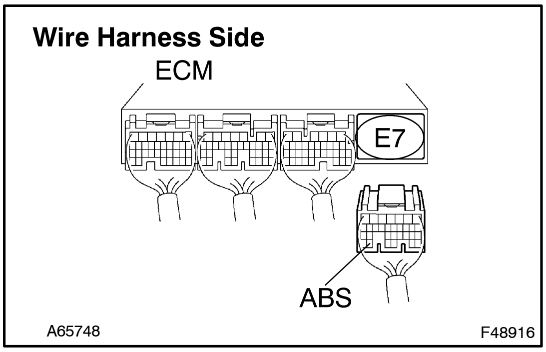
A	Malfunction Code
B	No DTC code output

B → **NO PROBLEM**

A

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

4 CHECK ECM (ABS VOLTAGE)



(a) Disconnect the E7 ECM connector.

(b) Turn the ignition switch ON.

(c) Measure the voltage according to the table below.

Standard:

Tester Connection	Specified Condition
E7–30 (ABS) – Body ground	20 to 32 V

NG → **REPLACE ECM (See page 01–27)**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

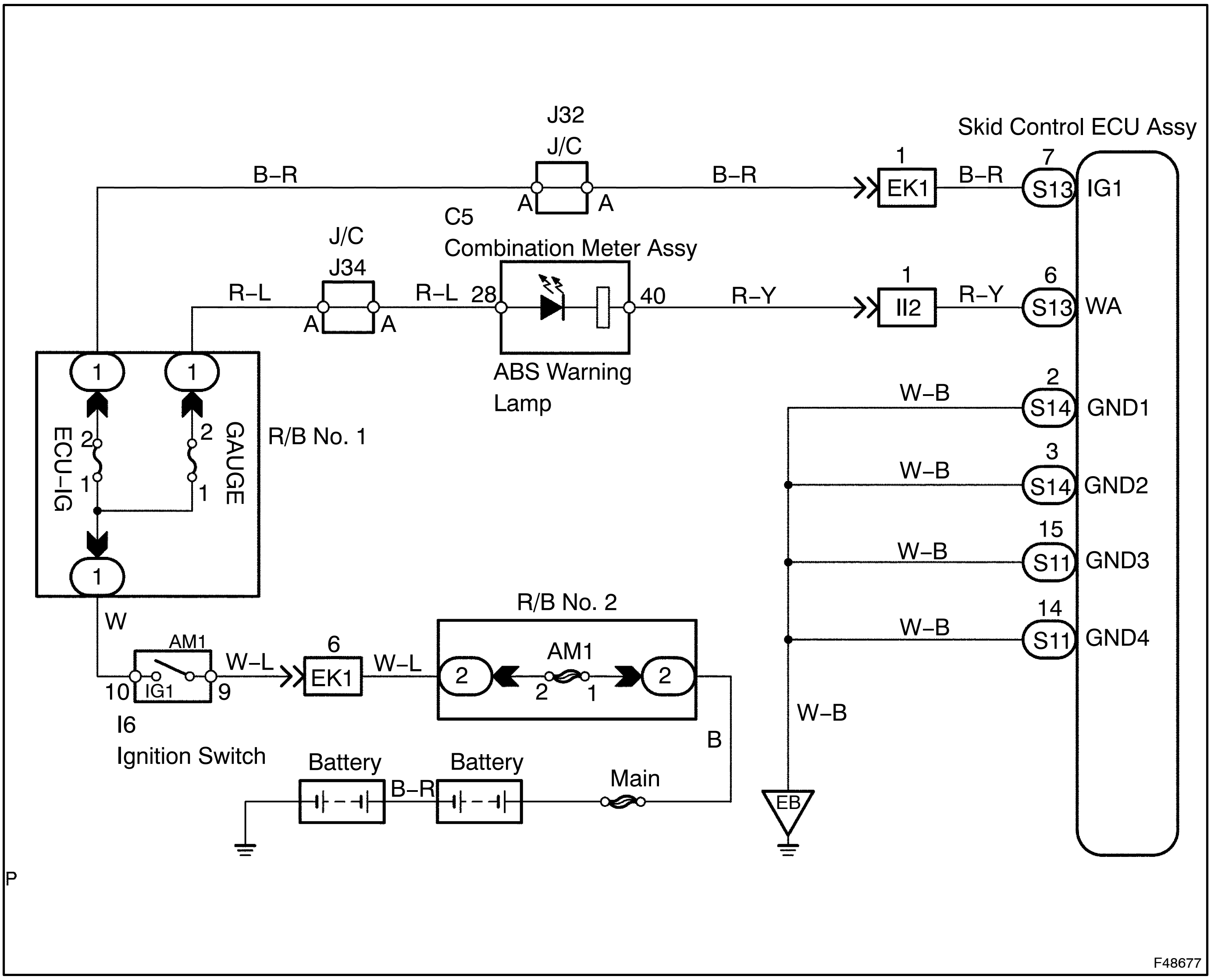
DTC | AlwaysON | MALFUNCTION IN ABS ECU

CIRCUIT DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
Always ON	1, 2 or 3 is detected: 1. ECU connectors are disconnected from ECU 2. Malfunction occurs in ECU internal circuit 3. Malfunction occurs in ABS warning lamp circuit	• Battery • Fuse • ABS warning lamp circuit • Charging system • Power source circuit • Skid control ECU assy

HINT:
- There is a case that the hand–held tester cannot be used if the ECU is abnormal.
- Fail–safe function:
  If any trouble occurs in the ECU, the ECU will cut off current to the ABS SOL MAIN relay and prohibit ABS control and BRAKE ASSIST.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT BATTERY

(a) Check the battery voltage.
Standard: 20 to 32 V

NG → **CHECK AND REPAIR CHARGING SYSTEM (See Pub. No. S1–YXZE05A, page 19–5)**

OK

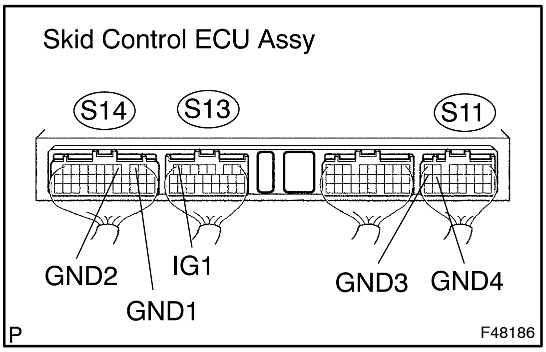
2 CHECK SKID CONTROL ECU ASSY (POWER SOURCE)

When using the hand–held tester:

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.
(b) Start the engine.
(c) Select the DATA LIST on the hand–held tester.
(d) Check the voltage condition output from the ECU displayed on hand–held tester.
Skid control ECU assy:

Item	Measurement Item/ Range (Display)	Normal Condition	Diagnostic Note
IG VOLTAGE	ECU power supply voltage / UN-DER / NORMAL / OVER	OVER: 32 V NORMAL: 20 V to 32V UNDER: Below 19 V	–

OK: "Normal" is displayed.



When not using the hand–held tester:

(e) Remove the ECU but do not disconnect the connectors.
(f) Turn the ignition switch ON.
(g) Measure the voltage according to the table below.
Standard:

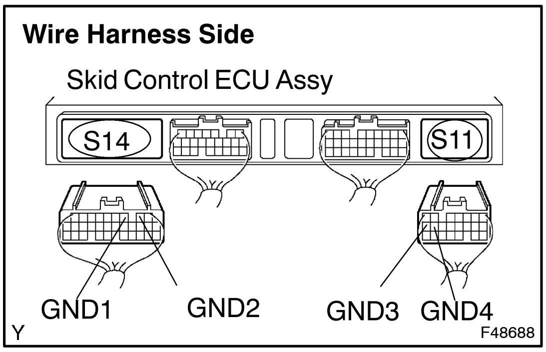
Tester Connection	Specified Condition
S13–7 (IG1) – S14–2 (GND1)	20 to 32 V
S13–7 (IG1) – S14–3 (GND2)	20 to 32 V
S13–7 (IG1) – S11–14 (GND4)	20 to 32 V
S13–7 (IG1) – S11–15 (GND3)	20 to 32 V

NG → **Go to step 3**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

3 CHECK WIRE HARNESS (SKID CONTROL ECU ASSY – BODY GROUND)



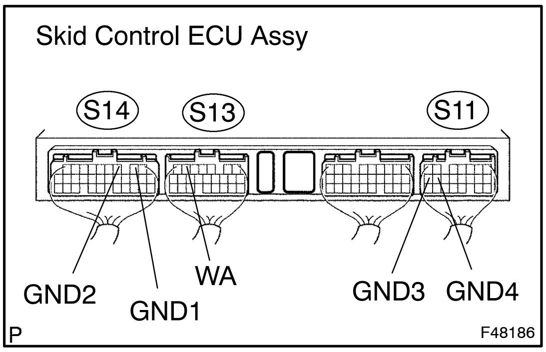
(a) Disconnect the S11 and S14 ECU connectors.
(b) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
S14–2 (GND1) – Body ground	Below 1 Ω
S14–3 (GND2) – Body ground	Below 1 Ω
S11–14 (GND4) – Body ground	Below 1 Ω
S11–15 (GND3) – Body ground	Below 1 Ω

NG **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

4 CHECK ABS WARNING LAMP



(a) Remove the ECU but do not disconnect the connectors.
(b) Using a service wire, connect terminals WA (S13–6) and GND (S14–2, 3, S11–14, 15) of the ECU connectors.
(c) Turn the ignition switch ON.
(d) Check the ABS warning lamp.
OK: ABS warning lamp turns off.

NG **Go to step 5**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

5 RECONFIRM DTC

(a) Check the DTC (see page 05–191).
HINT:
After erasing the DTC and driving the vehicle at more than 30 km/h (19 mph), check for DTCs.

A	No DTC code output
B	Malfunction code

B **REPAIR CIRCUIT INDICATED BY OUTPUT CODE**

A

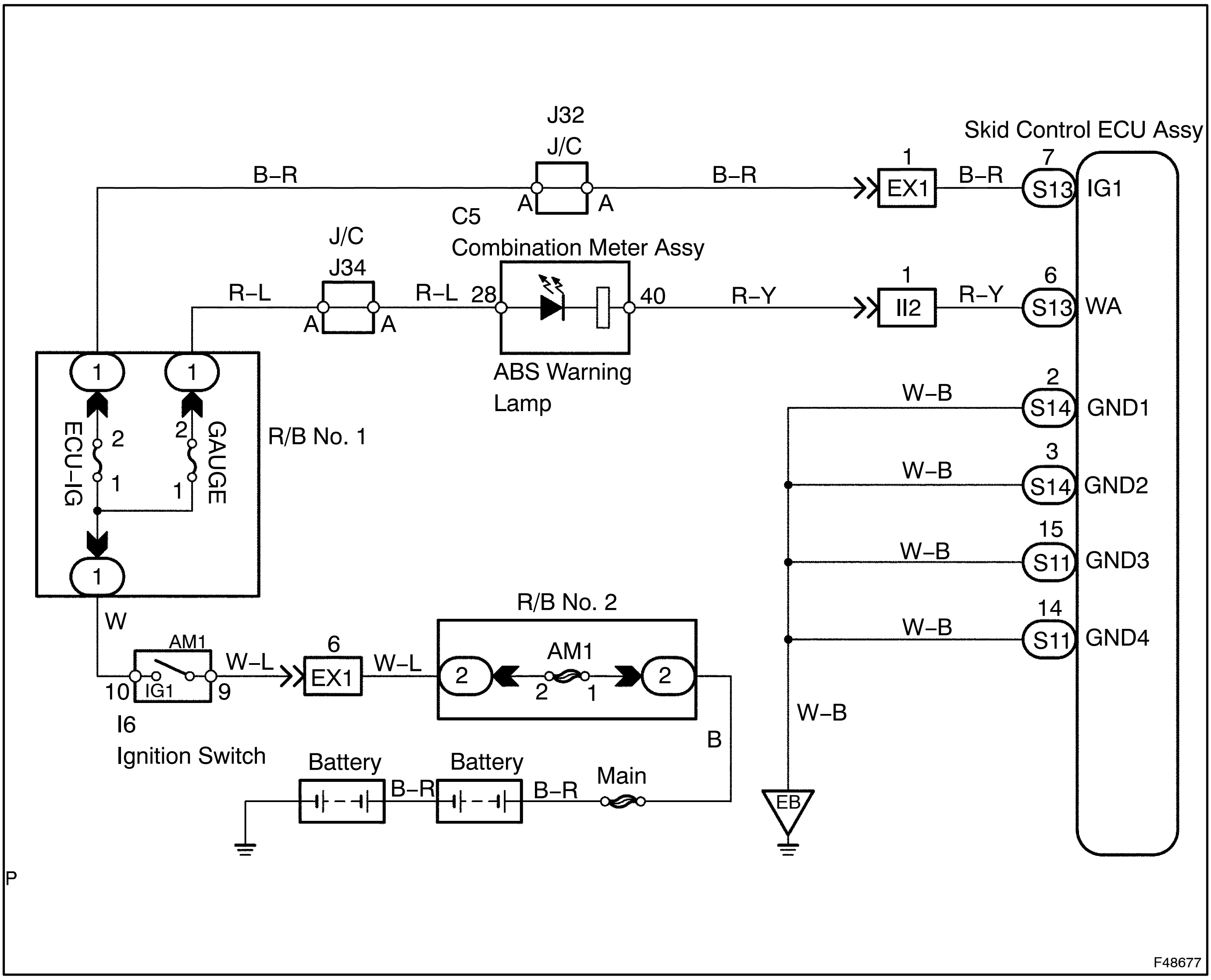
REPLACE COMBINATION METER ASSY (See Pub. No. S1–YXZE05A, page 71–1)

ABS WARNING LAMP CIRCUIT (DOES NOT LIGHT UP)

CIRCUIT DESCRIPTION

If the ECU detects a malfunction, the ABS warning lamp is illuminated and ABS control is prohibited. Then the ECU records the DTC in memory.
HINT:
Connect terminals TC and CG of the DLC3 to cause the ABS warning lamp to flash and output the DTC.

WIRING DIAGRAM



INSPECTION PROCEDURE

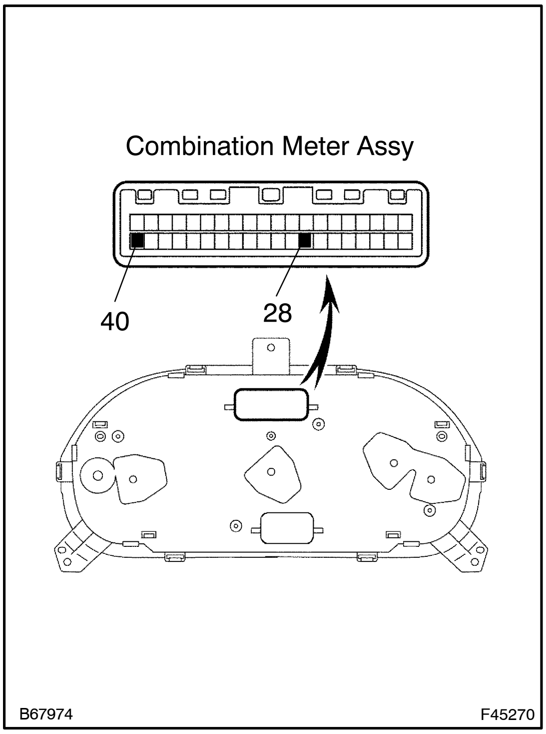
1 CHECK OTHER WARNING LAMP

(a) After the ignition switch is turned ON, check if the warning lamps other than the ABS warning lamp illuminate.

NG → **CHECK COMBINATION METER (See Pub. No. S1–YXZE05A, page 71–1)**

OK

2 INSPECT ABS WARNING LAMP



(a) Disconnect the C5 combination meter connector.

(b) Measure the resistance and voltage according to the table below.

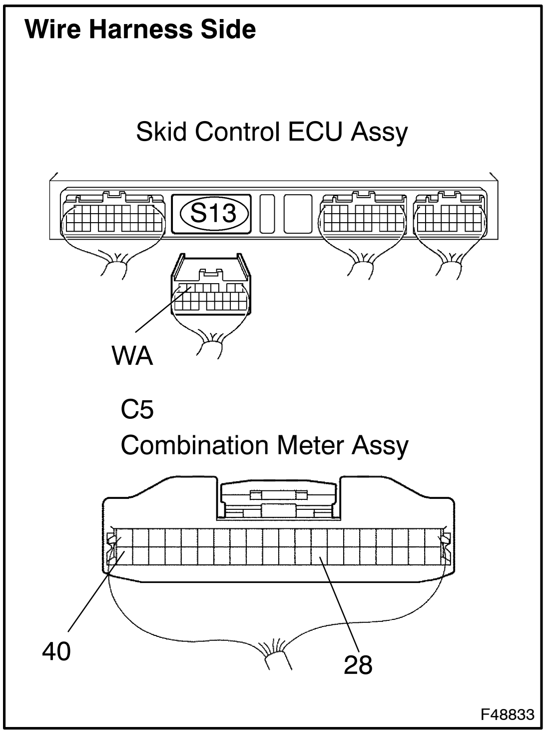
Standard:

Tester Connection	Specified Condition
28 – 40	Below 10 MΩ

NG → **REPLACE COMBINATION METER ASSY (See Pub. No. S1–YXZE05A, page 71–1)**

OK

3	CHECK WIRE HARNESS (SKID CONTROL ECU ASSY – COMBINATION METER ASSY)



(a) Disconnect the S13 ECU connector.
(b) Disconnect the C5 meter connector.
(c) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
S13–6 (WA) – C5–40	Below 1 Ω
28 – Body ground	20 to 32 V
S13–6 (WA) – Body ground	10 kΩ or higher

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

OK

4	CHECK ABS WARNING LAMP

(a) When the ignition switch is turned ON, check that the ABS warning lamp illuminates for 3 seconds.

NG → **REPLACE SKID CONTROL ECU ASSY (See page 01–27)**

OK

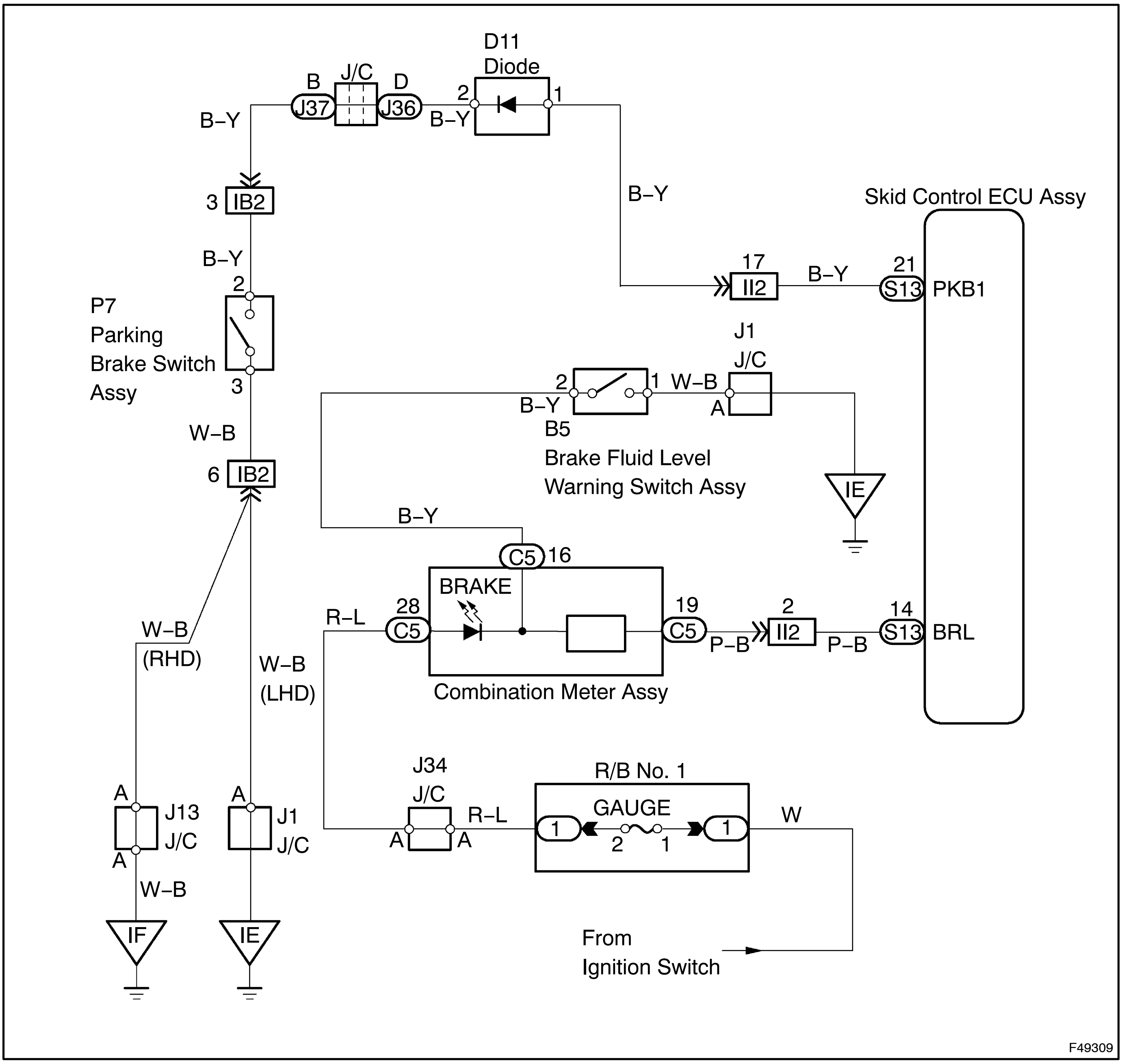
NO PROBLEM

BRAKE WARNING LAMP CIRCUIT (REMAINS ON)

CIRCUIT DESCRIPTION

The brake warning lamp illuminates when the brake fluid is insufficient, the parking brake is applied or the vacuum created by the vacuum pump is below the standard level.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 RECONFIRM DTC

(a) Check the DTC (see page 05–191).

HINT:

After erasing the DTC and driving the vehicle at more than 30 km/h (19 mph), check for DTCs.

A	No DTC Code output
B	Malfunction Code

B → **REPAIR CIRCUIT INDICATED BY OUTPUT CODE**

A

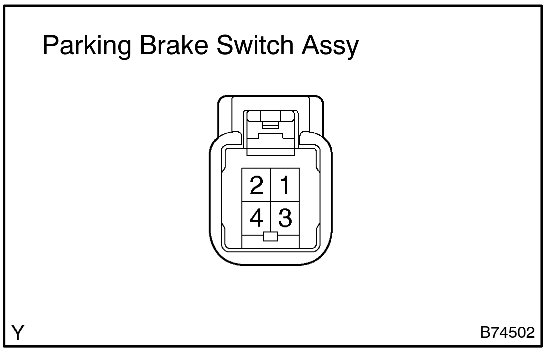
2 CHECK BRAKE WARNING LAMP

(a) Remove the skid control ECU but do not disconnect the connectors.
(b) Using a service wire, connect terminals BRL (S13–14) and body ground of the ECU connector.
(c) Turn the ignition switch ON.
(d) Check the brake warning lamp.
OK: Brake warning lamp turns OFF.

NG → **Go to step 10**

OK

3 INSPECT PARKING BRAKE SWITCH ASSY



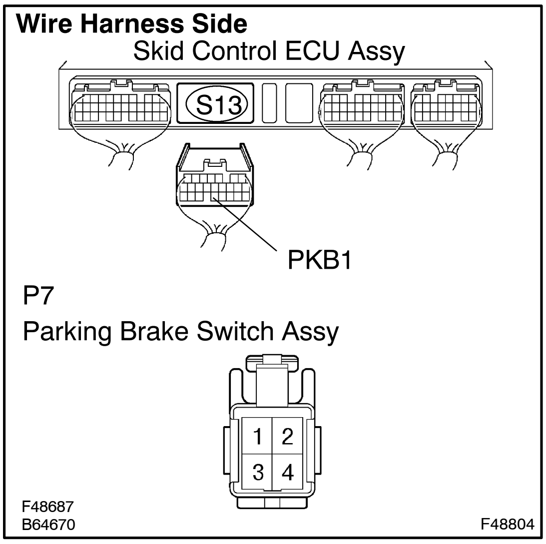
(a) Remove the parking brake switch.
(b) Measure the resistance according to the table below.
Standard:

Tester Connection	Switch Condition	Specified Condition
2 – 3	Pushed	Below 1 Ω
2 – 3	Not pushed	10 kΩ or higher

NG → **REPLACE PARKING BRAKE SWITCH ASSY**

OK

4	CHECK WIRE HARNESS (PARKING BRAKE SWITCH ASSY – SKID CONTROL ECU ASSY AND BODY GROUND)



(a) Disconnect the S13 ECU connector.
(b) Disconnect the P7 switch connector.
(c) Measure the resistance according to the table below.

Standard:

Tester Connection	Specified Condition
S13–21 (PKB1) – P7–2	Below 1 Ω
P7–3 – Body ground	Below 1 Ω
S13–21 (PKB1) – Body ground	10 kΩ or higher

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

OK

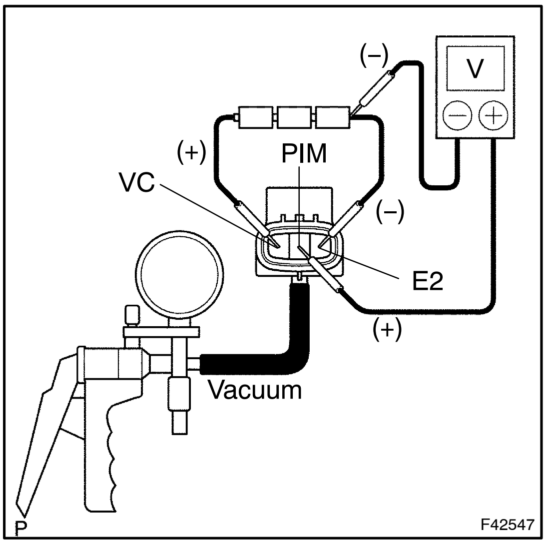
5	CHECK VACUUM HOSE

(a) Check for cracks and damage on the vacuum hoses.

NG → **REPLACE VACUUM HOSE**

OK

6 INSPECT VACUUM SENSOR (NO. 1, NO. 2)



(a) Check the vacuum sensor No. 1 and No. 2.

HINT:

Before checking vacuum sensor, check for cracks or damage on the vacuum hoses.

(1) Connect 3 dry batteries of 1.5 V in series.

(2) Connect the VC terminal to the battery's positive (+) terminal and the E2 terminal to the negative (–) terminal. Then apply about 4.5 V between the VC and E2 terminals.

NOTICE:

Do not apply 6 V or more to terminals VC and E2.

(3) Connect a voltmeter to terminals PIM and E2 of the ECU, and measure the output voltage at atmospheric pressure.

(4) Apply a vacuum to the vacuum sensor in 20 kPa (150 mmHg, 5.91 in.Hg) increments to 100 kPa (750 mmHg, 29.53 in.Hg).

(5) Measure the voltage drop and check the results in the table below.

Standard:

Front Brake Caliper Fluid Pressure	Voltage
80 kPa (150 mmHg, 5.91 in.Hg)	1.2 V
40 kPa (450 mmHg, 17.71 in.Hg)	2.4 V
0 kPa (750 mmHg, 29.53 in.Hg)	3.6 V

(6) Check the difference of voltage between the vacuum sensors.

Standard: Difference is 340 mV or more.

NG > **REPLACE VACUUM SENSOR**

OK

7 CHECK BRAKE FLUID LEVEL IN RESERVOIR

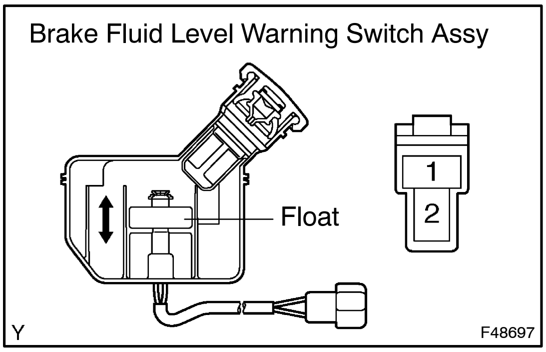
(a) Check the fluid level and add fluid, if necessary.

NOTICE:
Immediately wipe off any brake fluid that does not belong.

NG → **CHECK AND REPAIR BRAKE FLUID LEAKAGE AND ADD FLUID**

OK

8 INSPECT BRAKE FLUID LEVEL WARNING SWITCH ASSY



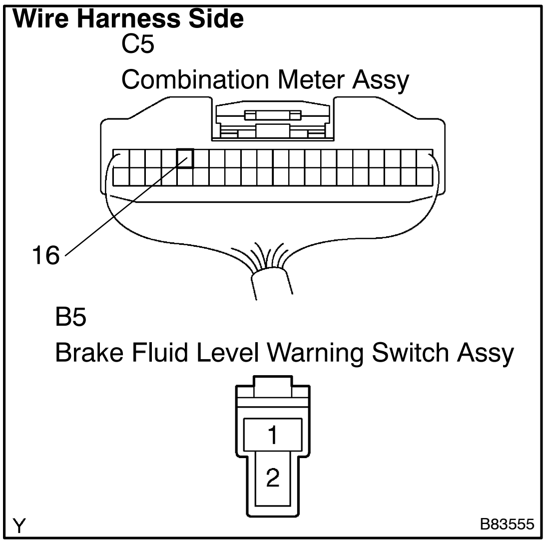
(a) Remove the reservoir tank cap and strainer.
(b) Disconnect the B5 switch connector.
(c) Measure the resistance according to the table below.
Standard:

Tester Connection	Switch Condition	Specified Condition
1 – 2	Float UP	10 kΩ or higher
1 – 2	Float DOWN	Below 1 Ω

NG → **REPLACE BRAKE FLUID LEVEL WARNING SWITCH ASSY**

OK

9 CHECK WIRE HARNESS (COMBINATION METER ASSY – BRAKE FLUID LEVEL WARMING SWITCH ASSY AND BODY GROUND)



(a) Disconnect the C5 meter connector.
(b) Disconnect the B5 switch connector.
(c) Measure the resistance according to the table below.
Standard:

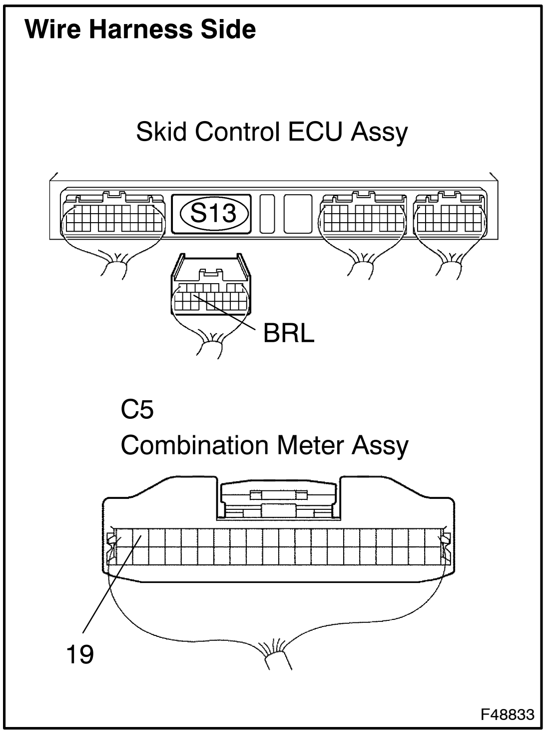
Tester Connection	Specified Condition
C5–16 – B5–2	Below 1 Ω
B5–1 – Body ground	Below 1 Ω

NG → **REPLACE OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

10 CHECK WIRE HARNESS (SKID CONTROL ECU ASSY – COMBINATION METER ASSY)



(a) Disconnect the S13 ECU connector.
(b) Disconnect the C5 meter connector.
(c) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
S13–4 (BRL) – C5–19	Below 1 Ω
S13–4 (BRL) – Body ground	10 kΩ or higher

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

OK

REPLACE COMBINATION METER ASSY (See Pub. No. S1–YXZE05A, page 71–1)

BRAKE WARNING LAMP CIRCUIT (DOES NOT LIGHT UP)

CIRCUIT DESCRIPTION

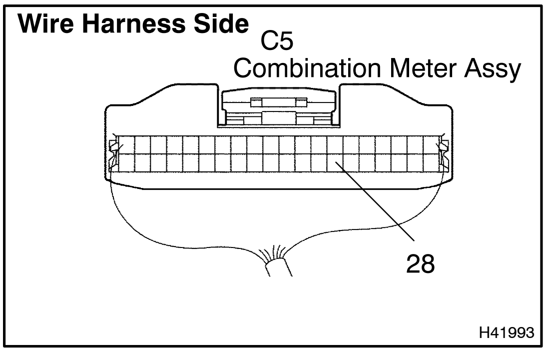
Refer to brake warning lamp circuit (remains ON) (see page 05–253).

WIRING DIAGRAM

Refer to brake warning lamp circuit (remains ON) (see page 05–253).

INSPECTION PROCEDURE

1 CHECK COMBINATION METER ASSY (POWER SOURCE)



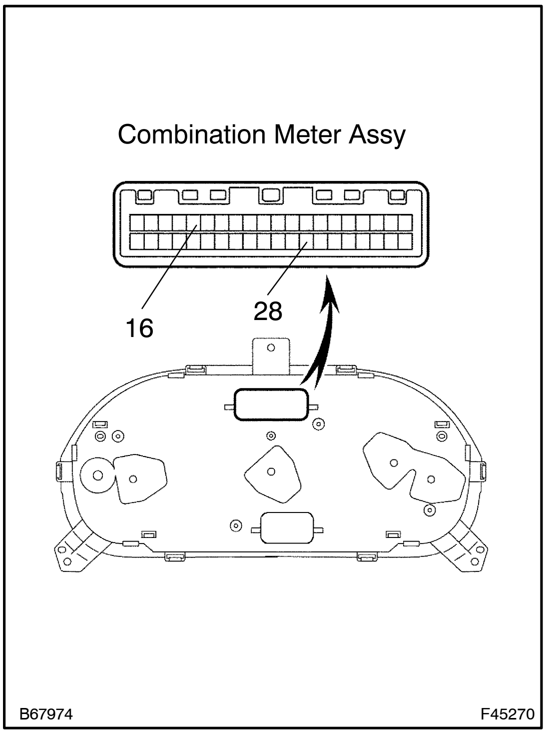
(a) Remove the combination meter but do not disconnect the connectors.
(b) Turn the ignition switch ON.
(c) Measure the voltage according to the table below.
Standard:

Tester Connection	Specified Condition
C5–28 – Body ground	20 to 32 V

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

OK

2 CHECK COMBINATION METER ASSY (BRAKE WARNING LAMP)



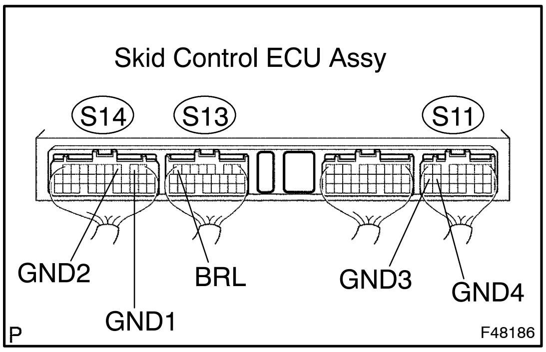
(a) Disconnect the C5 meter connector.
(b) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
28 – 16	Below 20 MΩ

NG → **REPLACE COMBINATION METER ASSY (See Pub. No. S1–YXZE05A, page 71–1)**

OK

3 CHECK BRAKE WARNING LAMP

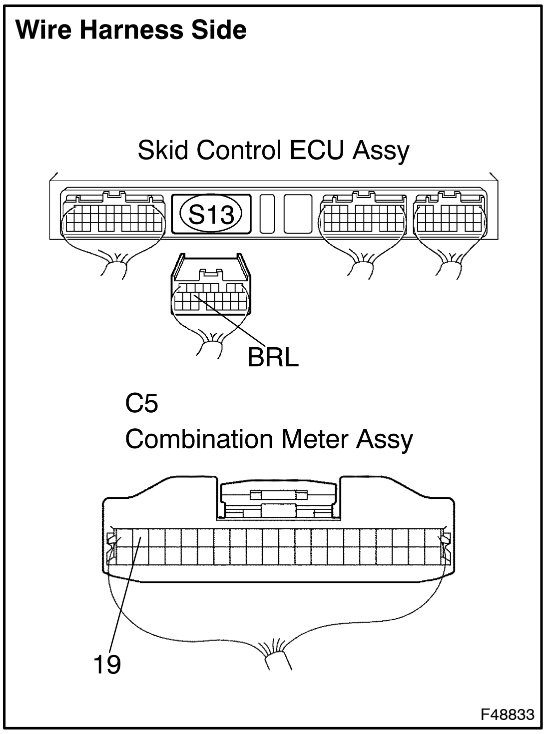


(a) Remove the skid control ECU but do not disconnect the connectors.
(b) Using a service wire, connect terminals BRL (S13–14) and GND (S11–14, 15, S14–2, 3) of the skid control ECU.
(c) Turn the ignition switch ON.
(d) Check that the brake warning lamp.
OK: Brake warning lamp turns ON.

OK → **REPLACE SKID CONTROL ECU ASSY (See page 01–27)**

NG ↓

4 CHECK WIRE HARNESS (SKID CONTROL ECU ASSY – COMBINATION METER ASSY)



(a) Disconnect the S13 ECU connector.
(b) Disconnect the C5 meter connector.
(c) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
S13–14 (BRL) – C5–19	Below 1 Ω
S13–14 (BRL) – Body ground	10 kΩ or higher

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

OK ↓

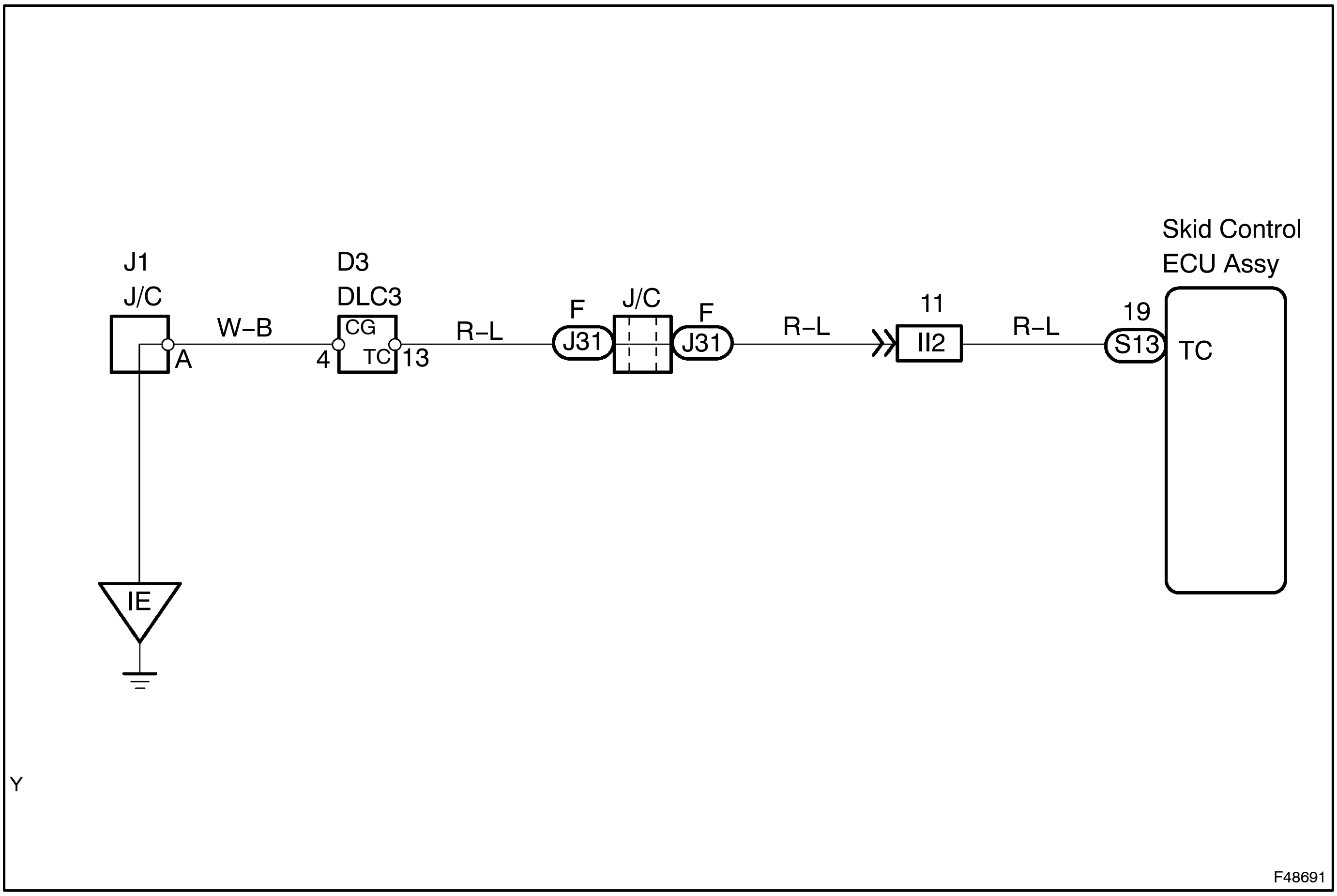
REPLACE COMBINATION METER ASSY (See Pub. No. S1–YXZE05A, page 71–1)

TC TERMINAL CIRCUIT

CIRCUIT DESCRIPTION

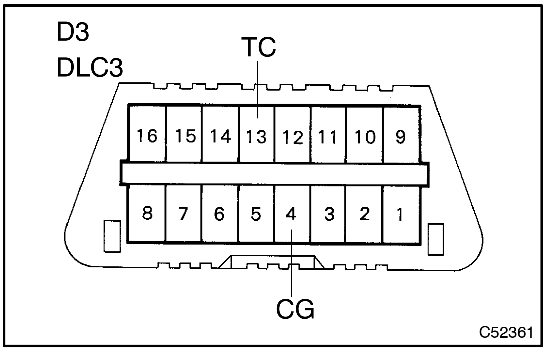
Connecting terminals TC and CG of the DLC3 causes the ECU to output a DTC by flashing the ABS warning lamp.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 CHECK DLC3



(a) Turn the ignition switch ON.
(b) Measure the voltage and resistance according to the table below.

Standard:

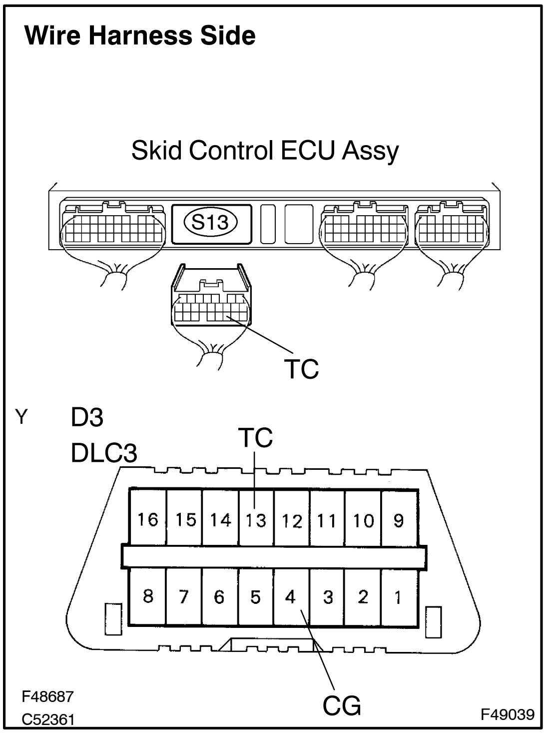
Tester Connection	Specified Condition
D3–13 (TC) – D3–4 (CG)	20 to 28 V
D3–4 (CG) – Body ground	Below 1 Ω

NG → **Go to step 2**

OK

NORMAL

2 CHECK WIRE HARNESS (DLC3 – SKID CONTROL ECU ASSY AND BODY GROUND)



(a) Disconnect the S13 ECU connector.
(b) Measure the resistance according to the table below.

Standard:

Tester Connection	Specified Condition
S13–19 (TC) – D3–13 (TC)	Below 1 Ω
D3–4 (CG) – Body ground	Below 1 Ω
D3–13 (TC) – Body ground	10 kΩ or higher

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

OK

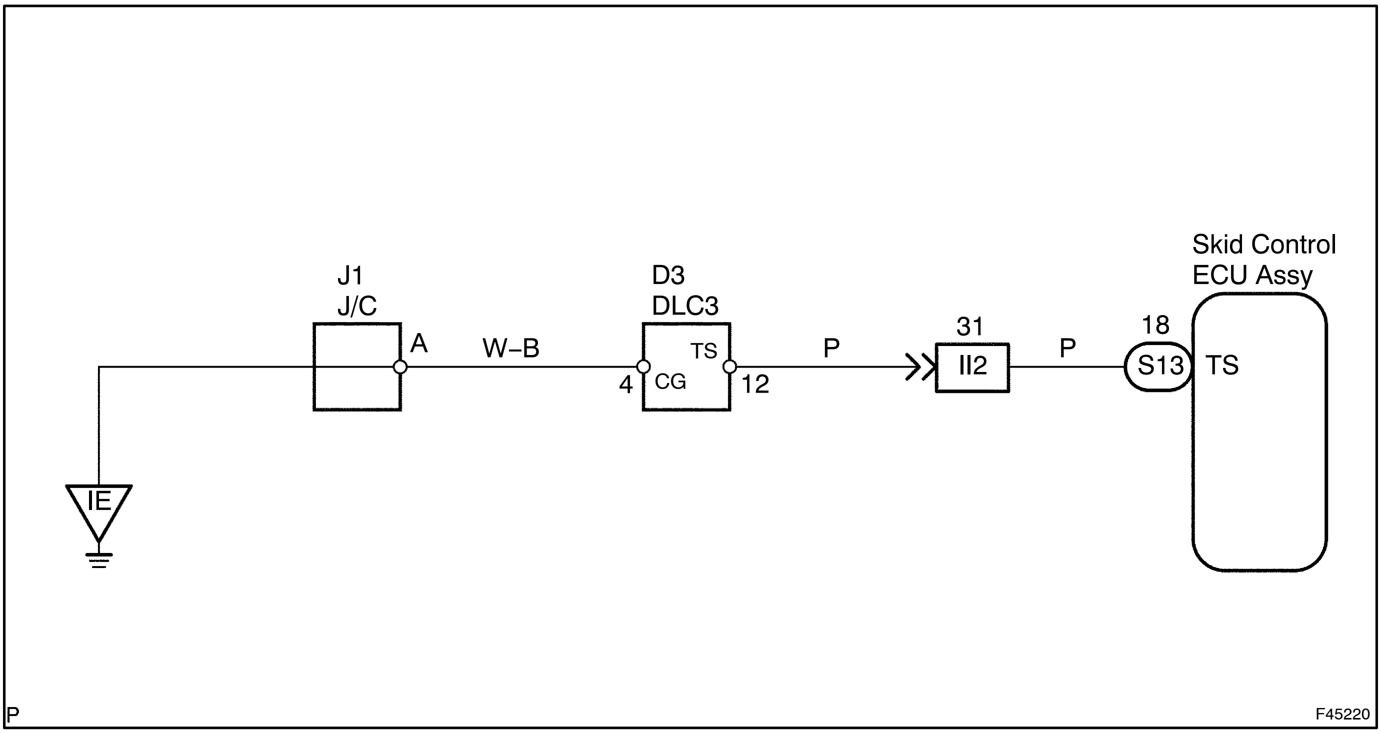
REPLACE SKID CONTROL ECU ASSY (See page 01–27)

TS TERMINAL CIRCUIT

CIRCUIT DESCRIPTION

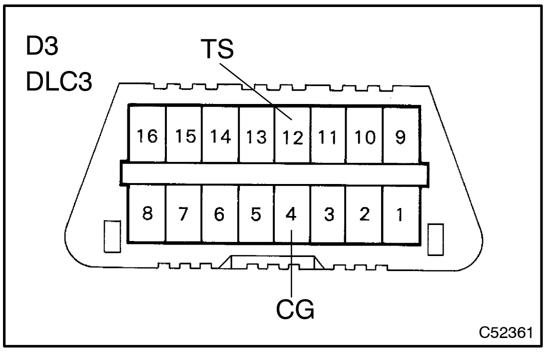
The sensor check circuit detects abnormalities in the speed sensor signal, master cylinder pressure sensor signal and vacuum sensor signal. These abnormalities cannot be detected with the DTC check.
Switching to the sensor check mode can be performed by connecting terminals TS and CG of the DLC3 and turning the ignition switch from OFF to ON.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT DLC3



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage and resistance according to the table below.
Standard:

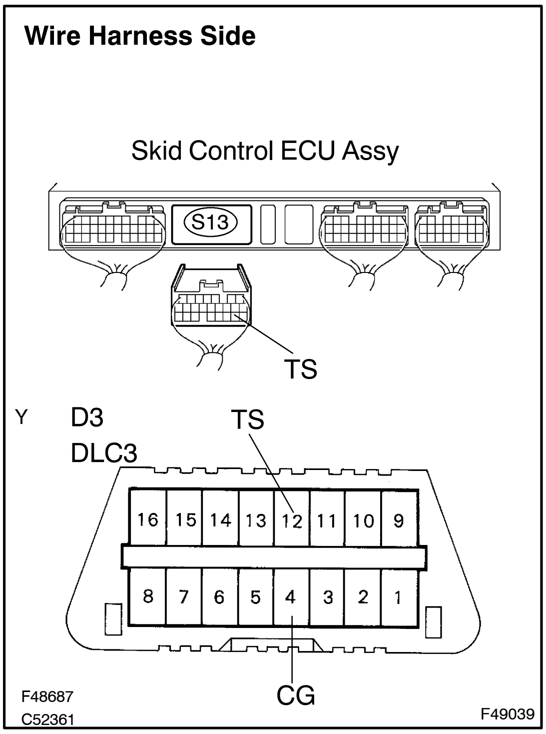
Tester Connection	Specified Condition
D3–12 (TS) – D3–4 (CG)	20 to 28 V
D3–4 (CG) – Body ground	Below 1 Ω

NG → **Go to step 2**

OK

NORMAL

2 CHECK WIRE HARNESS (DLC3 – SKID CONTROL ECU ASSY AND BODY-GROUND)



(a) Disconnect the S13 ECU connector.
(b) Measure the resistance according to the table below.
Standard:

Tester Connection	Specified Condition
S13–18 (TS) – D3–12 (TS)	Below 1 Ω
D3–4 (CG) – Body ground	Below 1 Ω
D3–12 (TS) – Body ground	10 kΩ or higher

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

OK

REPLACE SKID CONTROL ECU ASSY (See page 01–27)

EASY & SMOOTH STARTING SYSTEM (N04C–TF)

05BBF–02

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:
- Use this procedure to troubleshoot the easy & smooth starting system (ES starting system).
- The hand–held tester should be used in steps 3, 6 and 8.

1	**VEHICLE BROUGHT TO WORKSHOP**

2	**CUSTOMER PROBLEM ANALYSIS CHECK AND PROBLEM SYMPTOM CHECK (See page 05–267)**

3	**CHECK AND CLEAR DTCS (See page 05–268)**

4	**PROBLEM SYMPTOM CONFIRMATION**

(a) If the symptom does not occur, proceed to A.
(b) If the symptom occurs, proceed to B.

B → **Go to step 6**

A

5	**SYMPTOM SIMULATION (See page 01–17)**

6	**CHECK FOR DTC**

(a) Check for DTCs and note any codes that are output.
(b) Clear the DTC.
(c) Recheck for DTCs. Based on the DTC output in (a), try to force output of the ABS & BA system or ES starting system DTC by simulating the operation indicated by the DTC.
 (1) If the DTC does not reoccur, proceed to A.
 (2) If the ABS & BA system DTC reoccurs, proceed to B.
 (3) If the ES starting system DTC reoccurs, proceed to C.

B → **Go to ABS & BA SYSTEM (See page 05–191)**

C → **Go to step 9**

A

7	PROBLEM SYMPTOMS TABLE (See page 05–280)

(a) If the fault is not listed on the problem symptoms table, proceed to A.
(b) If the fault is listed on the problem symptoms table, proceed to B.

B → **Go to step 9**

A

8	OVERALL ANALYSIS AND TROUBLESHOOTING

(a) PRE–CHECK (see page 05–268)
 (1) Inspection with hand–held tester (DATA LIST)
 (2) Inspection with hand–held tester (ACTIVE TEST)
(b) Terminals of ECU (see page 05–278)

9	ADJUST, REPAIR OR REPLACE

10	CONFIRMATION TEST

END

05BBG–02

CUSTOMER PROBLEM ANALYSIS CHECK

EASY & SMOOTH STARTING SYSTEM Check Sheet

Inspector's name :

Customer's Name		**VIN**	
		Production Date	/ /
		License Plate No.	
Date Vehicle Brought in	/ /	**Odometer Reading**	km miles

Date Problem First Occurred		/ /
Frequency Problem Occurs		☐ Constant ☐ Intermittent (times a day) ☐ Only once
Weather Conditions When Problem Occurred	**Weather**	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Others
	Outdoor Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (Approx. °C (°F)
Symptoms	☐ ES starting system does not operate	
	☐ ES starting system does not operate efficiently	
	☐ Brake pressure increase function does not operate	
	ES Start Indicator Lamp Abnormal	☐ Remains ON ☐ Does not turn ON
DTC Check	**1st Time**	☐ Normal Code ☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code ☐ Malfunction Code (Code)

05KYP–01

PRE–CHECK

1. SELF–CHECK

(a) Turn the ignition switch ON.

(b) Check the buzzer and ES start indicator lamp on the combination meter.

OK: The buzzer emits a beep and the ES start indicator lamp turns on for 3 seconds.

NOTICE:

- **If only the ES start indicator lamp turns on, perform the clutch stroke sensor adjustment or cancel position initial setting.**
- **If the ES start indicator lamp flashes and the buzzer emits beeps repeatedly, the switch or sensor may have a malfunction. Check for DTCs.**
- **As long as no inspection method is specified, be sure to turn the ignition switch and systems OFF before removing/installing ECUs, actuators and sensors *.**
- **Be careful with the following as the systems are off:**
- **Turn the ignition switch OFF and wait for 10 seconds. Then, disconnect the connectors.**
- **Turning the ignition switch OFF while the ES starting system is operating causes the buzzer to sound for 30 seconds. When 10 seconds have passed after the buzzer stops sounding, disconnect the connectors.**
- **If the ES main switch is malfunctioning, the ES start indicator lamp will blink and the buzzer will sound even if the main switch is OFF.**

HINT:

*: Even after the ignition switch is turned OFF, systems may be operating due to power supplied from +B circuit.

2. OPERATION CHECK

CAUTION:

When checking the vehicle, be careful of the following:

- **The vehicle may jump out.**
- **The vehicle may move backwards on a slope.**

(a) Turn the ignition switch to the START position, release the parking break, and then turn the ES start main switch ON.

(b) Depress the break pedal for 1 second at the vehicle speed of 0 km/h (0 mph). Check that the buzzer emits a beep, the ES start indicator lamp turns on and the ES starting system is activated.

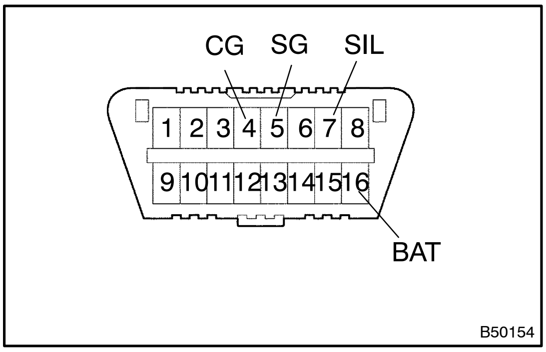
(c) Check that the brake is applied.

(d) Perform the normal starting operation (the gear is engaged and clutch is connected), and check that the ES starting system is canceled.

3. DIAGNOSIS SYSTEM

(a) Description

(1) The ECU controls the vehicle's easy & smooth starting system (ES starting system) functions. ES starting system data and the Diagnostic Trouble Code (DTCs) can be read through the vehicle's Data Link Connector 3 (DLC3) or ABS warning lamp. When the system seems to be malfunctioning, use the hand–held tester or SST check wire to check for malfunctions and perform repairs.

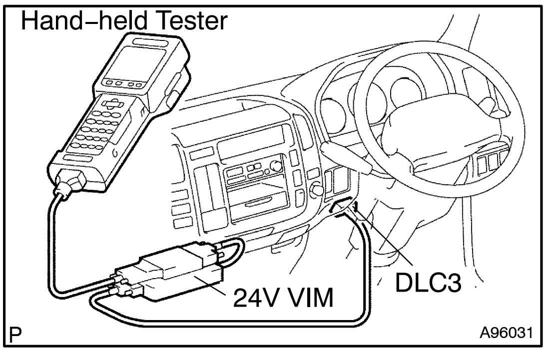


(b) Inspect the DLC3.

The vehicle uses the ISO 15765–4 communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031–03 and matches the ISO 15765–4 format.

Symbols	Terminal No.	Name	Reference Terminal	Result	Condition
SIL	7	Bus "+" line	5 – Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	20 to 28 V	Always

If the result is not as specified, the DLC3 may have a malfunction. Repair or replace the harness and connector.



HINT:

Connect the cable of the hand–held tester (with 24V VIM) to the DLC3, turn the ignition switch ON and attempt to use the tester. If the screen displays UNABLE TO CONNECT TO VEHICLE, a problem exists on the vehicle side or the tester side.

- If communication is normal when the tester is connected to another vehicle, inspect the DLC3 of the original vehicle.
- If communication is still impossible when the tester is connected to another vehicle, the problem may be in the tester itself. Consult the Service Department listed in the tester's instruction manual.

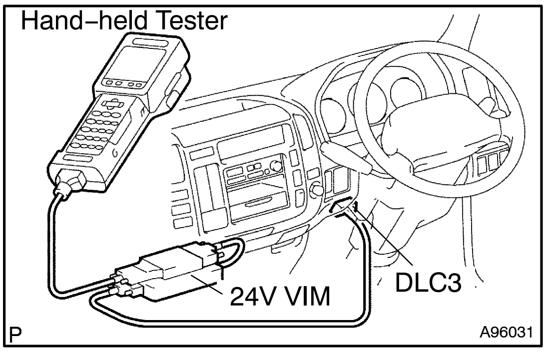
NOTICE:

Be sure to use the 24V VIM, because the hand–held tester will be damaged if you do not use 24V VIM.

(c) Measure the battery voltage.

Standard: 20 to 28 V

If the voltage is below 20 V, replace the battery before proceeding.



4. DTC CHECK/CLEAR (USING HAND–HELD TESTER)

(a) Check the DTC.

(1) Connect the hand–held tester (with 24V VIM) to the DLC3.

(2) Turn the ignition switch ON.

(3) Read the DTCs on the tester's screen.

HINT:

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

(b) Clear the DTC.

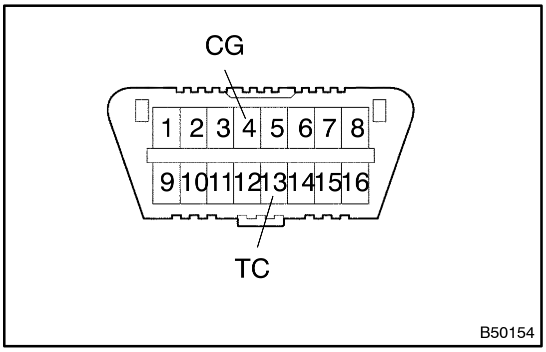
(1) Connect the hand–held tester to the DLC3.

(2) Turn the ignition switch ON.

(3) Erase the DTCs by following the directions on the tester's screen.

HINT:

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



5. DTC CHECK/CLEAR (USING SST CHECK WIRE)

(a) Check the DTC.

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

SST 09843–18040

(2) Turn the ignition switch ON.

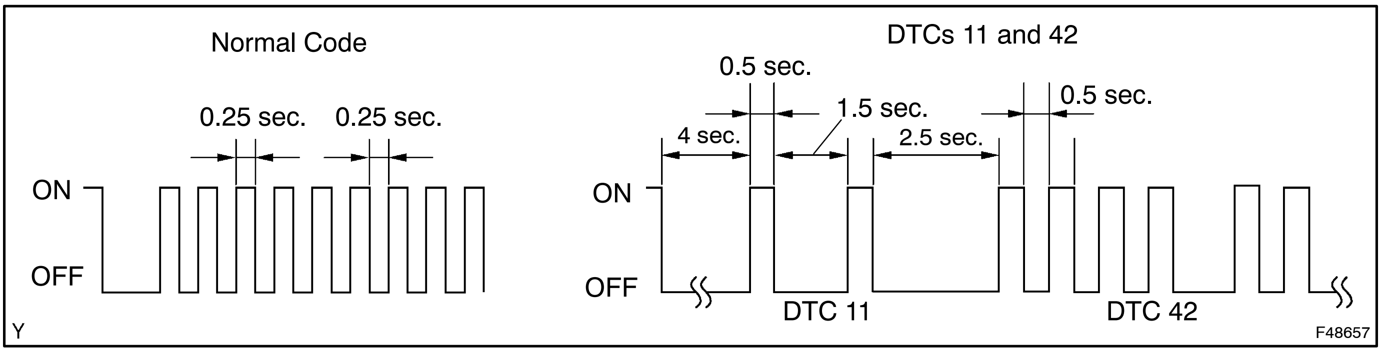
(3) Read the DTC from the ABS warning lamp on the combination meter.

HINT:

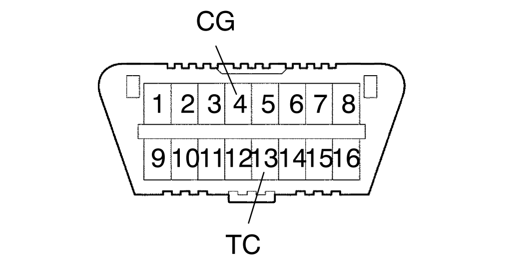
- If 2 or more malfunctions are detected at the same time, the lowest numbered code will be displayed first.
- If no code appears, inspect the diagnostic circuit and the ABS warning lamp circuit.

Trouble Area	See Page
TC and CG terminal circuit	05–261
ABS warning lamp	05–250

- As an example, the blinking patterns for a normal system code, DTCs 11 and 42 are shown on the illustration below.

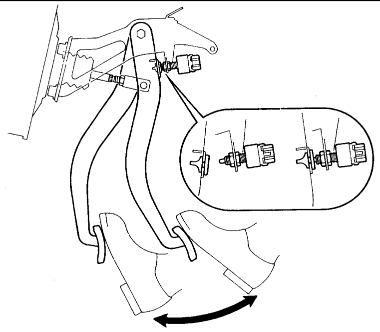


(1) Codes are explained in the code table on page 05–276.
(2) After completing the check, disconnect terminals TC and CG of the DLC3, and turn off the display.



B50154

(b) Clear the DTC.
(1) Using SST, connect terminals TC and CG of the DLC3.
SST 09843–18040
(2) Turn the ignition switch ON.


BR3890

(3) Clear the DTCs stored in the ECU by depressing the brake pedal 8 or more times within 5 seconds.
(4) Check that the ABS warning lamp shows the blinking pattern for the normal code.
(5) Remove the SST from the DLC3.
SST 09843–18040

6. WARNING FUNCTIONS CHECK

(a) If a malfunction occurs, the type of malfunction is communicated through flashing indicator lamps and buzzer beeps.
(b) If a malfunction is present, troubleshoot according to the DTC.

Indicator Lamp	Buzzer	Type	Warning Contents	Countermeasures
Flashing	No signal	Unperformed adjustment warning	Initial settings have not been performed	Execute initial settings
Flashing	Beeps	Trouble warning	Switch or sensor trouble	• Deactivate ES starting system by moving operation cancel switch to the cancel position • Troubleshoot according to DTC
ON	Beeps	Driver's seat vacant warning	Door is opened while ES start system is activated	Securely engage parking brake
ON	Beeps	Ignition switch OFF warning	Ignition switch is turned off with the shift lever in neutral position while ES starting system is activated	Securely engage parking brake

Indicator Lamp	Buzzer	Type	Warning Contents	Countermeasures
ON	Beeps	Vehicle moving warning	vehicle moves when shift lever is in neutral position while ES starting system is activated	• Securely engage parking brake • Increase foot pressure applied to brake pedal
ON	Elapsed time signal	Operating time information	ES start operating time is announced every minute After 1 minute: 1 beep After 2 minutes: 2 beeps After 10 minutes and thereafter: series of beeps repeated 5 times	• Securely engage parking brake • Increase foot pressure applied to brake pedal (alarm is reset after foot pressure is applied, and the operating time will be counted from the beginning again)

7. CANCEL TIMING ADJUSTMENT

HINT:

If the cancel timing is fast or slow (the brakes are dragged or the vehicle moves backward), the driver can adjust it by himself.

(a) Engine start and then turn the ES start main switch ON.

(b) Press either the FAST or SLOW of the ES start timing switch for at least 0.5 seconds.

(c) If the brakes are dragged, press FAST to advance the cancel timing. If the vehicle moves backwards, press SLOW to retard the cancel timing.

(d) The adjustment setting has 8 levels to FAST side and 5 levels to SLOW side. The adjustment settings are indicated by buzzer signals shown in the table below.

Adjustment Setting	Buzzer Signal
Intermediate setting	Long beep
Slow setting	Short beep
Fast setting	2 short beeps

NOTICE:

Cancel timing adjustment mode cannot be activated under the following conditions: if a malfunction is detected by the self–diagnosis function, if the vehicle speed is 5 km/h (3.1 mph) or more, if the ES start switch is OFF, or if the alarm is activated.

8. CANCEL POSITION INITIAL SETTING

HINT:

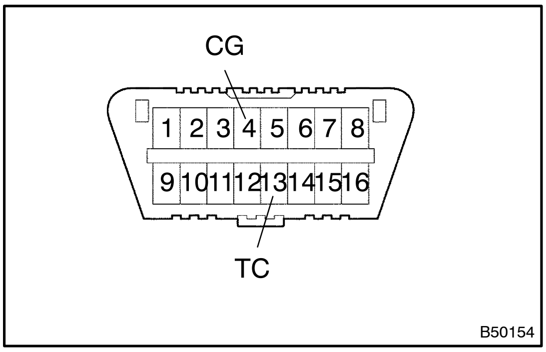
If the ES starting system cannot be canceled, preform the cancel position initial setting.

NOTICE:

- **The clutch pedal play must first be properly adjusted before setting the initial cancel position.**
- **Operating the ES starting system without adjusting the clutch pedal play may result in premature wear of brakes and clutch, or it may cause the vehicle to move on a downhill grade.**

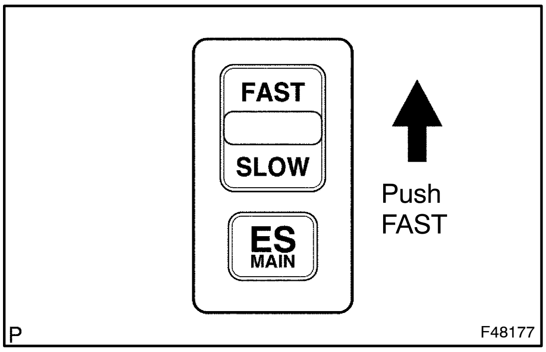
(a) Turn the ignition switch ON.

(b) Turn the ES start main switch ON and start the engine with the parking brake applied.



(c) Using SST, connect terminals TC and CG of the DLC3.
SST 09843–18040

(d) Disengage the clutch. Move the shift lever into the 2nd gear.



(e) Press FAST of the ES start timing switch for 3 seconds.

HINT:

The buzzer will emit a long beep and the indicator lamp will flash at the same time.

(f) Depress the clutch pedal.

(g) Move the shift lever into the 2nd gear and slowly engage the clutch.

(h) The engine speed will drop slightly and then be restored after about 1 second. When this happens, press FAST of the ES start timing switch again.

HINT:

The buzzer will emit 4 short beeps and the indicator lamp will turn off.

(i) Remove the SST from the terminals of the DLC3 and turn the ignition switch OFF to exit from the initial setting mode.

(j) After setting the cancel position, operate the ES starting system and make sure that the cancel position is suitable.

NOTICE:

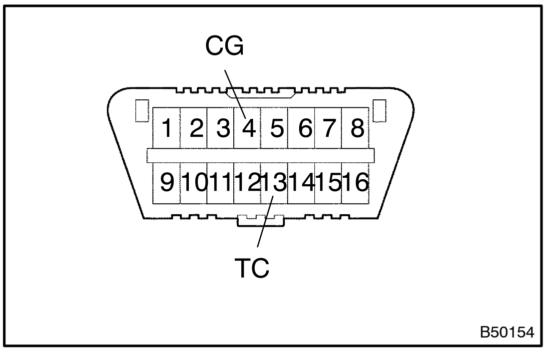
Initial setting mode cannot be activated when any of the following conditions is met: if a malfunction is detected by the self–diagnosis function, if the vehicle speed is 0.5 km/h (0.3 mph) or more, the ES starting system is in operation, if the parking brake is not applied, or if terminals TC and CG of the DLC3 are not connected.

9. CLUTCH STROKE SENSOR ADJUSTMENT

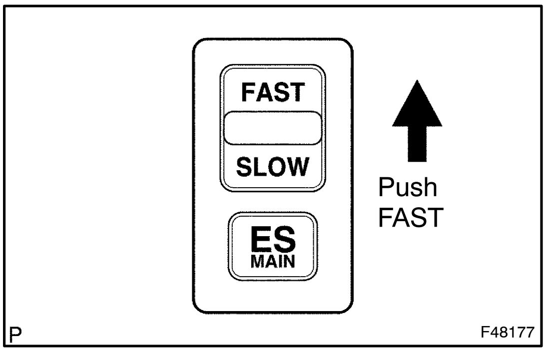
NOTICE:

Adjust the clutch stroke sensor after replacing the sensor.

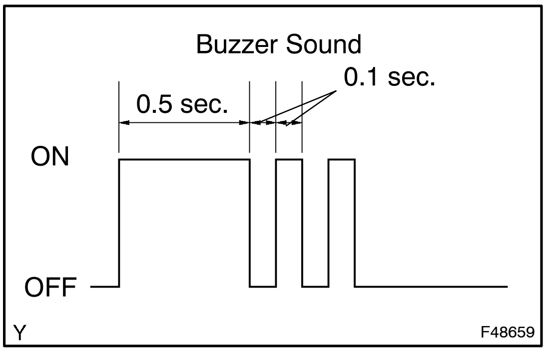
(a) Turn the ES start main switch OFF and turn the ignition switch ON with the parking brake applied.



(b) Using SST, connect terminals TC and CG of the DLC3.
SST 09843–18040



(c) Press FAST of the ES start timing switch once.



HINT:
The buzzer sounds.

(d) Remove the SST from the terminals of the DLC3 and turn the ignition switch OFF to exit from the stroke sensor position adjustment mode.

HINT:
- If the buzzer emits a beep, the clutch stroke sensor adjustment has failed to be set. In this case, inspect the clutch stroke sensor circuit (see page 05–281).
- If the buzzer does not sound, inspect the circuits listed below:
  TC terminal circuit (see page 05–261)
  Parking brake switch circuit (see page 05–309)
  Tachometer circuit (see page 05–295)
  ES start switch circuit (see page 05–288)
  ES buzzer circuit (see page 05–306)
  Clutch stroke sensor circuit (see page 05–281)

NOTICE:
- **Always set the initial cancel position after adjusting the clutch stroke sensor position.**
- **The stroke sensor position cannot be adjusted if the vehicle speed is 0.5 km/h (0.3 mph) or more and the ES starting system is in operation, or if terminals TC and CG of the DLC3 are not connected.**

10. DATA LIST

HINT:
Using the hand–held tester's DATA LIST allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the DATA LIST early in troubleshooting is one way to shorten labor time.

(a) Connect the hand–held tester (with 24V VIM) to the DLC3.
(b) Turn the ignition switch ON.
(c) Read the DATA LIST according to the display on the tester.
Skid control ECU:

Item	Measurement Item/ Display (Range)	Normal Condition	Diagnostic Note
ES WARN LIGHT	ES start indicator lamp/ ON or OFF	ON: ES start indicator lamp ON OFF: ES start indicator lamp OFF	–
DOOR SW	Door switch/ ON or OFF	ON: Door open OFF: Door closed	–

Item	Measurement Item/ Display (Range)	Normal Condition	Diagnostic Note
PKB SW2	Parking brake switch/ ON or OFF	ON: Parking brake pulled OFF: Parking brake not pulled	–
NEUTRAL SW	Neutral Switch/ ON or OFF	ON: Shift position neutral OFF: Shift position except neutral	–
SLOW SW	Timing SLOW switch/ ON or OFF	ON: Timing SLOW switch ON OFF: Timing SLOW switch OFF	–
FAST SW	Timing FAST switch/ ON or OFF	ON: Timing FAST switch ON OFF: Timing FAST switch OFF	–
MAIN SW 1	ES start main switch 1/ ON or OFF	ON: ES start main switch ON OFF: ES start main switch OFF	–
MAIN SW 2	ES start main switch 2/ ON or OFF	ON: ES start main switch ON OFF: ES start main switch OFF	–
RELEASE LRN	Learning value of cancel position setting/ min. 0, max. 5	Learning value of cancel position setting	–
RELEASE INI	Initial value of cancel position setting/ min. 0, max. 5	Initial value of cancel position setting	–
CLUTCH LRN	Learning value of clutch stroke sensor adjustment/ min. 0, max. 5	Learning value of clutch stroke sensor adjustment	–
ES NUMBER	Number times of ES operation/ min. 0, max. 100	Times of ES operation number	–
OIL PRESS LRN	Learning value of oil pressure/ min. 0, max. 5	Learning value of oil pressure	–
CLUTCH STROKE	Clutch stroke sensor/ min. 0, max. 5	Clutch stroke sensor	–
ES VEHICLE SPD	Vehicle speed calculated by ES starting system/ min. 0, max. 204.6 (km/h)	Vehicle speed calculated by ES starting system	–

11. ACTIVE TEST

HINT:

Performing the hand–held tester's ACTIVE TEST allows relay, VSV, actuator, and other times to be operated without removing any parts. Performing the ACTIVE TEST early in troubleshooting is one way to shorten labor time. The DATA LIST can be displayed during the ACTIVE TEST.

(a) Connect the hand–held tester (with 24V VIM) to the DLC3.

(b) Turn the ignition switch ON.

(c) Perform the ACTIVE TEST according to the display on the tester.

Skid control ECU:

Item	Normal Condition	Diagnostic Note
ES LIGHT	ES start light ON/OFF	–
ES BUZZER	ES start buzzer ON/OFF	–

05BBI–02

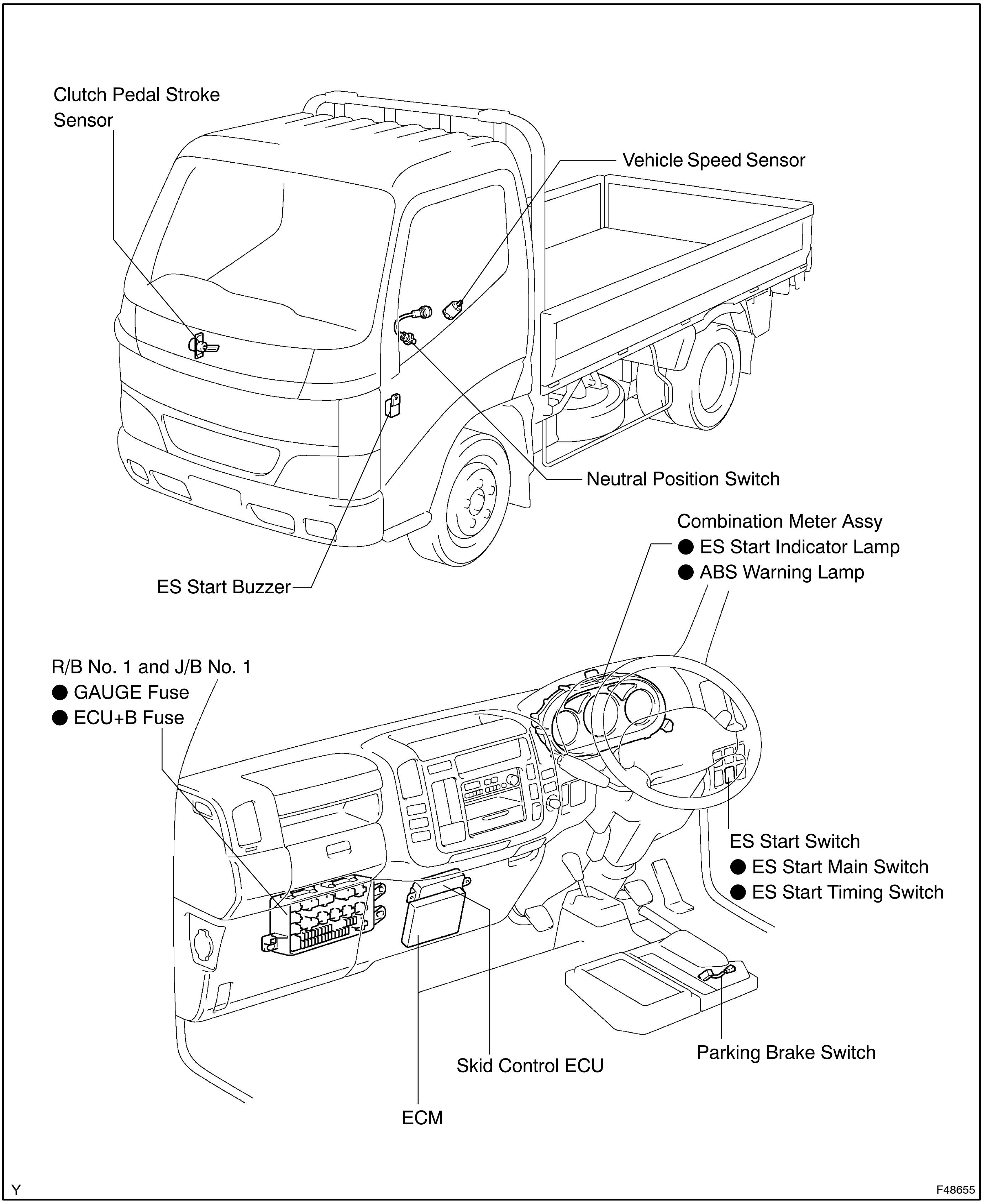
DIAGNOSTIC TROUBLE CODE CHART

HINT:
If a malfunction code is displayed during the DTC check, check the circuit indicated by the DTC.
For details of each code, see the page for the respective "DTC No." in the DTC chart.

DTC No. (See Page)	Detection Item	Trouble Area
C1382/112 (05–281)	Malfunction in Clutch Stroke Sensor	• Clutch pedal stroke sensor • Skid control ECU • Wire harness
C1383/111 (05–284)	Malfunction in Vehicle Speed Sensor	• Vehicle speed sensor • Skid control ECU • Wire harness
C1384/113 (05–286)	Malfunction in Neutral Switch	• Neutral position switch • Skid control ECU • Wire harness
C1386/116 (05–288)	Malfunction in ES Starting Operation/Release Switch	• ES start switch • Skid control ECU • Wire harness
C1387/115 (05–291)	Malfunction in ES Starting Release Timing Switch	• ES start switch • Skid control ECU • Wire harness
C1388/117 (05–294)	Malfunction in ES Starting Initialization	Skid control ECU
C1389/118 (05–295)	Malfunction in Tachometer Sensor	• ECM • Skid control ECU • Combination meter • Wire harness
C1390/42 (05–298)	Malfunction in Battery Power Supply Voltage	• ECU+B fuse • Skid control ECU • Wire harness

05KYI–01

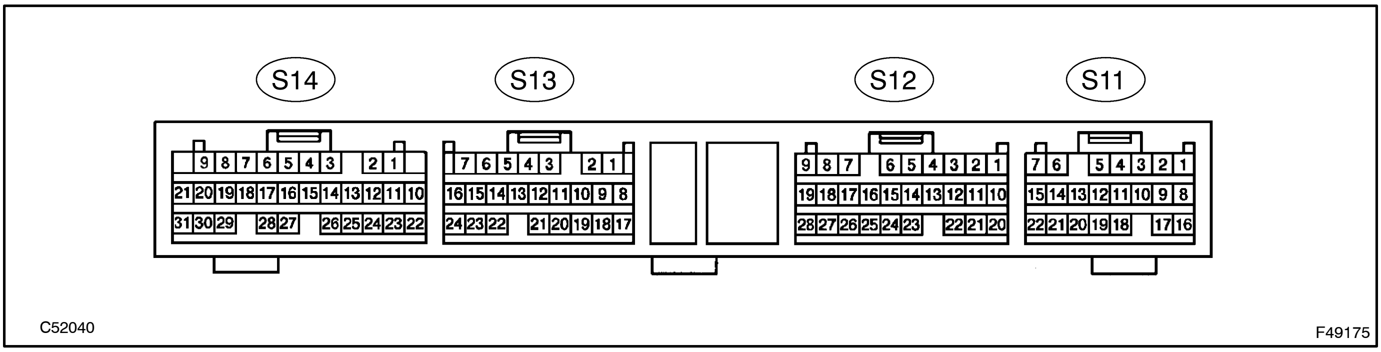
LOCATION



05BBK–02

TERMINALS OF ECU

1. CHECK SKID CONTROL ECU



(a) Disconnect the S11, S12, S13 and S14 ECU connectors.

(b) Measure the voltage and resistance of each terminal of the wire harness side connectors.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
N (S11–12) – Body ground	B–W – Body ground	Neutral switch signal	Shift lever position N → Except N	10 kΩ or higher → Below 1 Ω
GND4 (S11–14) – Body ground	W–B – Body ground	Ground	Always	Below 1 Ω
GND3 (S11–15) – Body ground	W–B – Body ground	Ground	Always	Below 1 Ω
DOOR (S12–2) – Body ground	L–O – Body ground	Courtesy switch	Door closed → open	10 kΩ or higher → Below 1 Ω
S/OFF (S12–3) – Body ground	L–R – Body ground	ES start main switch	ES start main switch ON → OFF	0 V → 20 to 28 V
S/MAIN (S12–4) – Body ground	R–W – Body ground	ES start main switch	ES start main switch OFF → ON	Less than 2 V → 20 to 28 V
FAST (S12–5) – Body ground	G–W – Body ground	Timing FAST switch	Timing FAST switch OFF → FAST (pressed)	Less than 2 V → 20 to 28 V
SLOW (S12–6) – Body ground	P–L – Body ground	Timing SLOW switch	Timing SLOW switch OFF → SLOW (pressed)	Less than 2 V → 20 to 28 V
TACH (S12–7) – Body ground	P – Body ground	Tachometer	Engine start	Pulse generation
VSS (S12–8) – Body ground	B – Body ground	Vehicle speed sensor	Vehicle running	Pulse generation
STP (S13–1) – Body ground	R – Body ground	Stop lamp switch	Brake pedal depressed → Not depressed	Less than 3 V → 20 to 28 V
BAT (S13–3) – Body ground	B–Y – Body ground	Battery	Always	20 to 28 V
IG1 (S13–7) – Body ground	B–R – Body ground	Ignition power supply	Ignition switch OFF → ON	0 V → 20 to 28 V
PKB2 (S13–11) – Body ground	P–G – Body ground	Parking brake switch	Parking brake lever pulled → Not pulled	Less than 2 V → 20 to 28 V
TC (S13–19) – Body ground	R–L – Body ground	Test terminal	Ignition switch OFF → ON	0 V → 20 to 28 V
PKB1 (S13–21) – Body ground	B–Y – Body ground	Parking brake switch	Parking brake lever pulled → Not pulled	Below 1 Ω → 10 kΩ or higher
GND1 (S14–2) – Body ground	W–B – Body ground	Ground	Always	Below 1 Ω
GND2 (S14–3) – Body ground	W–B – Body ground	Ground	Always	Below 1 Ω
CL (S14–16) – Body ground	W–L – Body ground	Clutch stroke sensor ground	Always	Below 1 Ω

If the result is not as specified, there may be a malfunction on the wire harness side.

(c) Reconnect the S11, S12, S13 and S14 ECU connectors.

(d) Measure the voltage of each terminal of the connectors.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
WL (S13–2) – Body ground	LG–R – Body ground	ES start indicator lamp	ES start indicator lamp trurn ON → OFF	Less than 2 V → 20 to 32 V
BZ (S13–5) – Body ground	L–Y – Body ground	ES start buzzer	Ignition switch ON, ES start buzzer sound → Not sound	20 to 32 V → Less than 2 V
CL+ (S14–4) – Body ground	L – W–L	Clutch stroke sensor power supply	Ignition switch OFF → ON	3 to 5 V
CLS (S14–15) – Body ground	L–R – W–L	Clutch stroke sensor	Ignition switch ON, clutch pedal depressed → Not depressed	Less than 2 V → More than 2 V

If the result is not as specified, the ECU may have a malfunction.

05BBL–02

PROBLEM SYMPTOMS TABLE

Symptom	Suspected Area	See Page
ES starting system does not operate	1. ES start switch 2. Parking brake switch 3. Skid control ECU 4. Power source circuit 5. Vehicle speed sensor 6. Wire harness	05–301 05–301 05–301 05–301 05–301
ES buzzer does not sound	1. ES start buzzer 2. Skid control ECU 3. Wire harness	05–306 05–306

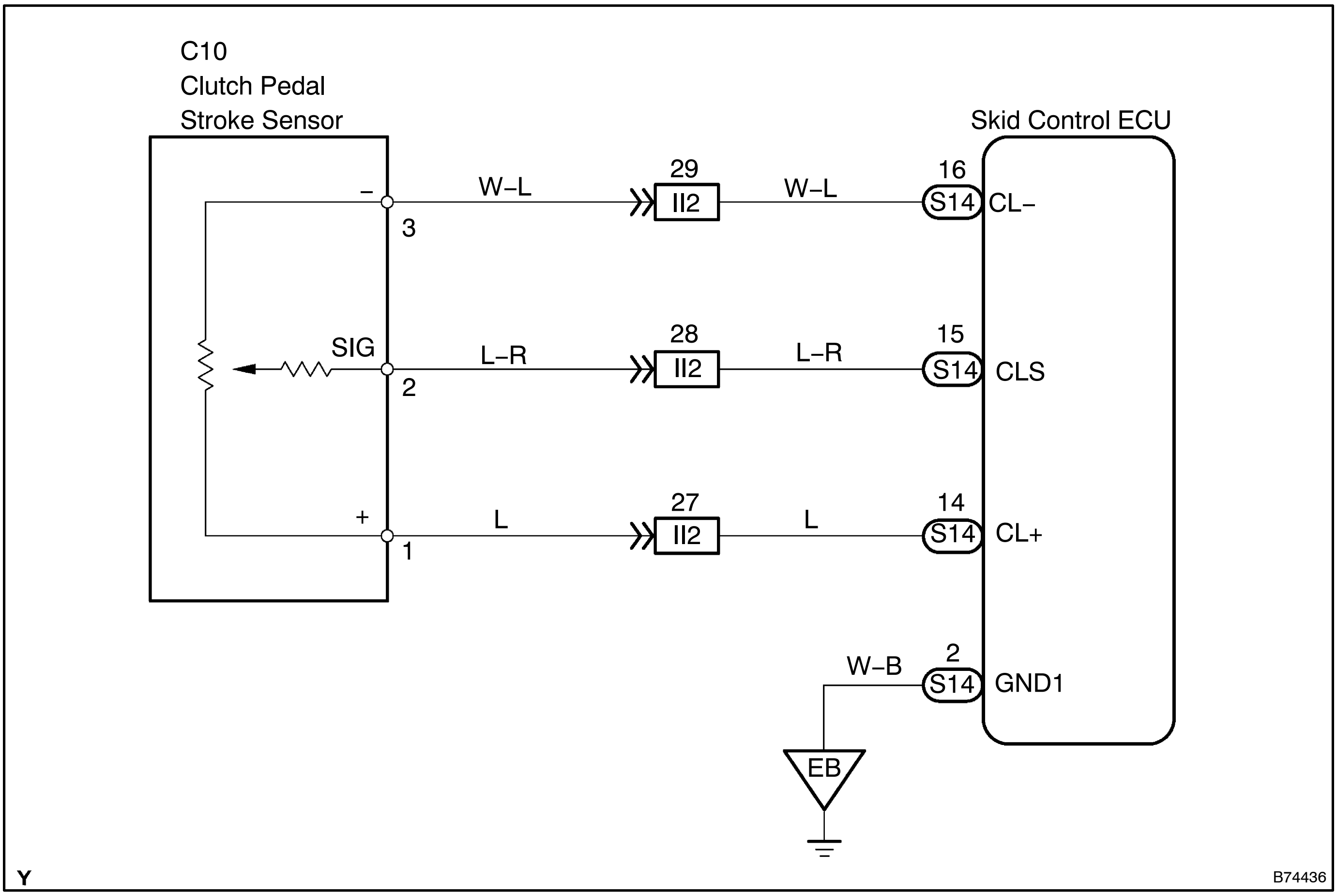
DTC	C1382/112	MALFUNCTION IN CLUTCH STROKE SENSOR

CIRCUIT DESCRIPTION

The clutch stroke sensor detects the depressed volume of the clutch pedal and sends signals to the skid control ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1382/112	(a) While vehicle is accelerated to 40 km/h (25 mph) from 0 km/h (0 mph), difference between minimum voltage and maximum voltage of clutch pedal stroke sensor becomes the value below continuously 5 times • Difference ≦ 0.392 x sensor power source voltage (b) Clutch pedal stroke sensor power source voltage is less than 3.2 V for 1 sec. or more (c) Clutch pedal stroke sensor output voltage becomes either of the following for 1 sec. or more: • Output voltage ≧ 0.97 x sensor power source voltage • Output voltage ≦ 0.03 x sensor power source voltage	• Clutch pedal stroke sensor • Skid control ECU • Wire harness

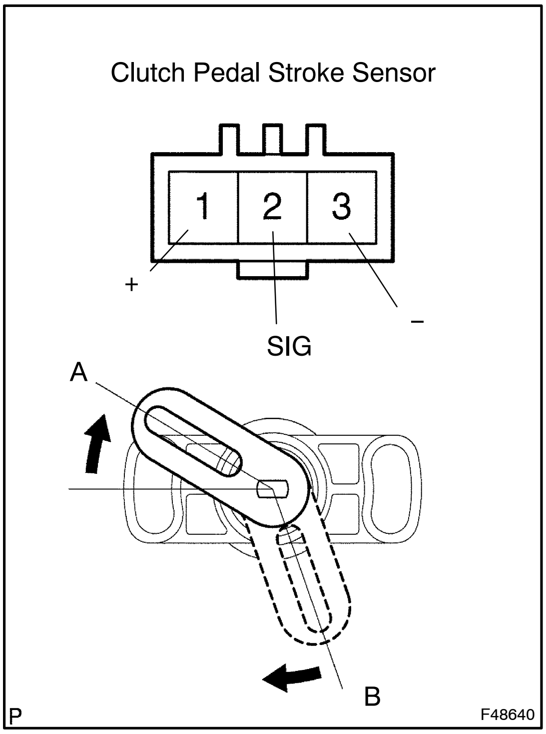
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

1 INSPECT CLUTCH PEDAL STROKE SENSOR



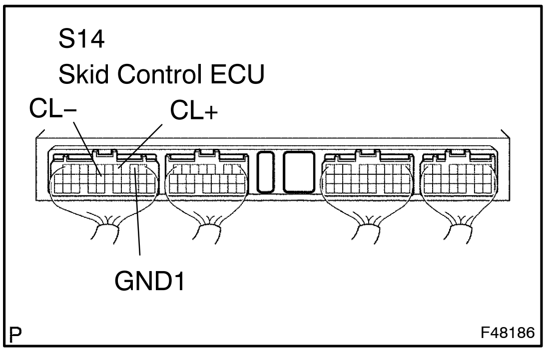
(a) Remove the clutch pedal stroke sensor.
(b) Measure the resistance of the sensor.
Standard:

Tester Connection	Sensor Condition	Specified Condition
C10–1 (+) – C10–3 (–)	Always	1.6 to 2.4 kΩ
C10–1 (+) – C10–2 (SIG)	Position A	0.32 to 0.48 kΩ
C10–1 (+) – C10–2 (SIG)	Position B	1.92 to 2.88 kΩ
C10–1 (+) – C10–2 (SIG)	Arm is moved from A to B	Changing (0.32 to 0.48 kΩ → 1.92 to 2.88 kΩ)

NG → **REPLACE CLUTCH PEDAL STROKE SENSOR**

OK

2 INSPECT SKID CONTROL ECU



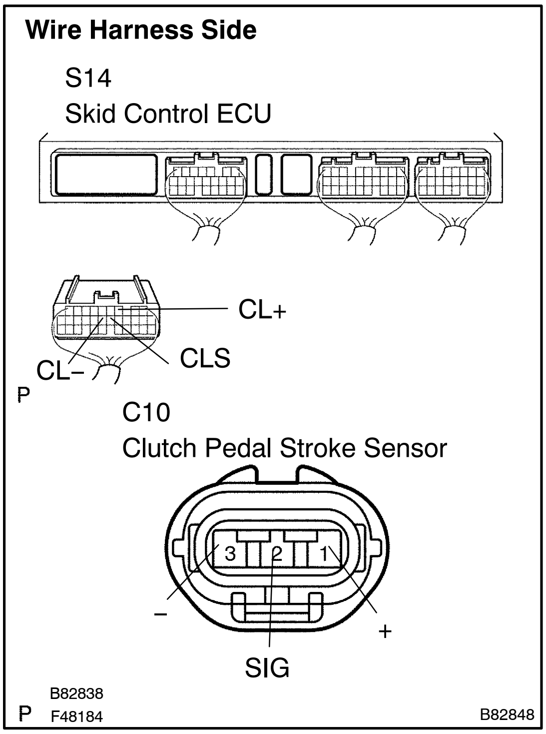
(a) Measure the voltage of the ECU.
Standard:

Tester Connection	Condition	Specified Condition
S14–4 (CL+) – S14–2 (GND1)	Ignition Switch OFF → ON	3 to 5 V
S14–16 (CL–) – S14–2 (GND1)	Always	Below 2 V

NG → **REPLACE SKID CONTROL ECU**

OK

3	CHECK WIRE HARNESS (SKID CONTROL ECU – CLUTCH PEDAL STROKE SENSOR)



(a) Disconnect the S14 ECU connector.
(b) Disconnect the C10 sensor connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
S14–16 (CL–) – C10–3 (–)	Below 1 Ω
S14–16 (CL–) – Body ground	10 kΩ or higher
S14–15 (CLS) – C10–2 (SIG)	Below 1 Ω
S14–15 (CLS) – Body ground	10 kΩ or higher
S14–4 (CL+) – C10–1 (+)	Below 1 Ω
S14–14 (CL+) – Body ground	10 kΩ or higher

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

OK

4	CHECK FOR DTCS

(a) Clear the DTC (see page 05–268).
(b) Drive the vehicle at the vehicle speed of 7 km/h (4 mph) or more.
(c) Check that no code is output.

NG → **REPLACE SKID CONTROL ECU**

OK

END

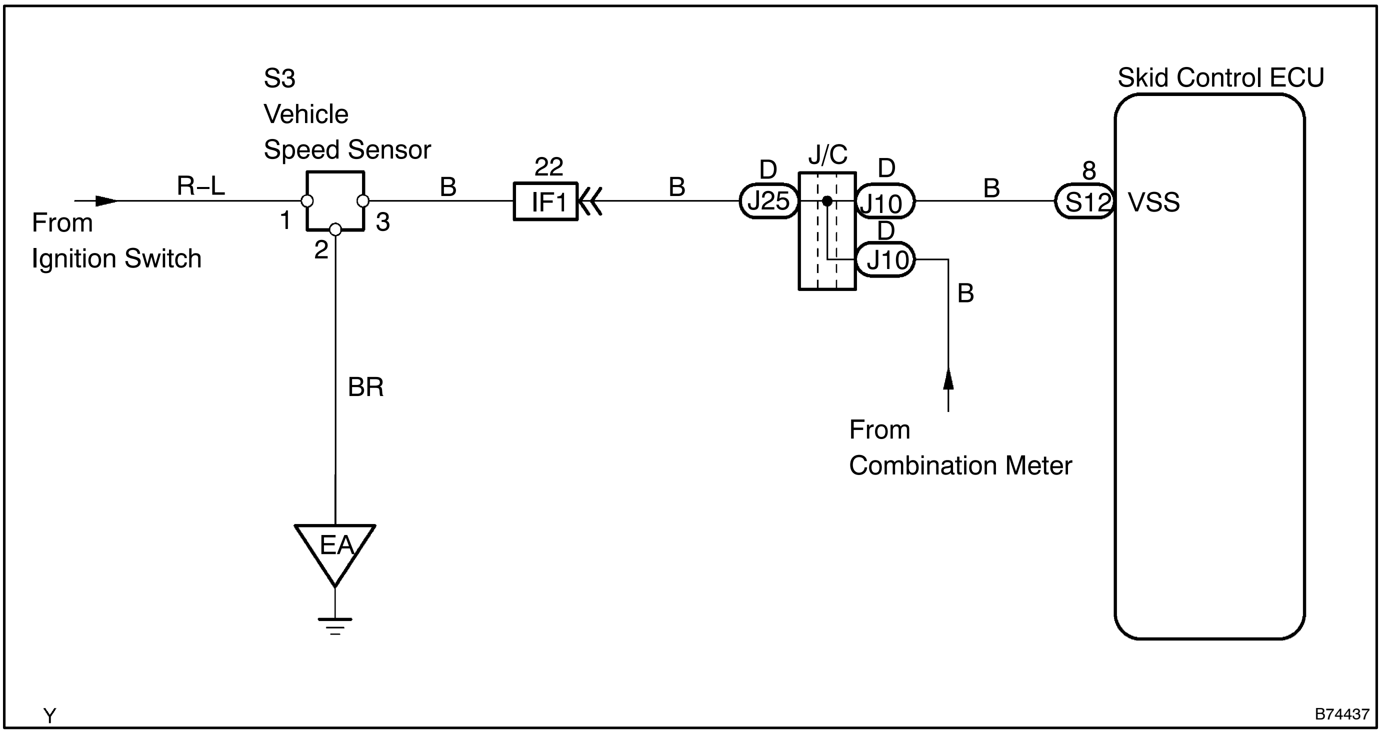
DTC C1383/111 MALFUNCTION IN VEHICLE SPEED SENSOR

CIRCUIT DESCRIPTION

The vehicle speed sensor detects vehicle speed and sends signals to the skid control ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1383/111	All conditions listed below are met and no vehicle speed signal is output for 3 sec. or more: • Engine is running • Parking brake is released • Battery voltage is normal • Vehicle speed is 20 km/h (13 mph) or more	• Vehicle speed sensor • Skid control ECU • Wire harness

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

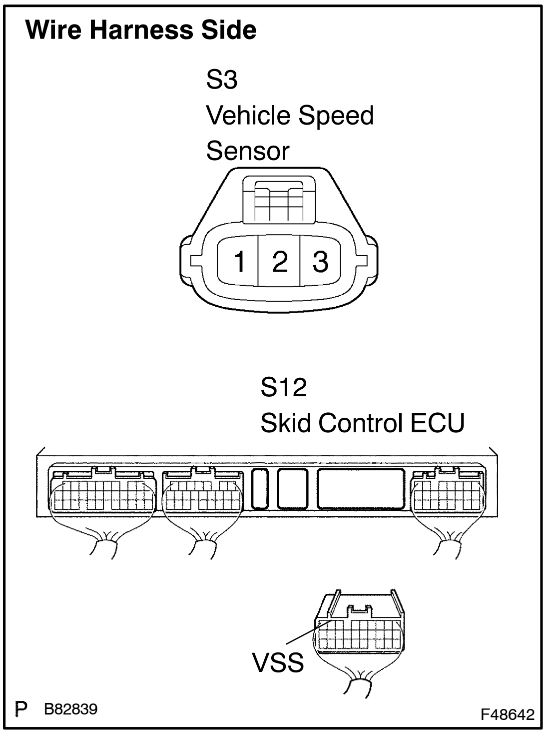
1 CHECK SPEEDOMETER

(a) Check that the speedometer is operating properly while the vehicle is being driven.

NG → **CHECK AND REPLACE COMBINATION METER (See Pub. No. S1–YXZE05A, page 71–2)**

OK

2 CHECK WIRE HARNESS (VEHICLE SPEED SENSOR – SKID CONTROL ECU, BATTERY AND BODY GROUND)



(a) Disconnect the S12 ECU connector.
(b) Disconnect the S3 vehicle speed sensor connector.
(c) Measure the voltage and resistance of the wire harness side connectors.

Standard:

Tester Connection	Condition	Specified Condition
S3–3 – S12–8 (VSS)	Always	Below 1 Ω
S3–1 – Body ground	Ignition switch ON	20 to 28 V
S3–2 – Body ground	Always	Below 1 Ω

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

OK

3 CHECK FOR DTCS

(a) Clear the DTC (see page 05–268).
(b) Drive the vehicle at the vehicle speed of 7 km/h (4 mph) or more.
(c) Check that no code is output.

NG → **REPLACE SKID CONTROL ECU**

OK

END

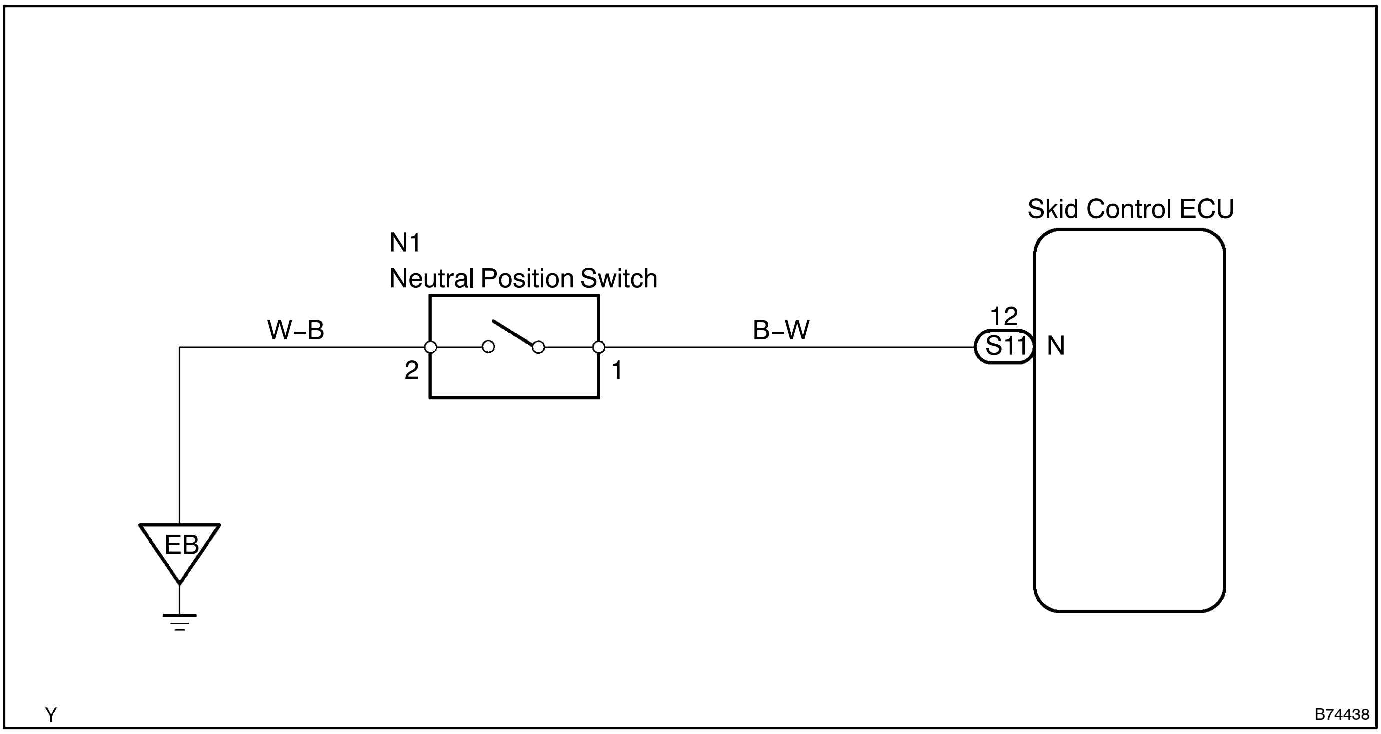
DTC C1384/113 MALFUNCTION IN NEUTRAL SWITCH

CIRCUIT DESCRIPTION

The neutral position switch detects neutral position and sends signals to the skid control ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1384/113	While vehicle is accelerated to 50 km/h (31 mph) from 5 km/h (3 mph), no gear change is detected continuously 5 times by neutral position switch	• Neutral position switch • Skid control ECU • Wire harness

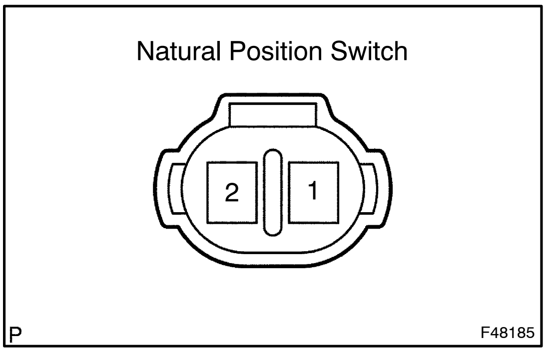
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

1	INSPECT NEUTRAL POSITION SWITCH



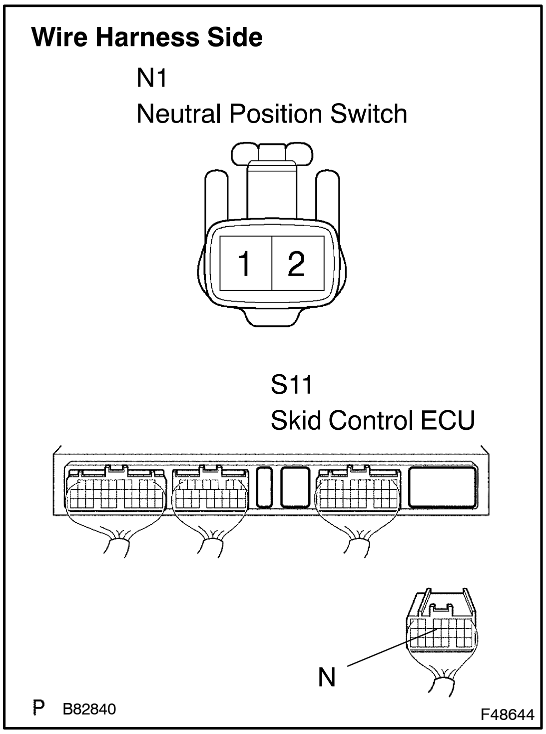
(a) Disconnect the N1 switch connector.
(b) Measure the resistance of the switch.
Standard:

Tester Connection	Condition	Specified Condition
1 – 2	Shift lever position N → Except N	10 kΩ or higher → Below 1 Ω

NG → **REPLACE NEUTRAL POSITION SWITCH**

OK

2 CHECK WIRE HARNESS (NEUTRAL POSITION SWITCH – SKID CONTROL ECU AND BODY GROUND)



(a) Disconnect the N1 switch connector.
(b) Disconnect the S11 ECU connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
N1–1 – S11–12 (N)	Below 1 Ω
N1–2 – Body ground	Below 1 Ω

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

OK

3 CHECK FOR DTCS

(a) Clear the DTC (see page 05–268).
(b) Drive the vehicle at the vehicle speed of 7 km/h (4 mph) or more.
(c) Check that no code is output.

NG → **REPLACE SKID CONTROL ECU**

OK

END

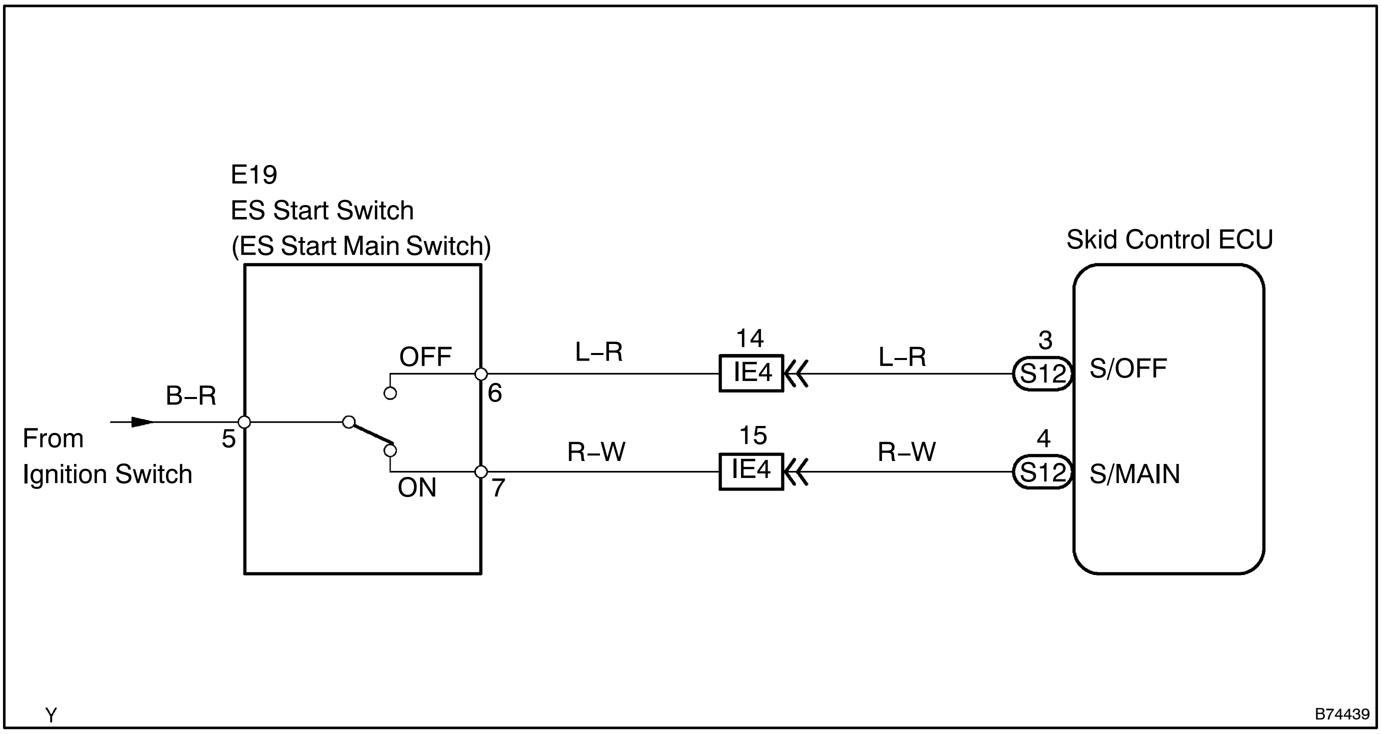
DTC	C1386/116	MALFUNCTION IN ES STARTING OPERATION/RELEASE SWITCH

CIRCUIT DESCRIPTION

The ES start main switch controls the ES starting system. The skid control ECU detects a malfunction in the ES start main switch, based on the conditions of the ON input terminal and the OFF input terminal, which are set from the ES start main switch.

DTC No.	DTC Detection Condition	Trouble Area
C1386/116	Either condition 1 or 2 is detected: 1. S/OFF and S/MAIN terminals are ON for 900 ms 2. S/OFF and S/MAIN terminals are OFF for 5 seconds	• ES start switch • Skid control ECU • Wire harness

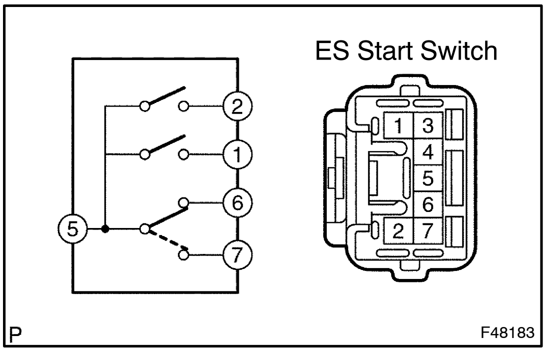
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

1 INSPECT ES START SWITCH (ES START MAIN SWITCH)



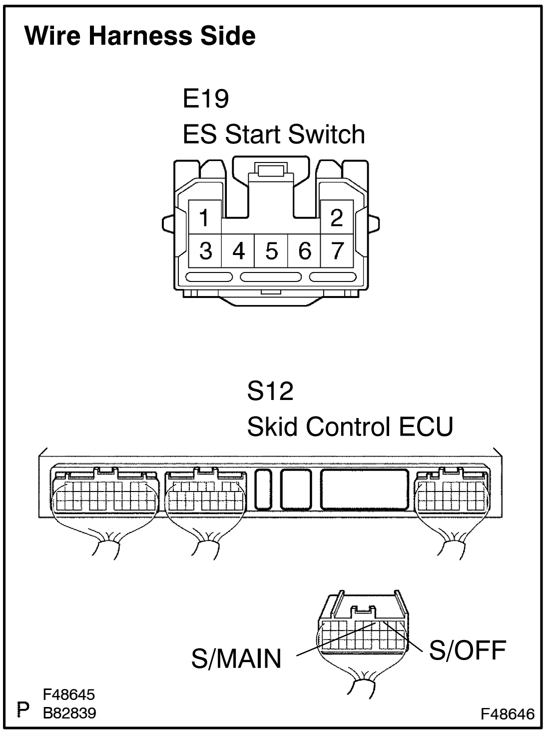
(a) Remove the ES start switch.
(b) Measure the resistance of the switch.
Standard:

Tester Connection	ES Start Main Switch Condition	Specified Condition
E19–5 – E19–6	OFF → ON	Below 1 Ω → 10 kΩ or higher
E19–5 – E19–7	ON → OFF	Below 1 Ω → 10 kΩ or higher

NG → **REPLACE ES START SWITCH**

OK

2 CHECK WIRE HARNESS (ES START SWITCH – SKID CONTROL ECU AND BATTERY)



(a) Disconnect the E19 switch connector.
(b) Disconnect the S12 ECU connector.
(c) Measure the voltage and resistance of the wire harness side connectors.
Standard:

Tester Connection	Condition	Specified Condition
E19–6 – S12–3 (S/OFF)	Always	Below 1 Ω
E19–7 – S12–4 (S/MAIN)	Always	Below 1 Ω
E19–5 – Body ground	Ignition switch ON	20 to 28 V

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

OK

3	CHECK FOR DTCS

(a) Clear the DTC (see page 05–268).
(b) Drive the vehicle at the vehicle speed of 7 km/h (4 mph) or more.
(c) Check that no code is output.

NG → **REPLACE SKID CONTROL ECU**

OK

END

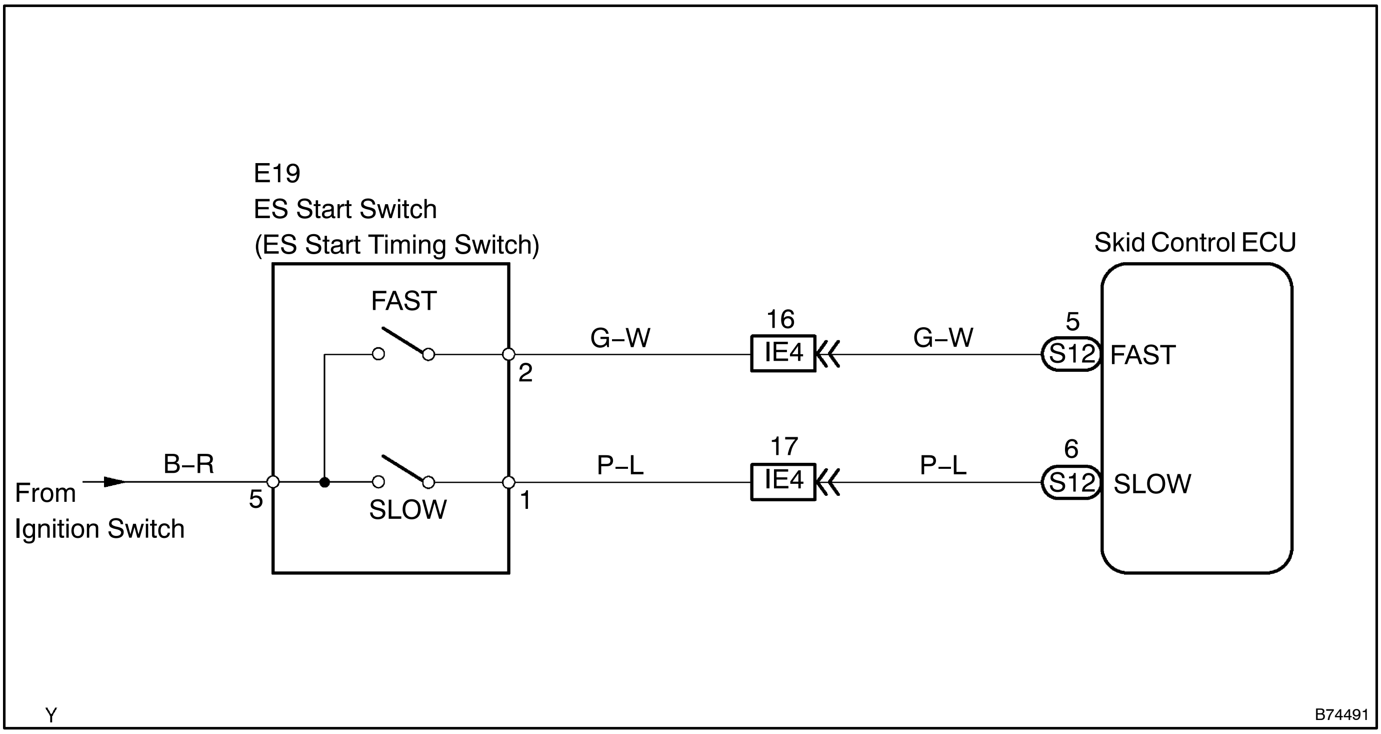
DTC	C1387/115	MALFUNCTION IN ES STARTING RELEASE TIMING SWITCH

CIRCUIT DESCRIPTION

The ES start timing switch can adjust the timing of releasing the brake hydraulic pressure. When the timing switch is operated, a release timing input signal (FAST input signal or SLOW input signal) is input to the skid control ECU. In response to this input signal, the skid control ECU adjusts the timing of releasing the brake hydraulic pressure.

DTC No.	DTC Detection Condition	Trouble Area
C1387/115	Both terminals FAST and SLOW are ON for 2 seconds	• ES start switch • Skid control ECU • Wire harness

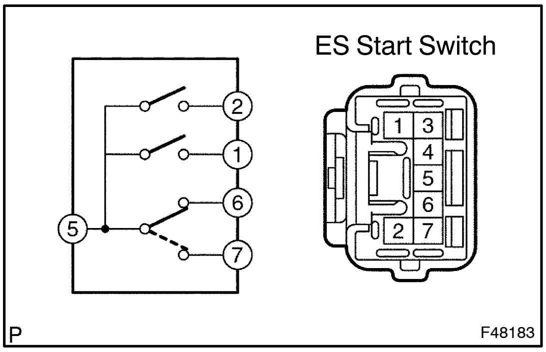
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

1 INSPECT ES START SWITCH (ES START TIMING SWITCH)



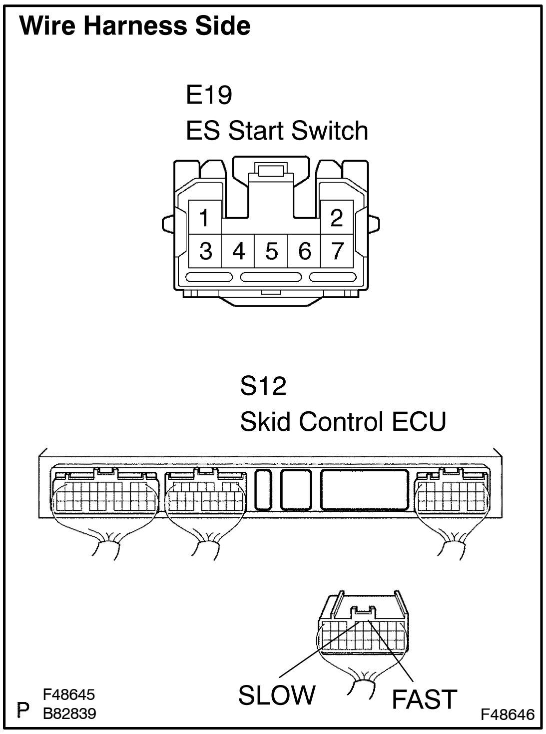
(a) Remove the ES start switch.
(b) Measure the resistance of the switch.
Standard:

Tester Connection	ES Start Timing Switch Condition	Specified Condition
E19–5 – E19–2	OFF → FAST (pressed)	Below 1 Ω → 10 kΩ or higher
E19–5 – E19–1	OFF → FAST (pressed)	10 kΩ or higher
E19–5 – E19–1	OFF → SLOW (pressed)	Below 1 Ω → 10 kΩ or higher
E19–5 – E19–2	OFF → SLOW (pressed)	10 kΩ or higher

NG → **REPLACE ES START SWITCH**

OK

2 CHECK WIRE HARNESS (ES START SWITCH – SKID CONTROL ECU AND BATTERY)



(a) Disconnect the S12 ECU connector.
(b) Disconnect the E19 switch connector.
(c) Measure the voltage and resistance of the wire harness side connectors.
Standard:

Tester Connection	Condition	Specified Condition
E19–2 – S12–5 (FAST)	Always	Below 1 Ω
E19–1 – S12–6 (SLOW)	Always	Below 1 Ω
E19–5 – Body ground	Ignition switch ON	20 to 28 V

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

OK

3	CHECK FOR DTCS

(a) Clear the DTC (see page 05–268).
(b) Drive the vehicle at the vehicle speed of 7 km/h (4 mph) or more.
(c) Check that no code is output.

NG → **REPLACE SKID CONTROL ECU**

OK

END

DTC C1388/117 MALFUNCTION IN ES STARTING INITIALIZATION

CIRCUIT DESCRIPTION

The clutch stroke sensor detects the depressed volume of the clutch pedal and sends signals to the skid control ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1388/117	Clutch stroke sensor adjustment and cancel position initial setting are not completed	Skid control ECU

INSPECTION PROCEDURE

HINT:
As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

1 CLUTCH STROKE SENSOR ADJUSTMENT (See page 05–268)

2 CANCEL POSITION INITIAL SETTING (See page 05–268)

3 CHECK FOR DTCS

(a) Recheck for DTCs.
Result:

Result	Proceed to
No DTC is output	A
DTC other than C1388/117 is output	B
DTC C1388/117 is output again	C

B → Go to DTC CHART (See page 05–276)

C → REPLACE SKID CONTROL ECU

A

END

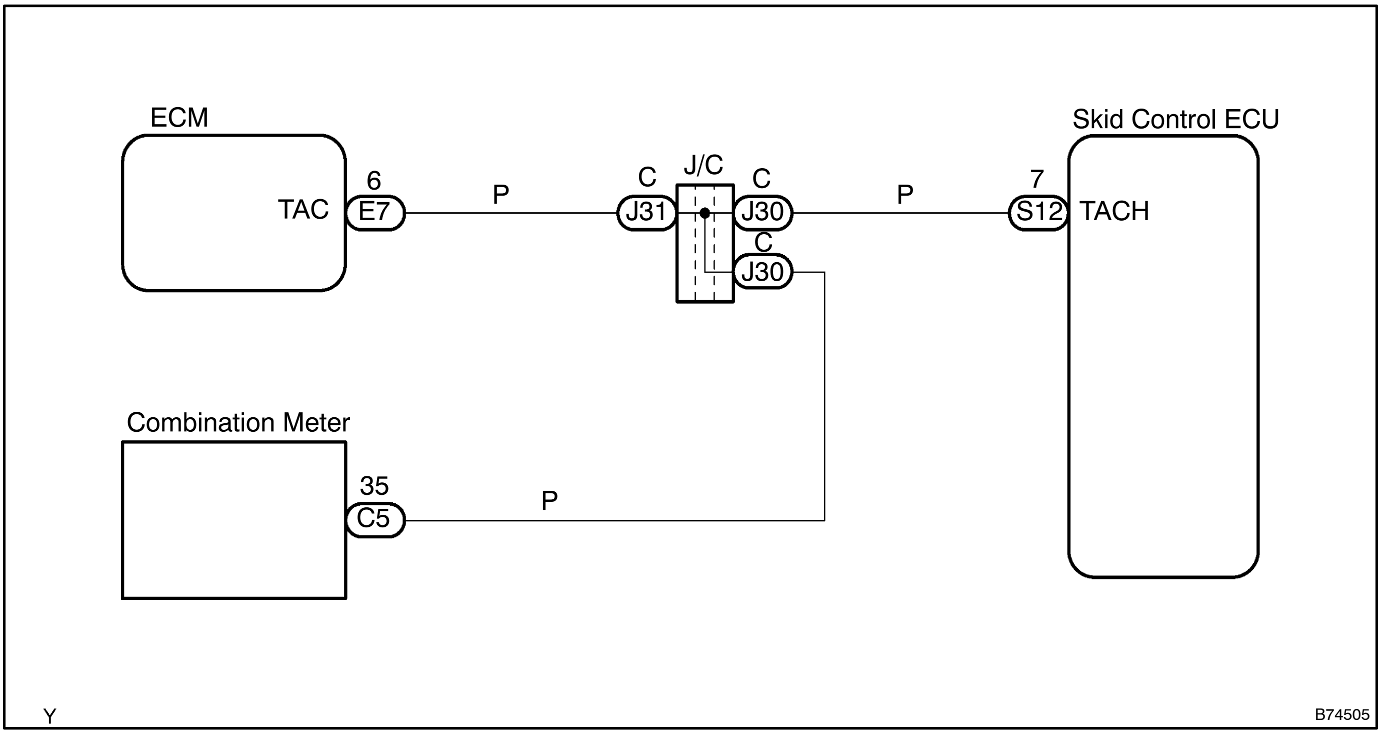
DTC C1389/118 MALFUNCTION IN TACHOMETER SENSOR

CIRCUIT DESCRIPTION

The ECM detects engine revolutions and sends signals to the skid control ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1389/118	All conditions listed below are met and no engine revolution signal is input for 3 sec. or more: • Battery voltage is 19 V or more • Clutch is connected • Gear is engaged • Vehicle speed is 20 km/h (13 mph) or more	• ECM • Skid control ECU • Combination meter • Wire harness

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

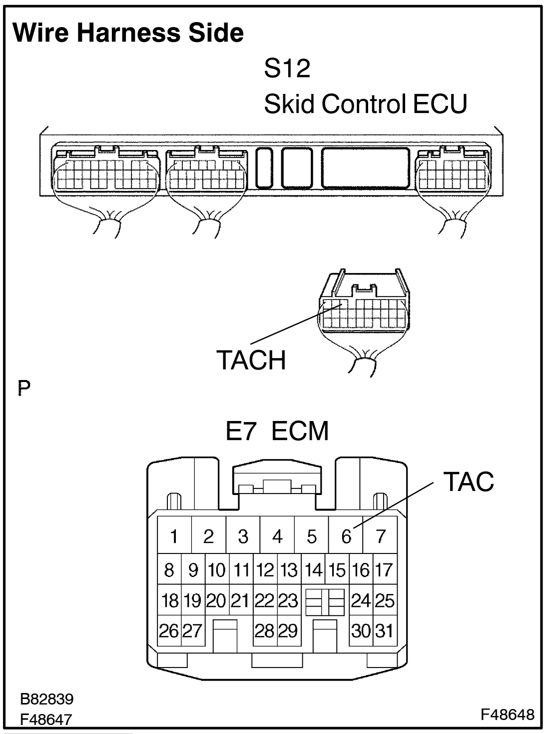
1	CHECK COMBINATION METER

(a) While the engine is running, depress the accelerator pedal with the shift lever in the neutral position and check the reading of the tachometer on the combination meter.
OK: In proportion to the engine speed, the reading of the tachometer changes.

NG → **CHECK AND REPLACE COMBINATION METER (See Pub. No. S1–YXZE05A, page 71–3)**

OK

2	CHECK WIRE HARNESS (SKID CONTROL ECU – ECM)



(a) Disconnect the S12 ECU connector.
(b) Disconnect the E7 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
S12–7 (TACH) – E7–6 (TAC)	Below 1 Ω

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

OK

3 CHECK FOR DTCS

(a) Clear the DTC (see page 05–268).
(b) Drive the vehicle at the vehicle speed of 7 km/h (4 mph) or more.
(c) Check that no code is output.

NG → **REPLACE SKID CONTROL ECU**

OK

END

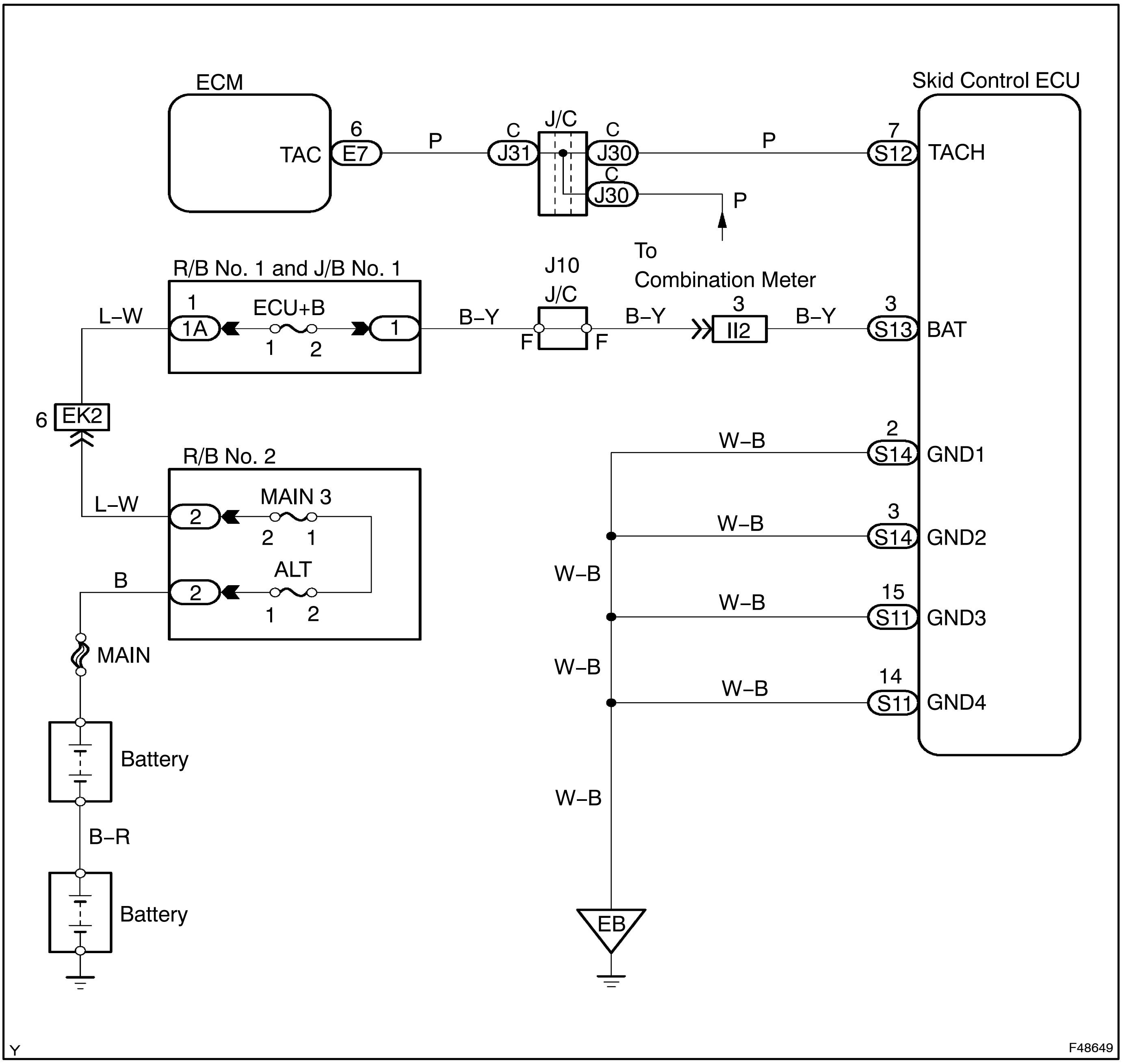
DTC	C1390/42	MALFUNCTION IN BATTERY POWER SUPPLY VOLTAGE

CIRCUIT DESCRIPTION

Power is supplied to the skid control ECU via the ECU+B fuse.

DTC No.	DTC Detection Condition	Trouble Area
C1390/49	Battery voltage is 19 V or more for 10 sec. or more while engine is running.	• ECU+B fuse • Skid control ECU • Wire harness

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

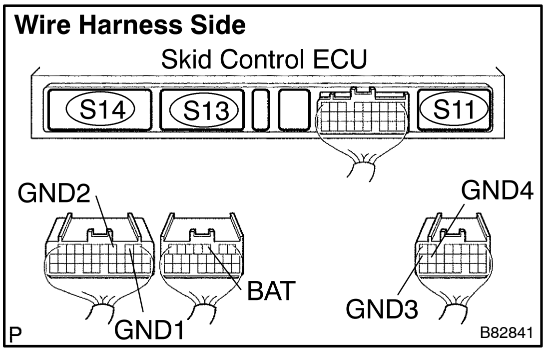
1 INSPECT FUSE (ECU+B)

(a) Remove the ECU+B fuse from the R/B No. 1 and J/B No. 1.
(b) Measure the resistance.
Standard: Below 1 Ω

NG → **REPLACE FUSE**

OK

2 CHECK WIRE HARNESS (SKID CONTROL ECU – BATTERY AND BODY GROUND)



(a) Disconnect the S11, S13 and S14 ECU connectors.
(b) Measure the voltage and resistance of the wire harness side connectors.
Standard:

Tester Connection	Specified Condition
S13–3 (BAT) – Body ground	20 to 28 V
S14–2 (GND1) – Body ground	Below 1 Ω
S14–3 (GND2) – Body ground	Below 1 Ω
S11–15 (GND3) – Body ground	Below 1 Ω
S11–14 (GND4) – Body ground	Below 1 Ω

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

OK

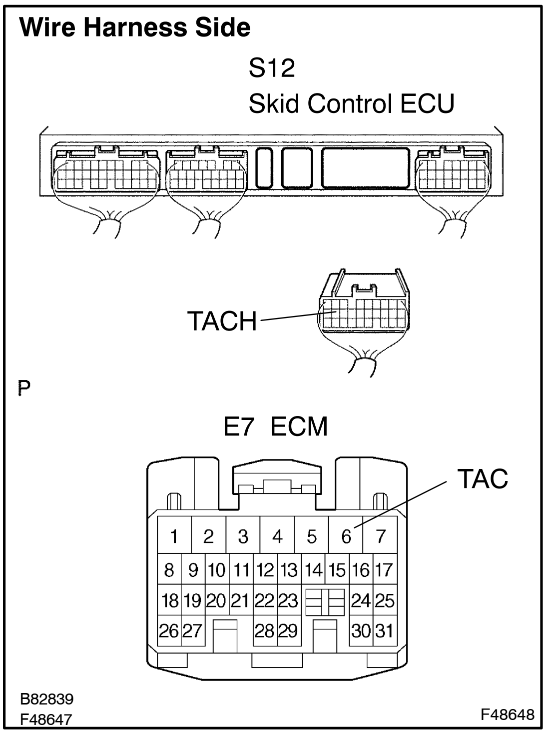
3 CHECK COMBINATION METER

(a) While the engine is running, depress the accelerator pedal with the shift lever in the neutral position and check the reading of the tachometer on the combination meter.
OK: In proportion to the engine speed, the reading of the tachometer changes.

NG → **CHECK TACHOMETER**
(See Pub. No. S1–YXZE05A, page 71–3)

OK

4 CHECK WIRE HARNESS (SKID CONTROL ECU – ECM)



(a) Disconnect the S12 ECU connector.
(b) Disconnect the E7 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
S12–7 (TACH) – E7–6 (TAC)	Below 1 Ω
S12–7 (TACH) – Body ground	10 kΩ or higher

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

OK

5 CHECK FOR DTCS

(a) Clear the DTC (see page 05–268).
(b) Drive the vehicle at the vehicle speed of 7 km/h (4 mph) or more.
(c) Check that no code is output.

NG → **REPLACE SKID CONTROL ECU**

OK

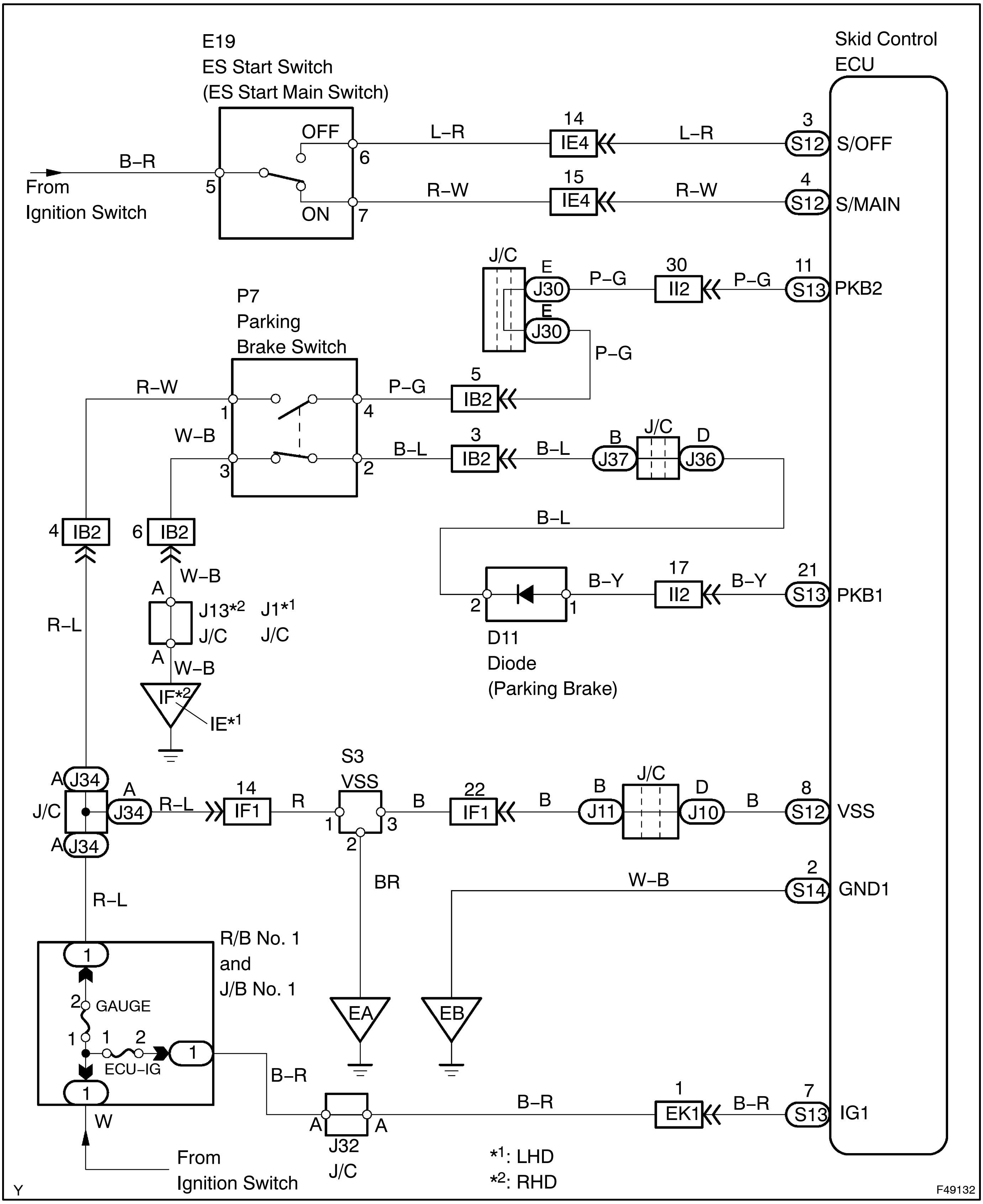
END

ES STARTING SYSTEM DOES NOT OPERATE

CIRCUIT DESCRIPTION

The skid control ECU controls the ES starting system. When the ABS & BA system has a malfunction, the ES starting system does not operate.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 CHECK FOR DTCS

(a) Check for DTCs.

Result:

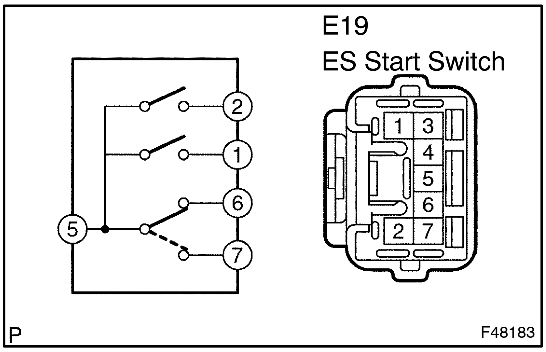
Result	Proceed to
No DTC is output	A
ABS & BA system DTC is output	B
ES starting system DTC is output	C

B **Go to ABS & BA SYSTEM (See page 05–191)**

C **Go to DTC CHART (See page 05–276)**

A

2 INSPECT ES START SWITCH (ES START MAIN SWITCH)



(a) Remove the ES start switch.

(b) Measure the resistance of the switch.

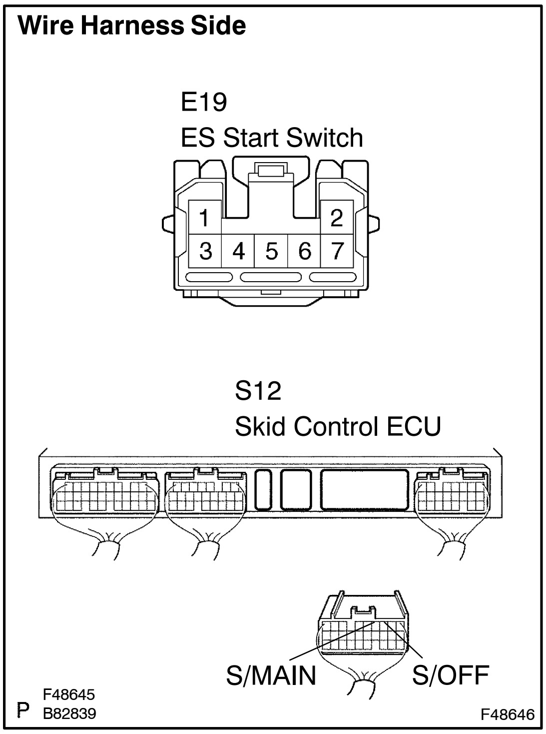
Standard:

Tester Connection	ES Start Main Switch Condition	Specified Condition
E19–5 – E19–6	OFF → ON	Below 1 Ω → 10 kΩ or higher
E19–5 – E19–7	ON → OFF	Below 1 Ω → 10 kΩ or higher

NG **REPLACE ES START SWITCH**

OK

3 CHECK WIRE HARNESS (ES START SWITCH – SKID CONTROL ECU AND BATTERY)



(a) Disconnect the S12 ECU connector.
(b) Disconnect the E19 switch connector.
(c) Measure the voltage and resistance of the wire harness side connectors.

Standard:

Terminal Connection	Condition	Specified Condition
E19–6 – S12–3 (S/OFF)	Always	Below 1 Ω
E19–7 – S12–4 (S/MAIN)	Always	Below 1 Ω
E19–5 – Body ground	Ignition switch ON	20 to 28 V

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

OK

4 INSPECT FUSE (GAUGE, ECU–IG)

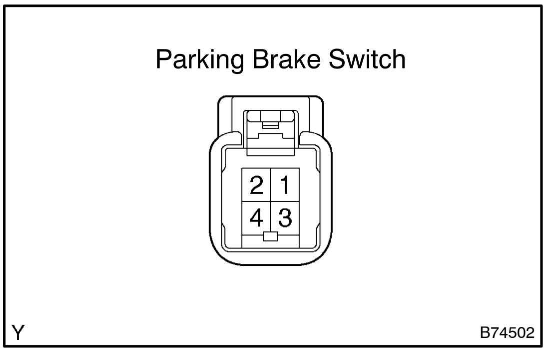
(a) Remove the GAUGE and ECU–IG fuse from the R/B No. 1 and J/B No. 1.
(b) Measure the resistance.

Standard: Below 1 Ω

NG → **REPLACE FUSE**

OK

5 INSPECT PARKING BRAKE SWITCH



(a) Remove the parking brake switch.
(b) Measure the resistance of the switch.

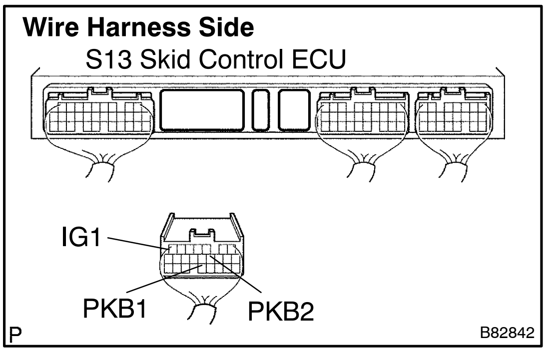
Standard:

Tester Connection	Parking Brake Switch Condition	Specified Condition
4 – 1	Not pushed → Pushed	10 kΩ or higher → Below 1 Ω
2 – 3	Pushed → Not pushed	10 kΩ or higher → Below 1 Ω

NG → **REPLACE PARKING BRAKE SWITCH**

OK

6 CHECK WIRE HARNESS (SKID CONTROL ECU – BATTERY AND BODY GROUND)



(a) Disconnect the S13 ECU connector.

(b) Measure the voltage and resistance of the wire harness side connector.

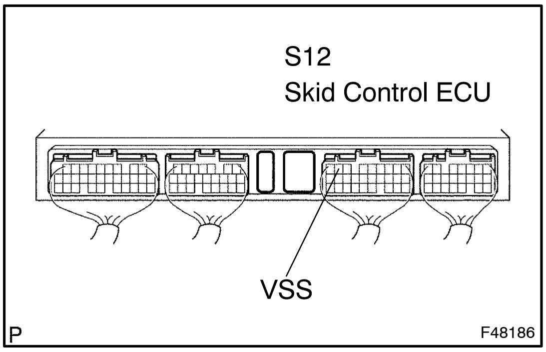
Standard:

Tester Connection	Condition	Specified Condition
S13–11 (PKB2) – Body ground	Ignition switch ON and parking brake lever not pulled → Pulled	0 V → 20 to 28 V
S13–21 (PKB1) – Body ground	Parking brake lever pulled → Not Pulled	10 kΩ or higher → Below 1 Ω
S13–7 (IG1) – Body ground	Ignition switch OFF → ON	0 V → 20 to 28 V

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

OK

7 CHECK WIRE HARNESS (SKID CONTROL ECU – BODY GROUND)



(a) Measure the voltage of the wire harness side connector.

Standard:

Tester Connection	Condition	Specified Condition
S12–8 (VSS) – Body ground	Ignition switch ON	Less than 2 V

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

OK

REPLACE SKID CONTROL ECU

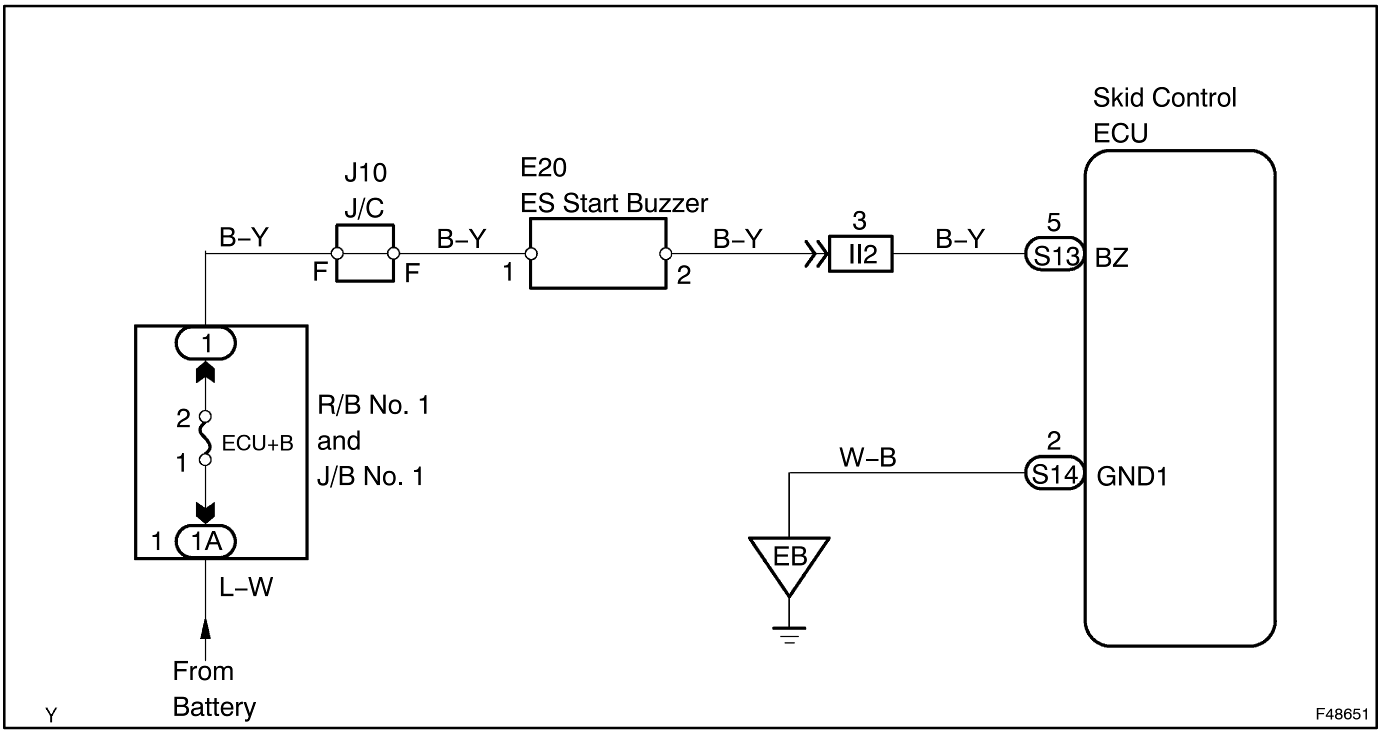
05BBP–02

ES BUZZER CIRCUIT

CIRCUIT DESCRIPTION

The skid control ECU operates the ES start buzzer.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

1	INSPECT FUSE (ECU+B)

(a) Remove the ECU+B fuse from the R/B No. 1 and J/B No. 1.

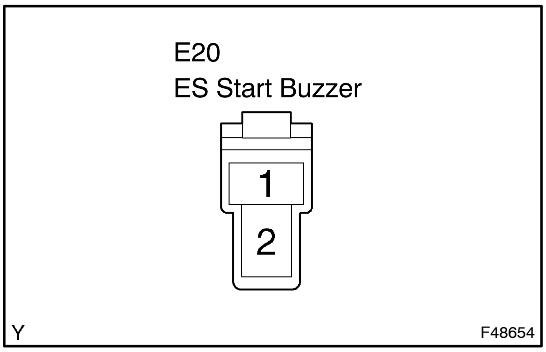
(b) Measure the resistance.

Standard: Below 1 Ω

NG → **REPLACE FUSE**

OK

2 CHECK ES START BUZZER (BATTERY VOLTAGE)



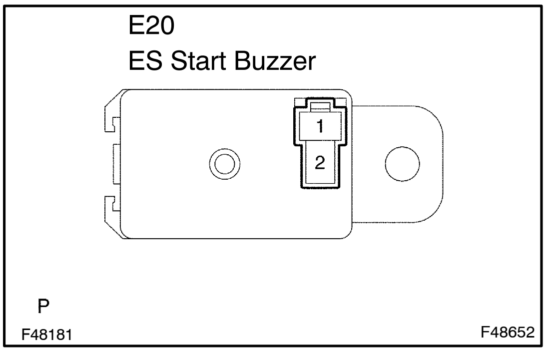
(a) Disconnect the E20 buzzer connector.
(b) Measure the vlotage of the buzzer.
Standard:

Tester Connection	Specified Condition
E20–1 – Body ground	20 to 28 V

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

OK

3 CHECK ES START BUZZER

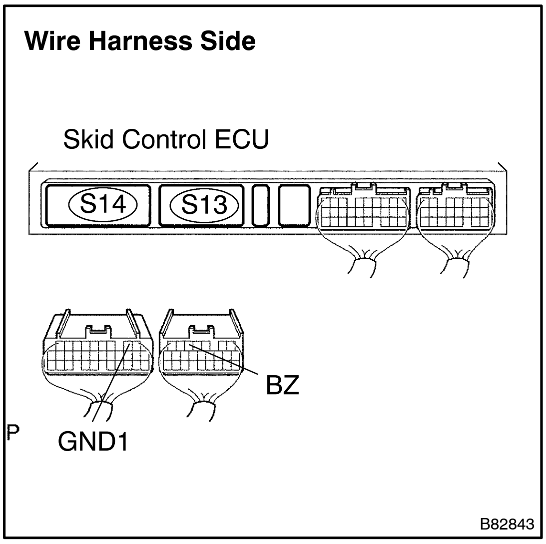


(a) Ground terminal E20–2 of the buzzer connector.
(b) Check that the buzzer sounds.
OK: Buzzer sounds

NG → **REPLACE ES START BUZZER**

OK

4 CHECK WIRE HARNESS (SKID CONTROL ECU – ES START BUZZER AND BODY GROUND)



(a) Disconnect the S13 and S14 ECU connectors.
(b) Disconnect the E20 buzzer connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
S13–5 (BZ) – E20–2	Below 1 Ω
S14–2 (GND1) – Body ground	Below 1 Ω

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

OK

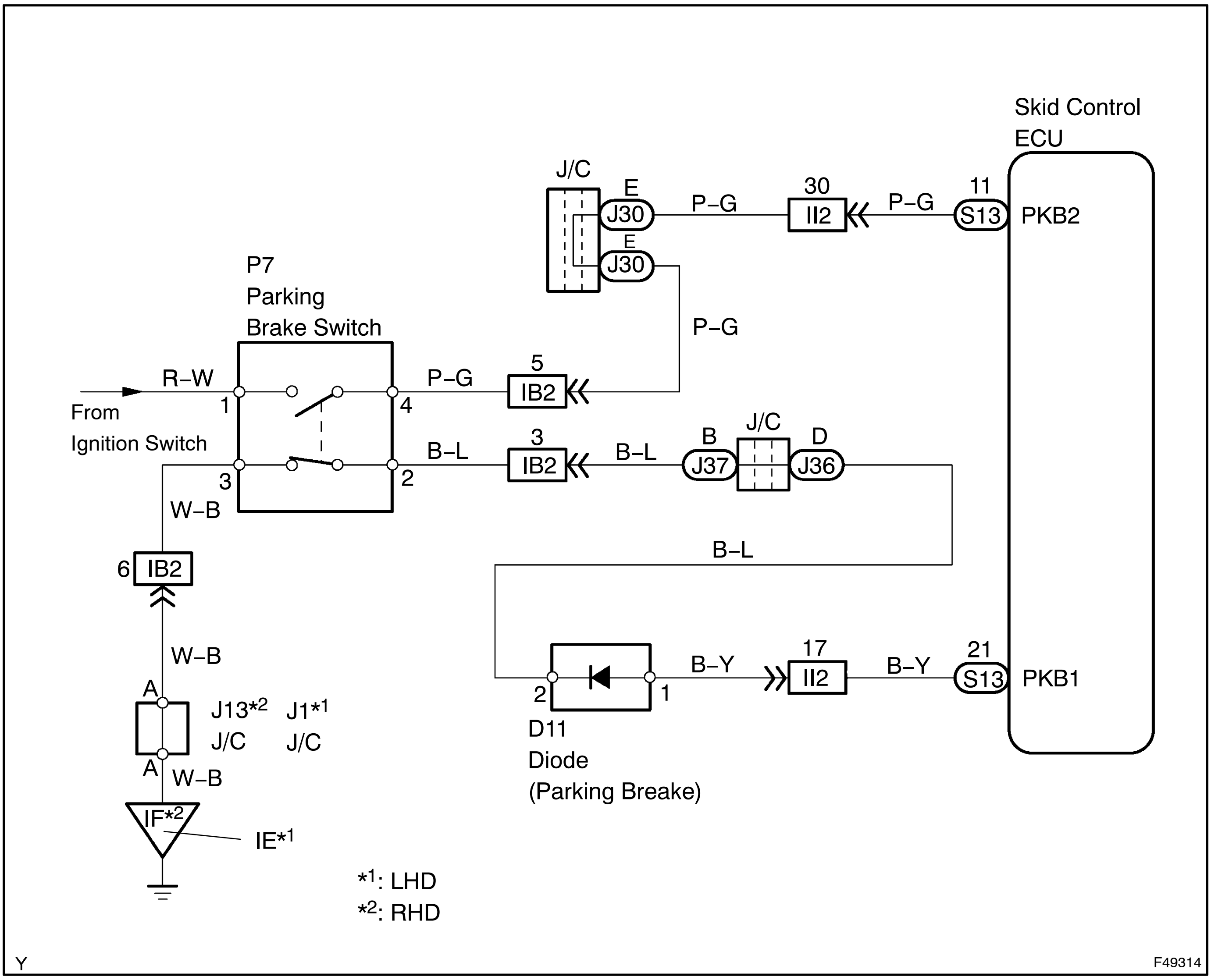
REPLACE SKID CONTROL ECU

PARKING BRAKE SWITCH CIRCUIT

CIRCUIT DESCRIPTION

The parking brake switch detects the parking brake position and sends signals to the skid control ECU.

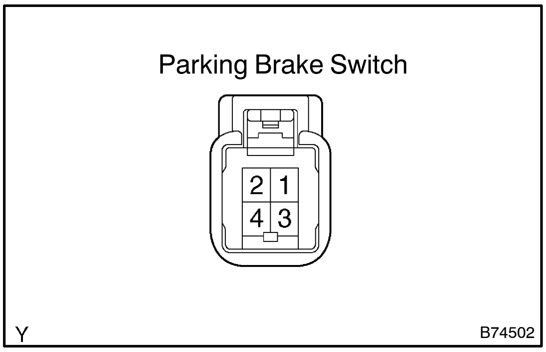
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
As the ES starting system is controlled by the skid control ECU, a malfunction in the ABS & BA system may affect ES starting system operation. Before proceeding to the flowchart below, check for ABS & BA system's DTCs. If any of the ABS & BA system's DTCs is present, troubleshoot those DTCs first (see page 05–191).

1 INSPECT PARKING BRAKE SWITCH



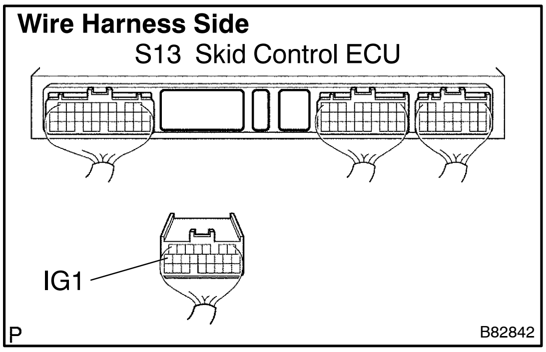
(a) Remove the parking brake switch.
(b) Measure the resistance of the switch.
Standard:

Tester Connection	Parking Brake Switch Condition	Specified Condition
4 – 1	Not pushed → Pushed	10 kΩ or higher → Below 1 Ω
2 – 3	Pushed → Not Pushed	10 kΩ or higher → Below 1 Ω

NG → **REPLACE FUSE**

OK

2 CHECK WIRE HARNESS (SKID CONTROL ECU – BATTERY)



(a) Disconnect the S13 ECU connector.
(b) Measure the voltage of the wire harness side connector.
Standard:

Tester Connection	Condition	Specified Condition
S13–7 (IG1) – Body ground	Ignition switch OFF → ON	0 V → 20 to 28 V

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

OK

REPLACE SKID CONTROL ECU

ENGINE CONTROL SYSTEM

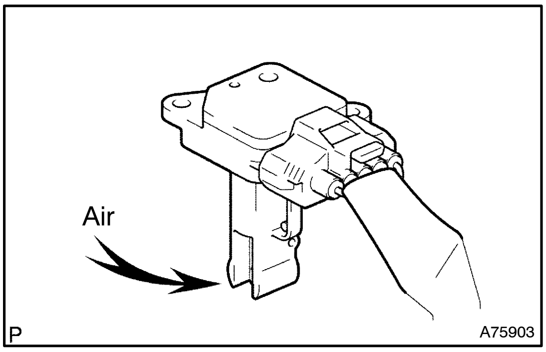
ECD SYSTEM (N04C−TF) . . . . 10−1
ON−VEHICLE INSPECTION . . . . 10−1
INSPECTION . . . . 10−3
VENTURI ASSY (N04C−TF) . . . . 10−6
COMPONENTS . . . . 10−6
REPLACEMENT . . . . 10−7
ACCELERATOR LINK ASSY (N04C−TF) . . . . 10−9
REPLACEMENT . . . . 10−9
ECM (N04C−TF) . . . . 10−10
REPLACEMENT . . . . 10−10

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1−YXZE05A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

ECD SYSTEM (N04C–TF)

ON–VEHICLE INSPECTION

100P6–01



1. INSPECT MAF METER

(a) Connect the hand–held tester (with 24V VIM) to the DLC3.

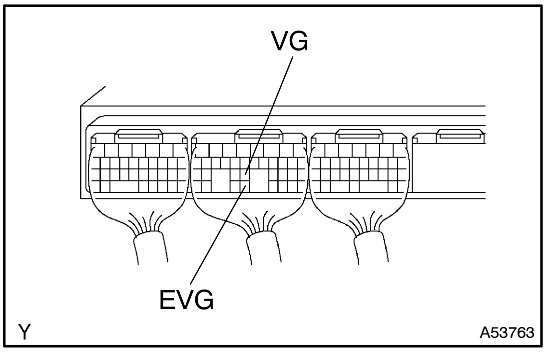
NOTICE:

Be sure to 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

(b) Turn the ignition switch ON.

(c) Blow air into the MAF meter. Check that the hand–held tester CURRENT DATA's MAF values fluctuates as a result of the air flow.

If the operation is not as specified, check the MAF meter (see page 05–59), wiring and ECM.



(d) When not using the hand–held tester:

(1) Turn the ignition switch ON.

(2) Connect the voltmeter's positive probe to terminal VG of the ECM and the negative probe to terminal EVG of the ECM.

(3) Blow air into the MAF meter and check that the voltage fluctuates.

If operation is not as specified, check the MAF meter (see page 05–59), wiring and ECM.

2. INSPECT VENTURI ASSY

(a) Inspect the throttle control motor for operating sound.

(1) Turn the ignition switch ON.

(2) When depressing the accelerator pedal, check that the running sound of the motor can be heard. Also, check that there is no friction sound.

If operation is not as specified, check the throttle control motor (see page 05–115), wiring and ECM.

(b) Inspect the throttle position sensor.

(1) Connect the hand–held tester (with VIM 24V) to the DLC3.

NOTICE:

Be sure to 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

(2) Turn the ignition switch ON.

(3) When turning the accelerator pedal position sensor lever to the fully open position, check that the throttle valve opening percentage (THROTTLE POS) of the CURRENT DATA shows the standard value specified below.

Standard throttle valve opening percentage:

60 % or more

If operation is not as specified, check the accelerator pedal position sensor (see page 05–86), wiring and ECM.

If no hand–held tester is available, measure the voltage between the terminals of the ECM connector (see page 05–115).

(c) Inspect the air assist system.
  (1) Start the engine and check that the MIL does not illuminate.
  (2) Allow the engine to warm up to normal operating temperature.
  (3) Turn the A/C compressor ON to OFF, and check the idle speed.
  Idle speed (Transmission in neutral): 600 to 700 rpm

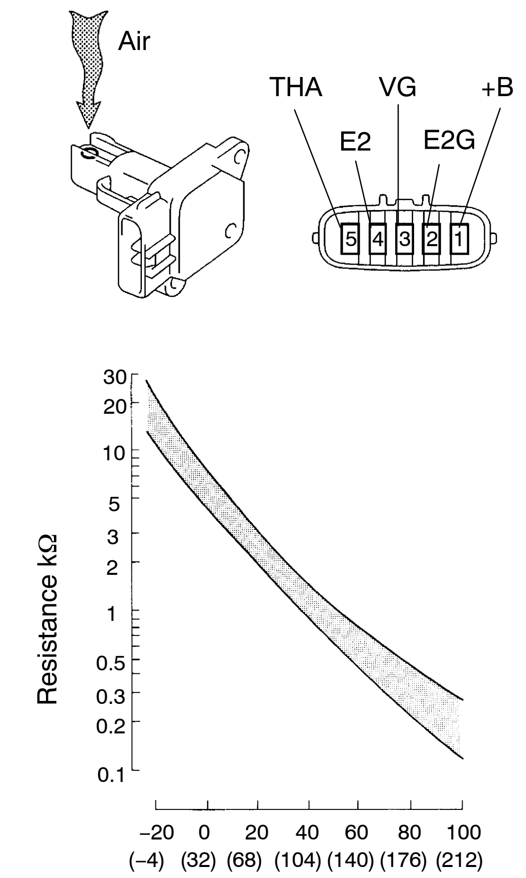
NOTICE:
Perform the inspection with all electrical loads shut OFF.

(d) After performing steps (b) and (c), perform the driving test and check that the vehicle runs smoothly.

3. INSPECT ACCELERATOR PEDAL POSITION SENSOR (See page 05–143)

100P7–01

INSPECTION



A96153

1. INSPECT MAF METER

(a) Check the output voltage.

(1) Apply battery voltage across terminals 1 (+B) and 2 (E2G).

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

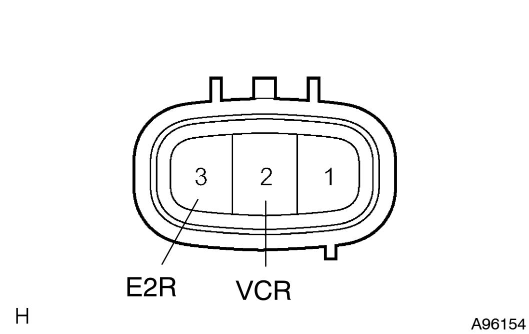
(3) Blow air into the MAF meter, and check that the voltage fluctuates.

(b) Measure the resistance between terminals 4 (THA) and 5 (E2).

Standard:

Condition	Specified Condition
–20°C (–4°F)	12.5 to 16.9 kΩ
20°C (68°F)	2.19 to 2.67 kΩ
60°C (140°F)	0.5 to 0.68 kΩ

If the result is not as specified, replace the MAF meter.



A96154

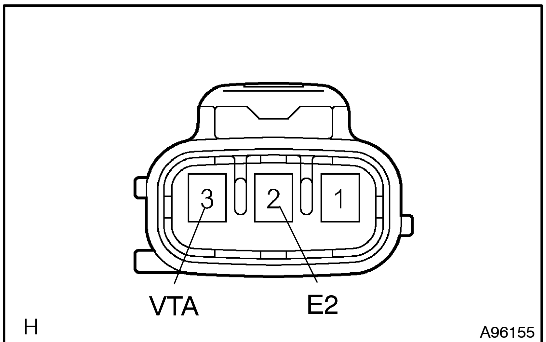
2. INSPECT VENTURI ASSY

(a) Measure the resistance between the terminals.

Standard:

Tester Connection	Condition	Specified Condition
2 (VCR) – 3 (E2R)	20°C (68°F)	2.0 to 10 kΩ

If the result is not as specified, replace the venturi assy.



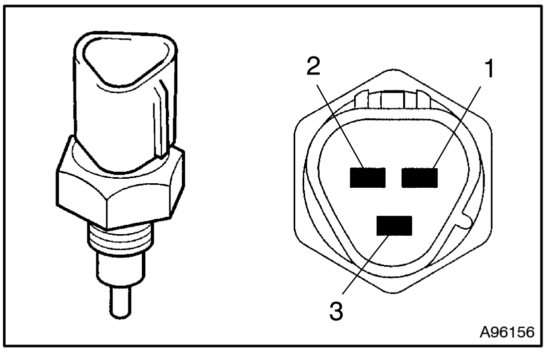
A96155

(b) Measure the resistance between the terminals.

Standard:

Tester Connection	Throttle Valve	Specified Condition
3 (VTA) – 2 (E2)	Fully open	0.2 to 5.7 kΩ
3 (VTA) – 2 (E2)	Fully closed	2.0 to 10.2 kΩ

If the result is not as specified, replace the throttle position sensor.



3. INSPECT ECT SENSOR

(a) Measure the resistance between each terminals.

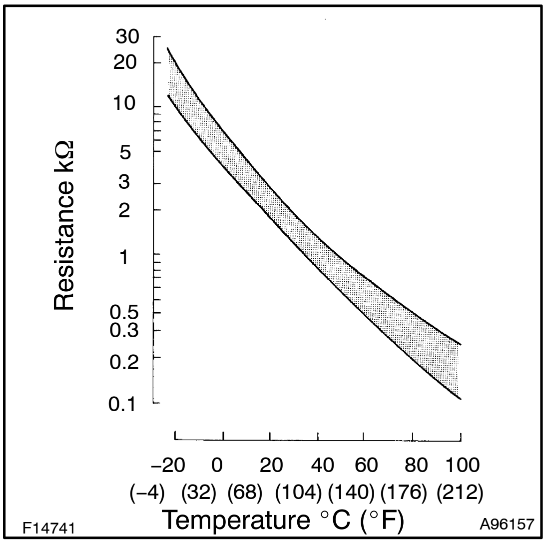
Standard:

Tester Connection	Condition	Specified Condition
1 – 2	Approx. 20°C (68°F)	2.32 to 2.59 kΩ
1 – 2	Approx. 80°C (176°F)	0.31 to 0.326 kΩ
3 – Body ground	Approx. 75°C (67°F)	79 to 93 Ω
3 – Body ground	Approx. 100°C (212°F)	35.5 to 41.5 Ω

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

NOTICE:

If checking the ECT sensor in water, keep the terminals dry. After the check, wipe the sensor dry.



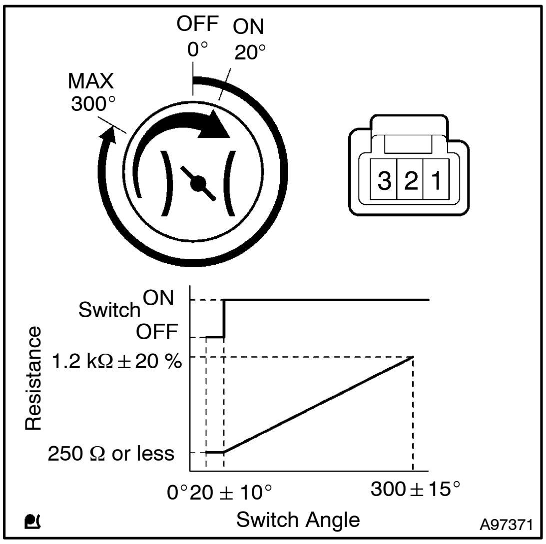
4. INSPECT IAT SENSOR

(a) Measure the resistance between each terminal.

Standard:

Condition	Specified Condition
Approx. 20°C (68°F)	2.21 to 2.65 kΩ
Approx. 60°C (140°F)	0.55 to 0.61 kΩ

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



5. INSPECT IDLE VARIABLE RESISTOR SWITCH

(a) Disconnect the idle variable resistor switch connector.

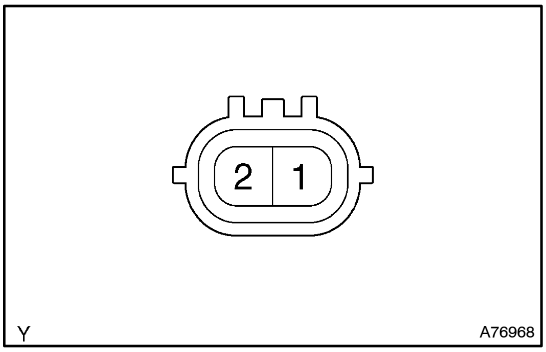
(b) Measure the resistance between the terminals of the switch.

Standard:

Tester Connection	Idle Variable Resistor Switch Condition	Specified Condition
2 – 3	ON	250 Ω
2 – 3	MAX	1.2 kΩ
2 – 3	ON → MAX	Resistance changes cos-tantly

If the result is not as specified, replace the switch assy.

6. INSPECT CAMSHAFT POSITION SENSOR (See page 05–111)



7. INSPECT CRANKSHAFT POSITION SENSOR

(a) Measure the resistance between the terminals.

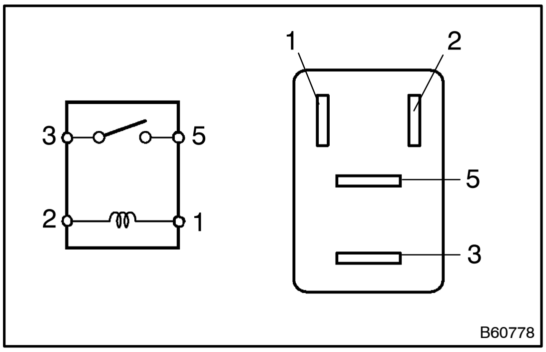
Standard:

Temperature	Specified Condition
Cold	1,630 to 2,740 Ω
Hot	2,065 to 3,225 Ω

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

NOTICE:

"Cold" and "Hot" mean 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).



8. INSPECT RELAY (Marking: MAIN, EDU)

(a) Remove the MAIN and EDU relays from the R/B No. 2.

(b) Measure the resistance of the relay.

Standard:

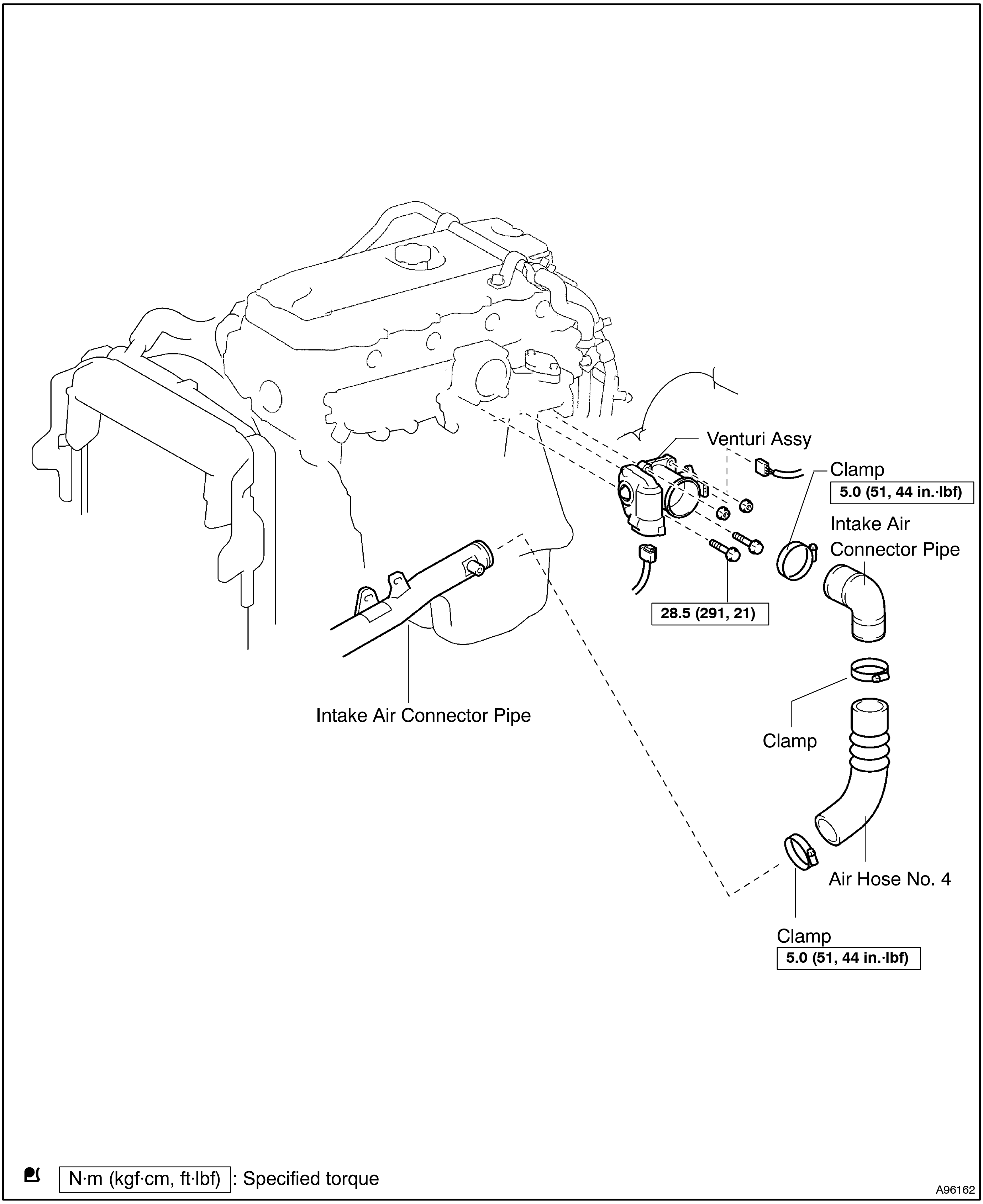
Between terminal	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

If the result is not as specified, replace the relay.

VENTURI ASSY (N04C–TF)

COMPONENTS

100P8–01



100P9–01

REPLACEMENT

1. DISCONNECT BATTERY NEGATIVE TERMINAL

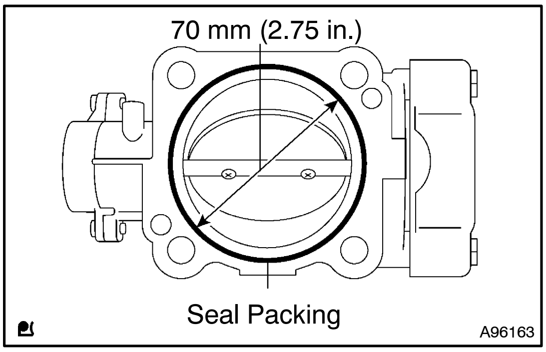
2. REMOVE INTAKE AIR CONNECTOR PIPE

(a) Loosen the hose clamp and disconnect the pipe.

3. REMOVE VENTURI ASSY

(a) Disconnect the connectors.

(b) Remove the 2 bolts, 2 nuts and venturi.



4. INSTALL VENTURI ASSY

(a) Remove any oil packing material from the contact surface.

(b) Apply a continuous bead of seal packing (width: 1.5 to 2.5 mm (0.06 to 0.10 in.)) as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

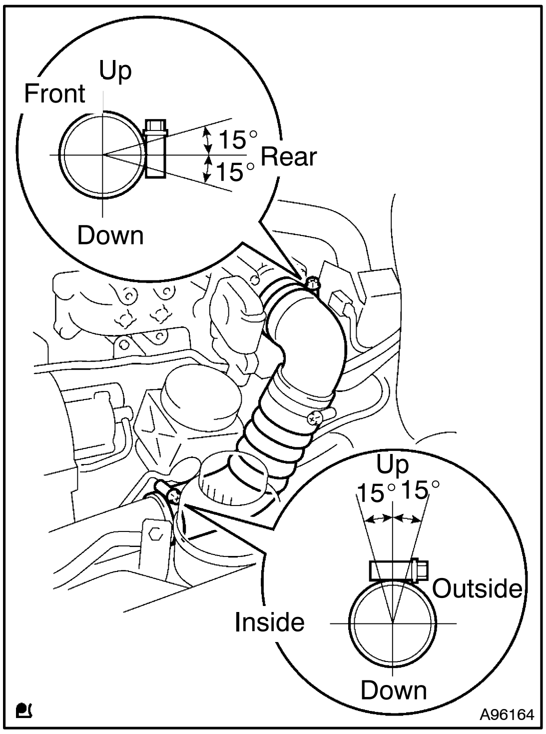
NOTICE:

- **Remove any oil from contact surface.**
- **Apply seal packing to the inner side of the bolt holes.**
- **Install the venturi assy within 3 minutes after applying seal packing.**
- **Do not expose the seal packing to engine oil for at least 2 hours after installing.**

(c) Install the venturi with the 2 bolts and 2 nuts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

(d) Connect the connector.



5. INSTALL INTAKE AIR CONNECTOR PIPE

(a) Install the clamps as shown in the illustration.

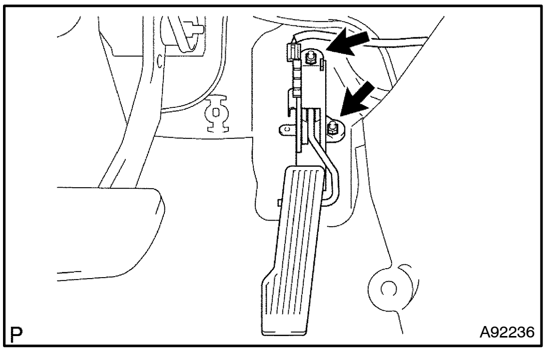
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)

6. CONNECT BATTERY NEGATIVE TERMINAL

ACCELERATOR LINK ASSY (N04C–TF)

REPLACEMENT

100PA–01



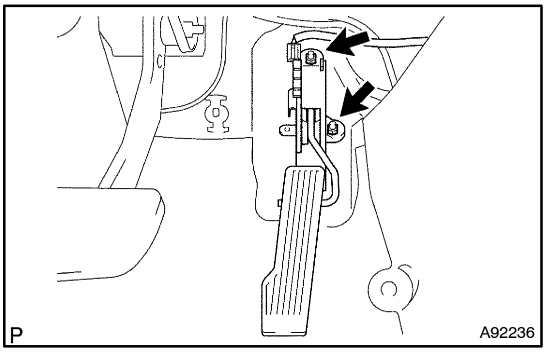
1. **REMOVE ACCELERATOR LINK ASSY**

(a) Disconnect the connector.

(b) Remove the 2 nuts and accelerator link.

NOTICE:

- **Do not drop the accelerator link.**
- **Do not disassemble the accelerator link.**



2. **INSTALL ACCELERATOR LINK ASSY**

(a) Install the accelerator link with the 2 nuts.

Torque: 5.5 N·m (56 kgf·cm, 49 in.·lbf)

(b) Connect the connector.

ECM (N04C–TF)

100PB–01

REPLACEMENT

1. **DISCONNECT BATTERY NEGATIVE TERMINAL**
2. **REMOVE INSTRUMENT COVER LOWER CENTER**
   (See pub. No. S1–YXZE05A, on pages 71–13 and 71–17)
3. **REMOVE ECM**

(a) Disconnect the connectors.
(b) Remove the 4 screws and ECM.

NOTICE:
Do not drop the ECM.

4. **INSTALL ECM**

(a) Install the ECM with the 4 screws.
(b) Connect the connectors.

NOTICE:
Connect the ECM connector securely and check that the connector is locked.

5. **INSTALL INSTRUMENT COVER LOWER CENTER**
   (See pub. No. S1–YXZE05A, on pages 71–13 and 71–17)
6. **CONNECT BATTERY NEGATIVE TERMINAL**
7. **INSPECT ECM**

FUEL

FUEL SYSTEM (N04C−TF) . . . . 11−1
PRECAUTION . . . . 11−1
ON−VEHICLE INSPECTION . . . . 11−2
INSPECTION . . . . 11−3
FUEL FILTER ELEMENT (N04C−TF) . . . . 11−5
REPLACEMENT . . . . 11−5
SUPPLY PUMP ASSY (N04C−TF) . . . . 11−9
COMPONENTS . . . . 11−9
REPLACEMENT . . . . 11−10
COMMON RAIL ASSY (N04C−TF) . . . . 11−15
REPLACEMENT . . . . 11−15
INJECTOR ASSY (N04C−TF) . . . . 11−18
COMPONENTS . . . . 11−18
REPLACEMENT . . . . 11−20
FUEL TANK ASSY (N04C−TF) . . . . 11−24
COMPONENTS . . . . 11−24
REPLACEMENT . . . . 11−26

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1−YXZE05A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

FUEL SYSTEM (N04C–TF)

1114D–01

PRECAUTION

CAUTION:

- **Before working on the fuel system, disconnect the negative (–) terminal cable from the battery.**
- **Do not smoke or be near an open flame when working on the fuel system.**
- **Keep fuel away from rubber or leather parts.**
- **Cover the disconnected fuel system parts with a vinyl or a plastic bag to prevent any damage and dirt.**
- **Each injector assembly has unique fuel injecting characteristics. If the injectors need to be removed, be sure to remember where each injector's previous location was and reinstall them accordingly.**

1. DISCHARGE FUEL SYSTEM PRESSURE

CAUTION:

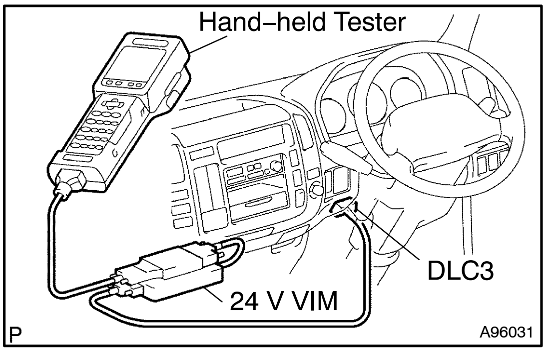
- **Do not disconnect any part of the fuel system until you have discharged the fuel system pressure.**
- **Even after discharging the fuel pressure, place a shop rag over fittings as you separate them to reduce risk of fuel spray on yourself or in the engine compartment.**

2. CHECK FOR FUEL LEAKS

(a) Check that there are no fuel leaks after doing maintenance anywhere on the fuel system (see page 11–2).

1114E–01

ON–VEHICLE INSPECTION



1. CHECK FUEL PRESSURE

(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.

NOTICE:

Be sure to use the 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

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

(c) Start the engine.

(d) Enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / COMMON RAIL and COMMON RAIL 2.

HINT:

For more information on the tester's DATA LIST mode, refer to the tester's instruction manual.

(e) Check that the internal fuel pressure of the common rail is within the specification below.

DATA LIST:

Hand–held Tester Display	Measurement Item/Range (Display)	Normal Condition	Diagnostic Note
COMMON RAIL	Common rail pressure status/ Min.: 0 MPa, Max.: 255 MPa (2,600 kgf/cm^2, 36,988 psi)	• Idling: 25 to 35 MPa (255 to 357 kgf/cm^2, 3,625 to 5,075 psi) • Engine running at 3,000 rpm: 80 to 90 MPa (816 to 918 kgf/cm^2, 11,604 to 13,055 psi)	—
COMMON RAIL 2	Common rail pressure status/ Min.: 0 MPa, Max.: 255 MPa (2,600 kgf/cm^2, 36,988 psi)	• Idling: 25 to 35 MPa (255 to 357 kgf/cm^2, 3,625 to 5,075 psi) • Engine running at 3,000 rpm: 80 to 90 MPa (816 to 918 kgf/cm^2, 11,604 to 13,055 psi)	—

2. CHECK FUEL LEAKS

(a) Enter the following menus: DIAGNOSIS / OBD/MOBD / ACTIVE TEST.

(b) According to the display on the tester, perform the ACTIVE TEST.

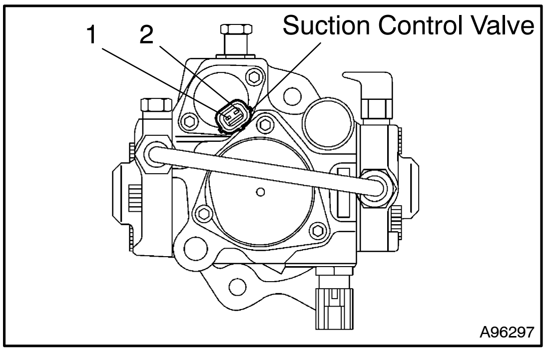
Hand–held Tester Display	Test Details	Diagnostic Note
FUEL LEAK TEST	Maintain engine speed at 2,000 rpm, and pressurize common rail internal fuel pressure to 160 MPa (1,632 kgf/cm^2, 23,215 psi) ON or OFF	Confirm that there is no leak in fuel system when common rail internal fuel pressure is high

(c) Turn the ignition switch OFF.

(d) Disconnect the hand–held tester from the DLC3.

1114F–01

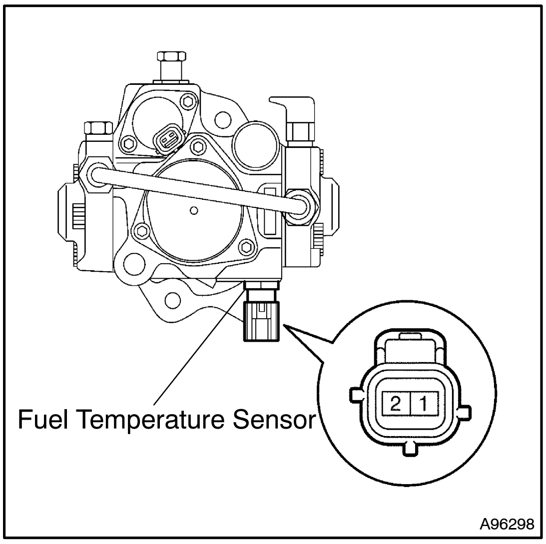
INSPECTION



1. INSPECT SUCTION CONTROL VALVE

(a) Measure the resistance between the terminal 1 and 2.
Standard: 7.6 to 8.2 Ω at 20°C (68°F)

If the result is not as specified, replace the supply pump assy.



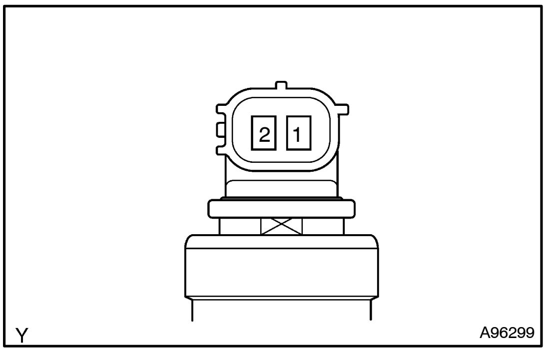
2. INSPECT FUEL TEMPERATURE SENSOR

(a) Measure the resistance between the terminal 1 and 2.
Standard:

Condition	Specified Condition
20°C (68°F)	2.32 to 2.59 kΩ
80°C (176°F)	0.310 to 0.326 kΩ

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

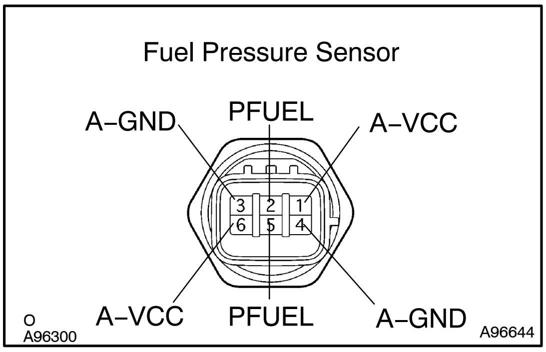
NOTICE:
When checking the fuel temperature sensor in water, be careful not to allow water to enter the terminals. After the check, wipe off the sensor.



3. INSPECT INJECTOR ASSY

(a) Measure the resistance between the terminal 1 and 2.
Standard: 0.35 to 0.55 Ω at 20°C (68°F)

If the result is not as specified, replace the injector assy.

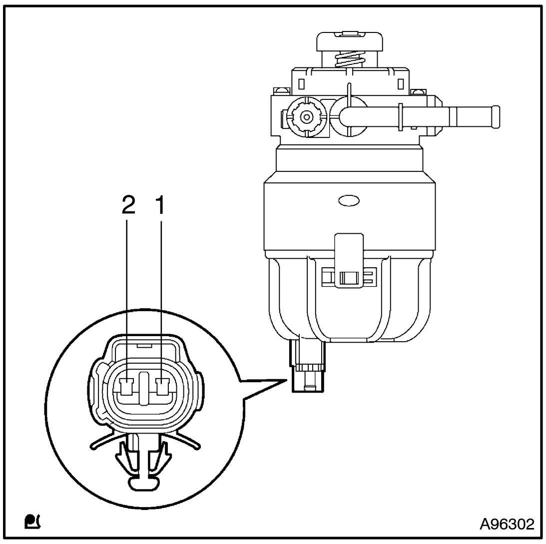


4. INSPECT FUEL PRESSURE SENSOR

(a) Measure the resistance between the terminals.
Standard:

Tester Connection	Specified Condition
F8–2 (PFUEL) – F8–3 (A–GND)	16.4 kΩ or less
F8–5 (PFUEL) – F8–4 (A–GND)	16.4 kΩ or less
F8–1 (A–VCC) – F8–2 (PFUEL)	3 kΩ or less
F8–6 (A–VCC) – F8–5 (PFUEL)	3 kΩ or less

If the result is not as specified, replace the common rail assy.



5. INSPECT LEVEL WARNING SWITCH

(a) Measure the resistance between the terminal 1and 2.

Standard:

Condition	Specified Condition
Upper end of float	Below 1 Ω
Lower end of float	10 kΩ or higher

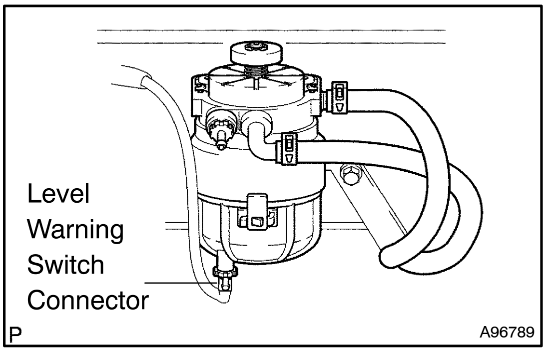
If the result is not as specified, replace the level warning switch.

FUEL FILTER ELEMENT (N04C–TF)

1114G–01

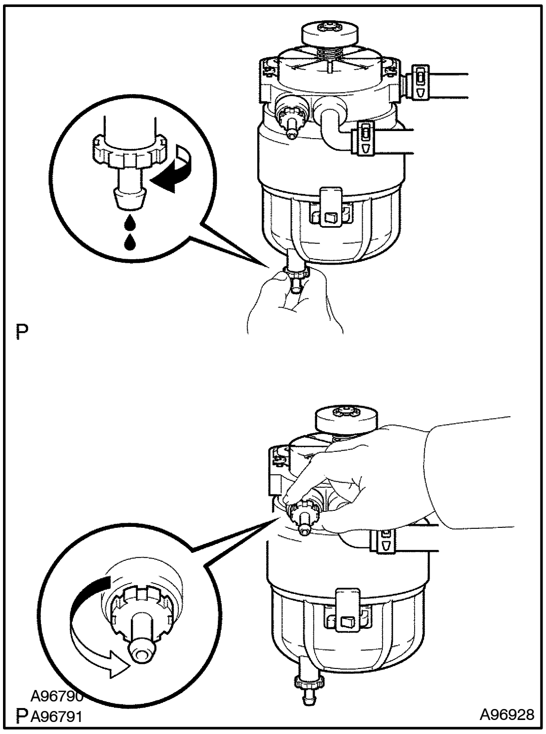
REPLACEMENT

HINT:
If only installing or removing the fuel element, steps 2 and 3 are not necessary.



1. REMOVE FUEL FILTER ELEMENT SUB–ASSY

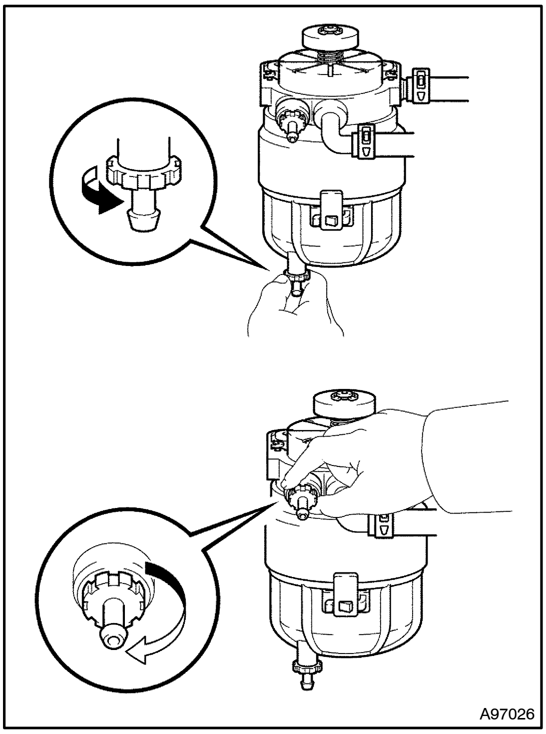
(a) Disconnect the level warning switch connector.



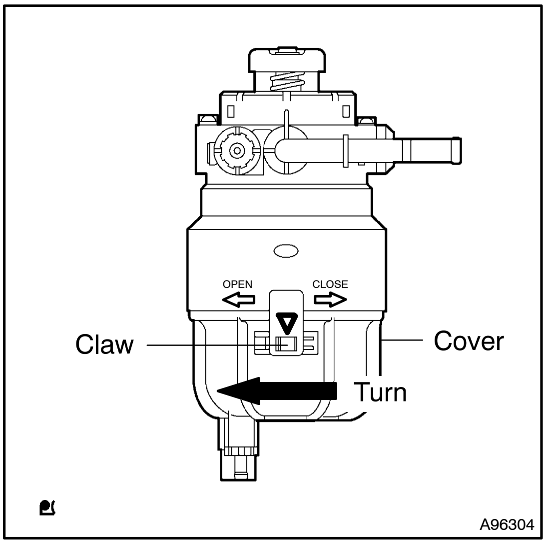
(b) Loosen the drain plug and air bleed plug as shown in the illustration. Drain the fuel.

NOTICE:

- **Do not spill any fuel.**
- **If any fuel is on any part of the engine, wipe it clean with a shop rag.**



(c) When fuel stops draining from the drain plug, tighten the drain plug and air bleed plug.



(d) Disengage the claw. Then, remove the cover by turning it counterclockwise approximately 120°.

(e) Remove the fuel filter element.

2. REMOVE DIESEL FUEL FILTER ASSY

(a) Disconnect the 2 fuel hoses.

(b) Remove the 2 bolts and fuel filter.

3. INSTALL DIESEL FUEL FILTER ASSY

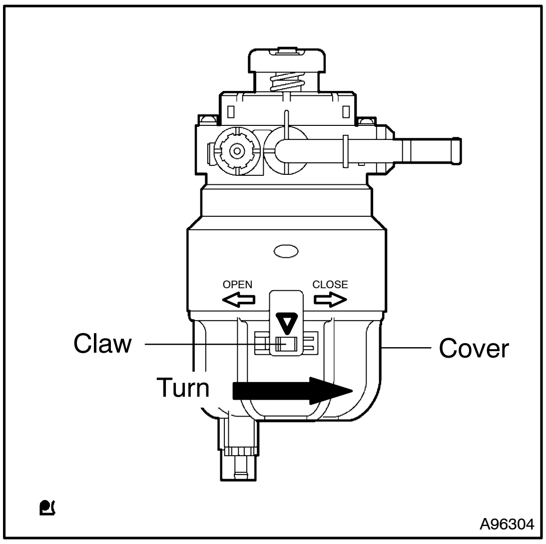
(a) Install the fuel filter with the 2 bolts.

Torque: 17.5 N·m (175 kgf·cm, 13 ft·lbf)

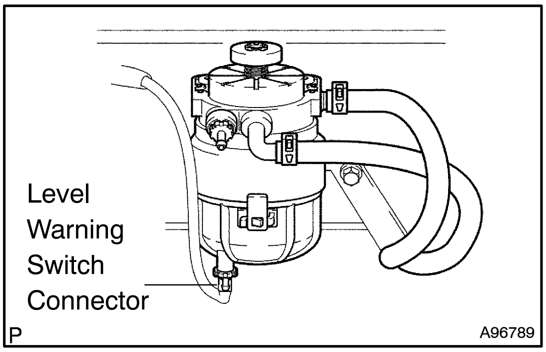
(b) Connect the 2 fuel hoses.

4. INSTALL FUEL FILTER ELEMENT SUB–ASSY

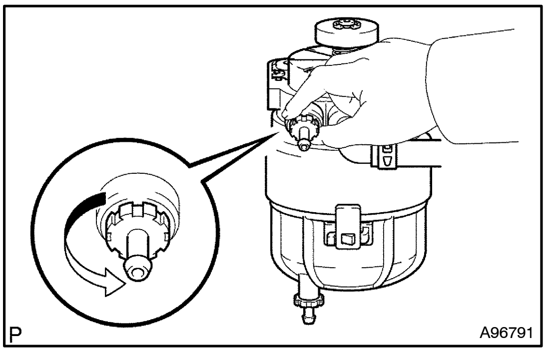
(a) Install the fuel filter element to the fuel filter body.



(b) Install the fuel filter cover by turning it clockwise until the claw is engaged.

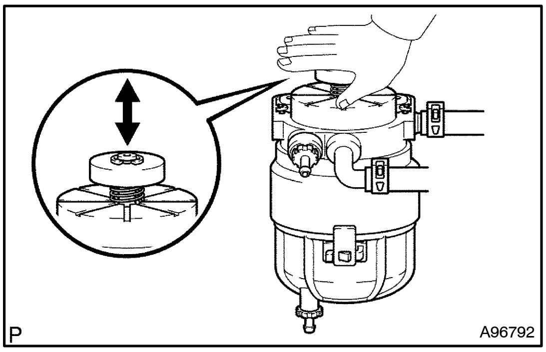


(c) Connect the level warning switch connector.

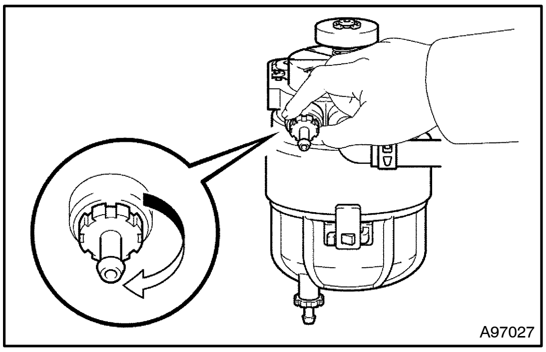


5. BLEED AIR FROM FUEL SYSTEM

(a) Loosen the fuel filter's air bleed plug.



(b) While covering the drain pipe with a shop rag, press and release the priming pump until the fuel from the drain pipe does not have any bubbles.



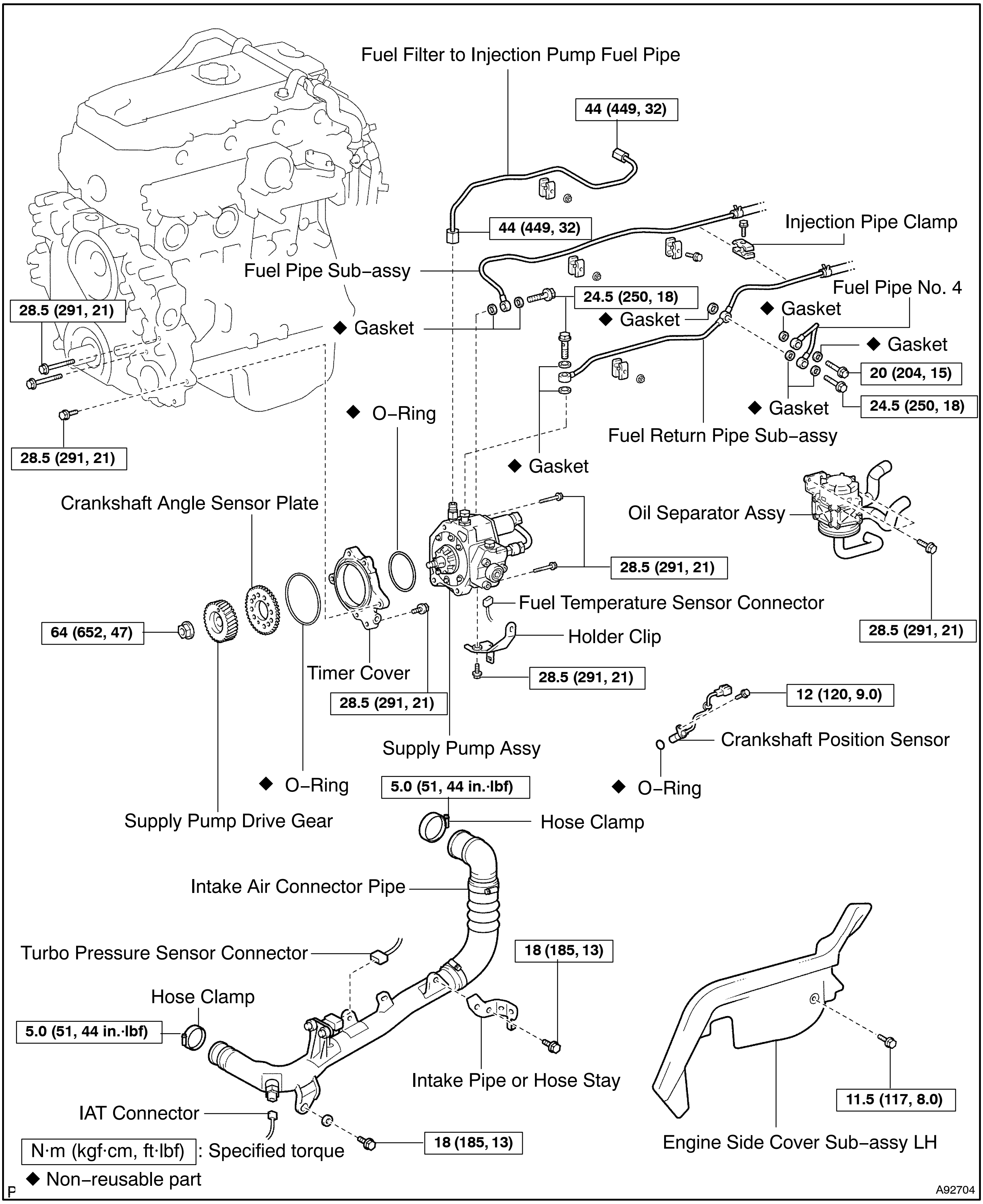
(c) Tighten the air bleed plug.

6. CHECK FOR FUEL LEAKS (See page 11–2)

SUPPLY PUMP ASSY (N04C–TF)

COMPONENTS

1114H–01

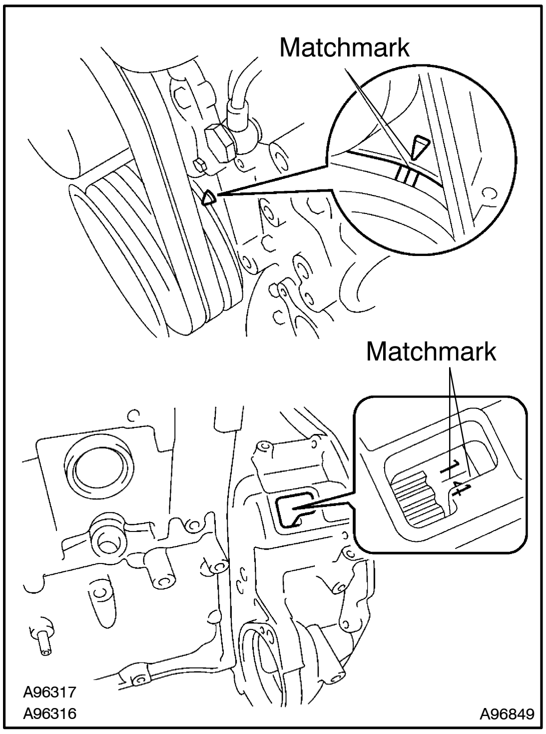


1114I–01

REPLACEMENT

1. DISCONNECT BATTERY NEGATIVE TERMINAL

2. DRAIN FUEL



3. SET NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley clockwise, and align the matchmarks as shown in the illustration.

(b) Check that the matchmarks of the flywheel housing and flywheel are aligned as shown in the illustration.

If not, turn the crankshaft 1 revolution (360°) and align the matchmarks as above.

4. REMOVE ENGINE SIDE COVER SUB–ASSY LH

(a) Remove the bolt and engine side cover.

5. DISCONNECT INTAKE AIR CONNECTOR PIPE

(a) Disconnect the IAT and pressure sensor connectors.
(b) Remove the 2 bolts.
(c) Loosen the 2 hose clamps.
(d) Disconnect the connector pipe.

6. REMOVE OIL SEPARATOR ASSY

(a) Disconnect the 3 pipes.
(b) Remove the 2 bolts and oil separator.

7. REMOVE FUEL PIPE NO. 4

(a) Remove the 2 union bolts, 5 gaskets and fuel pipe.

8. REMOVE FUEL PIPE SUB–ASSY

(a) Remove the 2 bolt, nut and 3 clamps.
(b) Remove the union bolt, 2 gaskets and fuel pipe.

9. REMOVE FUEL FILTER TO INJECTION PUMP FUEL PIPE

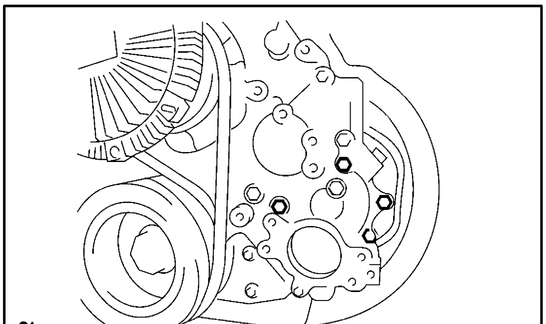
(a) Remove the nut and injection pipe clamp.
(b) Using SST, loosen the fuel pipe union on the common rail side.
SST 09023–12900
(c) Using SST, loosen the fuel pipe union on the pump side.
SST 09023–12900
(d) Remove the fuel pipe.

10. REMOVE FUEL RETURN PIPE SUB–ASSY

(a) Remove the nut and injection pipe clamp.
(b) Remove the union bolt, 2 gaskets and fuel return pipe.

11. REMOVE CRANKSHAFT POSITION SENSOR
(a) Remove the bolt and sensor.
(b) Remove the O–ring from the sensor.

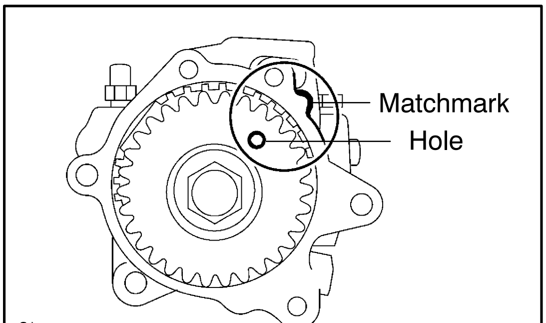
12. REMOVE SUPPLY PUMP ASSY
(a) Disconnect the fuel temperature sensor connector.
(b) Remove the bolt and holder clip.


A96853

(c) Remove the 4 bolts and supply pump.
(d) Remove the O–ring from the timer cover.

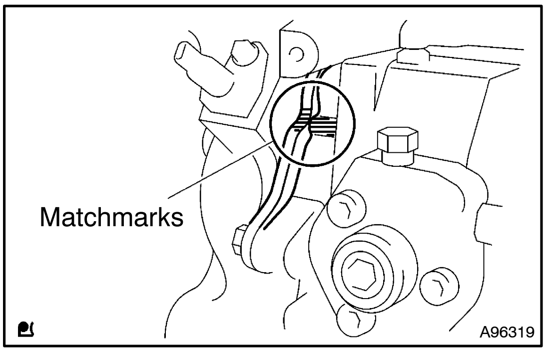
13. REMOVE SUPPLY PUMP DRIVE GEAR
(a) Use a vise to clamp the injection pump drive gear between 2 wooden blocks.
(b) Remove the nut, injection pump drive gear and crankshaft angle sensor plate.
(c) Remove the 2 bolts and timer cover.
(d) Remove the O–ring from the timer cover.

14. INSTALL SUPPLY PUMP DRIVE GEAR
(a) Install a new O–ring to the timer cover.
(b) Install the timer cover to the supply pump with the 2 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
(c) Install the crankshaft angle sensor plate and drive gear with the nut.
Torque: 63.7 N·m (650 kgf·cm, 47 ft·lbf)

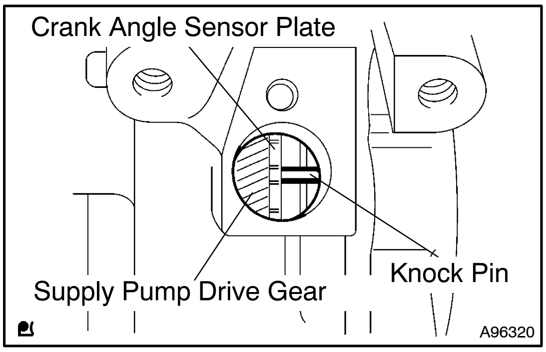


A96318

15. INSTALL SUPPLY PUMP ASSY
(a) Install the O–ring to the timer cover.
(b) Turn the supply pump drive gear and align the hole with the matchmark as shown in the illustration.

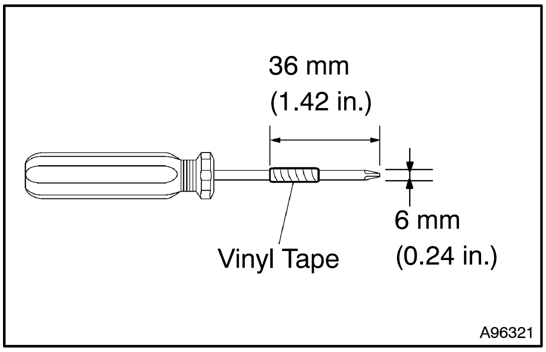


(c) Align the matchmarks of the timer cover and front end plate, then install the supply pump.

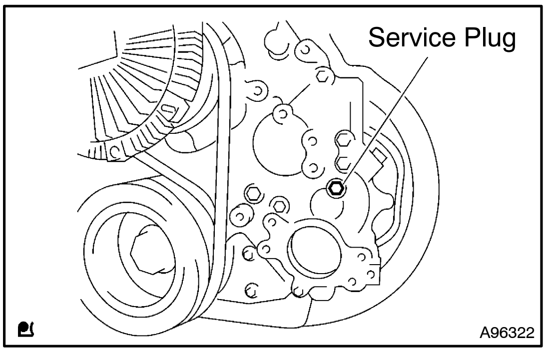


(d) When the crankshaft position sensor's installation hole can be seen directly:
   (1) Check that the knock pin of the injection pump drive gear is at the center of the hole. Then, proceed to step (f).

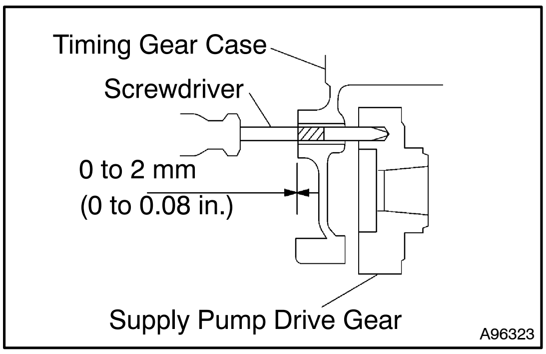
If not, perform steps (b) and (c) again.



(e) When the crankshaft position sensor's installation hole cannot be seen directly:
   (1) Tape the screwdriver as shown in the illustration.

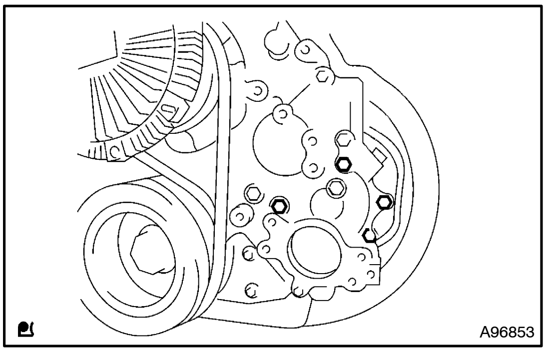


   (2) Remove the service plug from the timing chain or belt cover sub–assy.



   (3) Insert the screwdriver into the service plug hole.
   (4) Check that the tape end and timing chain or belt cover sub–assy are aligned as shown in the illustration.

If not, perform steps (b) and (c) again.
   (5) Install the service plug to the service plug hole.



(f) Install the 4 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
(g) Install the holder clip with the bolt.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
(h) Connect the fuel temperature sensor connector.

16. INSTALL CRANKSHAFT POSITION SENSOR
(a) Apply a light amount of engine oil to a new O–ring.
(b) Install a new O–ring to the crankshaft position sensor.
(c) Install the crankshaft position sensor with the bolt.
Torque: 12 N·m (120 kgf·cm, 9.0 ft·lbf)
NOTICE:
Be careful not to damage the O–ring.

17. INSTALL FUEL RETURN PIPE SUB–ASSY
(a) Install the fuel return pipe with 2 new gaskets and the union bolt.
Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf)
(b) Use the nut to install the clamp to the pipe. Tighten the nut until the clamp's edges make contact with the engine side clamp's edges.

18. INSTALL FUEL FILTER TO INJECTION PUMP FUEL PIPE
(a) Using SST, install the fuel pipe to the common rail and supply pump.
SST 09023–12900
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)
(b) Use the nut to install the clamp to the pipe. Tighten the nut until the clamp's edges make contact with the engine side clamp's edges.

19. INSTALL FUEL PIPE SUB–ASSY
(a) Install 2 new gaskets and the fuel pipe with the union bolt.
Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf)
(b) Use the 2 bolts and nut to install the 3 clamps to the pipe. Tighten the 2 bolts and nut until the clamp's edges make contact with the engine side clamp's edges.

20. INSTALL FUEL PIPE NO. 4
(a) Install the fuel pipe with 5 new gaskets and the 2 bolts.
Torque:
20 N·m (204 kgf·cm, 15 ft·lbf) for M10 bolt
24.5 N·m (250 kgf·cm, 18 ft·lbf) for M12 bolt

21. INSTALL OIL SEPARATOR ASSY
(a) Install the oil separator with the 2 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
(b) Connect the 3 pipes.

22. CONNECT INTAKE AIR CONNECTOR PIPE
(a) Connect the intake air connector pipe.
(b) Tighten the 2 hose clamps.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)
(c) Install the 2 bolts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)
(d) Connect the IAT and turbo pressure sensor connectors.

23. INSTALL ENGINE SIDE COVER SUB–ASSY LH

(a) Install the engine side cover with the bolt.
Torque: 11.5 N·m (117 kgf·cm, 8.0 ft·lbf)

24. ADD FUEL

25. BLEED AIR FROM FUEL SYSTEM (See page 11–5)

26. CONNECT BATTERY NEGATIVE TERMINAL

27. CHECK FOR EXHAUST GAS LEAKS (See page 15–2)

28. CHECK FOR FUEL LEAKS (See page 11–2)

COMMON RAIL ASSY (N04C–TF)

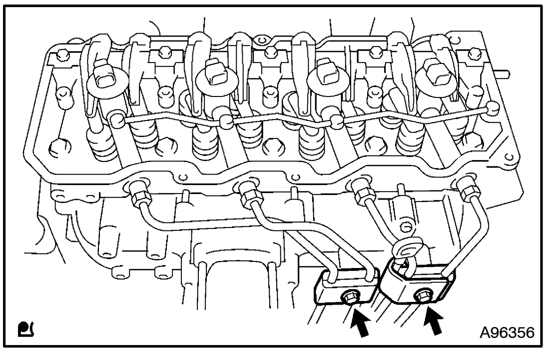
REPLACEMENT

1114J–01

1. **DISCONNECT BATTERY NEGATIVE TERMINAL**
2. **DRAIN FUEL**
3. **REMOVE VENTILATION PIPE NO. 2 (See page 11–20)**
4. **DISCONNECT INTAKE AIR CONNECTOR PIPE (See page 11–10)**
5. **REMOVE VENTILATION PIPE SUB–ASSY (See page 11–20)**
6. **REMOVE BRACKET**

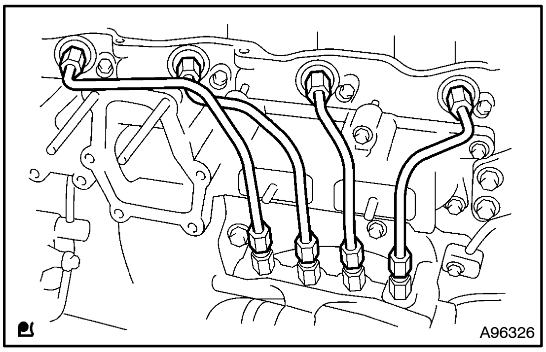
(a) Remove the 4 bolts and bracket.

7. **REMOVE OIL SEPARATOR ASSY (See page 11–10)**

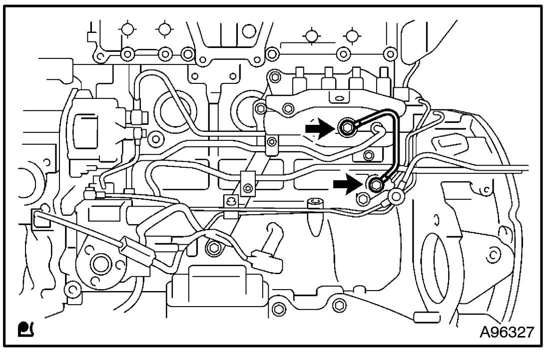


8. **REMOVE FUEL INJECTION PIPE**

(a) Remove the 2 nuts and 2 injection pipe clamps.

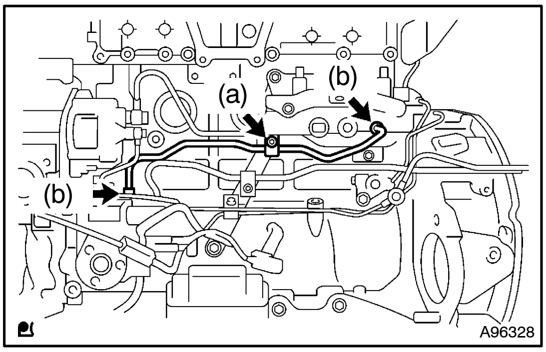


(b) Using SST, remove the 4 injection pipes.
SST 09023–12900



9. **REMOVE FUEL PIPE NO. 4**

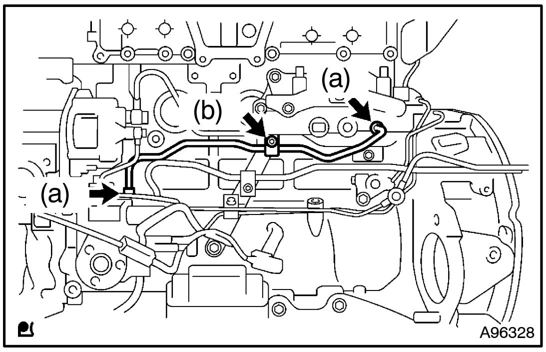
(a) Remove the 2 union bolts, 5 gaskets and fuel pipe.



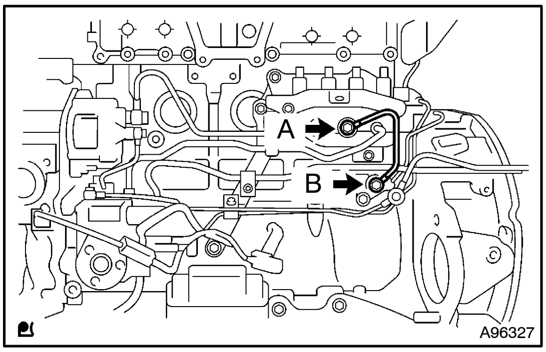
10. **REMOVE FUEL FILTER TO INJECTION PUMP FUEL PIPE**
(a) Remove the nut and clamp.
(b) Using SST, remove the injection pump fuel pipe.
SST 09023–12900

11. **REMOVE COMMON RAIL ASSY**
(a) Disconnect the fuel pressure sensor connector.
(b) Remove the 2 bolts, bracket and common rail.

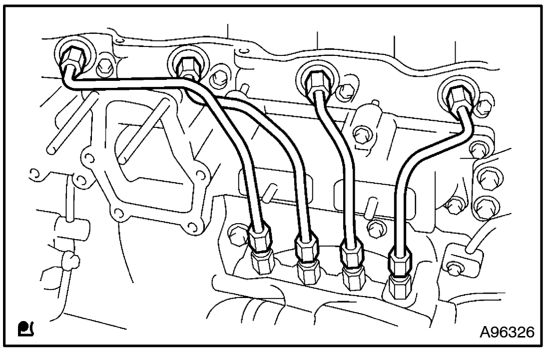
12. **INSTALL COMMON RAIL ASSY**
(a) Install the bracket and common rail with the 2 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
(b) Connect the fuel pressure sensor connector.



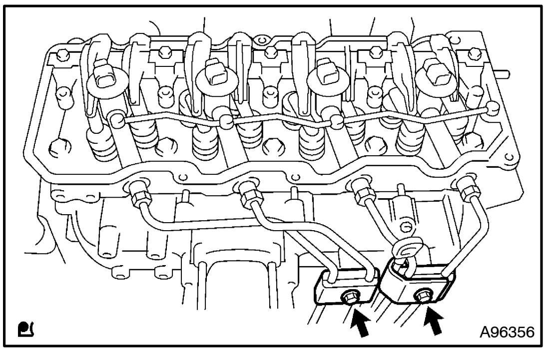
13. **INSTALL FUEL FILTER TO INJECTION PUMP FUEL PIPE**
(a) Using SST, install the fuel pipe.
SST 09023–12900
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)
(b) Use the nut to install the clamp to the pipe. Tighten the nut until the clamp's edges make contact with the engine side clamp's edges.



14. **INSTALL FUEL PIPE NO. 4**
(a) Install 5 new gaskets in place and tighten the 2 union bolts. Then install the fuel pipe.
Torque:
20 N·m (204 kgf·cm, 15 ft·lbf) for bolt A
24.5 N·m (250 kgf·cm, 18 ft·lbf) for bolt B



15. **INSTALL FUEL INJECTION PIPE**
(a) Using SST, install the 4 injection pipes.
SST 09023–12900
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)



(b) Use the 2 nuts to install the 2 clamps around the 4 pipes. Tighten each nut until each clamp's edges make contact with its respective engine side clamp's edges.

16. INSTALL OIL SEPARATOR ASSY (See page 11–10)

17. INSTALL BRACKET

(a) Install the bracket with the 4 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

18. INSTALL VENTILATION PIPE SUB–ASSY (See page 11–20)

19. INSTALL INTAKE AIR CONNECTOR PIPE (See page 11–10)

20. INSTALL VENTILATION PIPE NO. 2 (See page 11–20)

21. ADD FUEL

22. BLEED AIR FROM FUEL SYSTEM (See page 11–5)

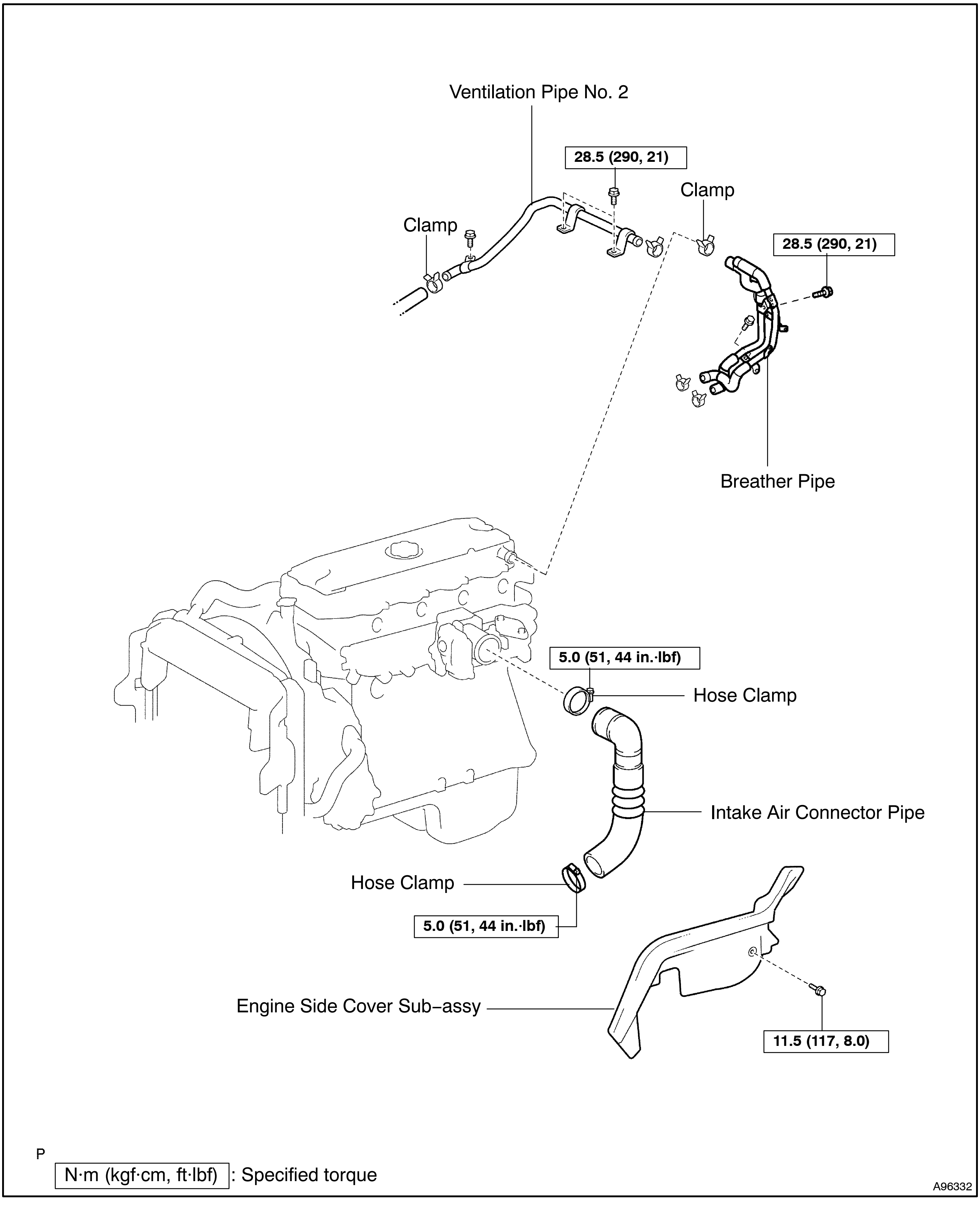
23. CONNECT BATTERY NEGATIVE TERMINAL

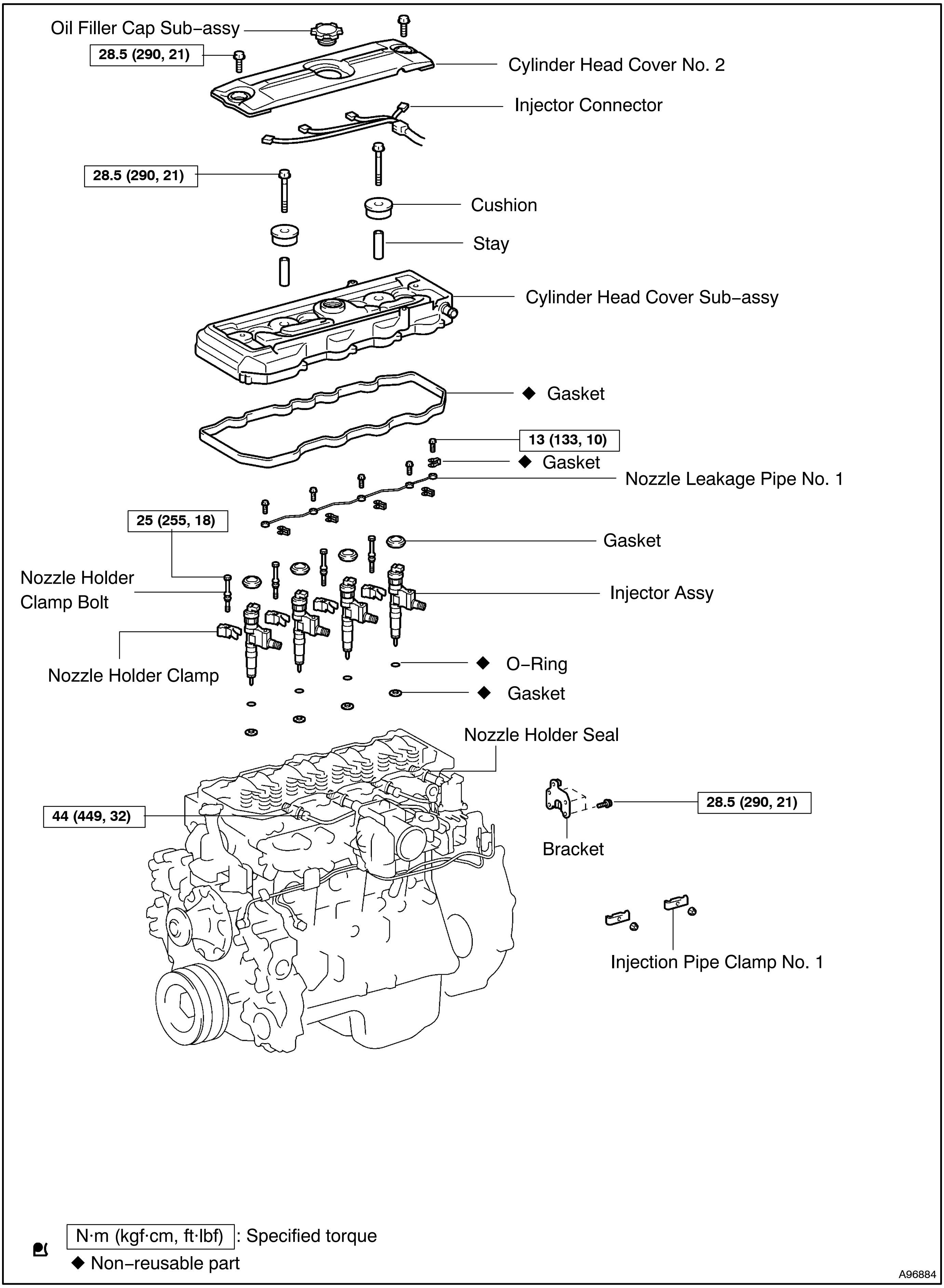
24. CHECK FOR FUEL LEAKS (See page 11–2)

INJECTOR ASSY (N04C–TF)

COMPONENTS

1114K–01




Oil Filler Cap Sub–assy
28.5 (290, 21)
Cylinder Head Cover No. 2
Injector Connector
28.5 (290, 21)
Cushion
Stay
Cylinder Head Cover Sub–assy
◆ Gasket
13 (133, 10)
◆ Gasket
Nozzle Leakage Pipe No. 1
25 (255, 18)
Gasket
Nozzle Holder Clamp Bolt
Injector Assy
Nozzle Holder Clamp
◆ O–Ring
◆ Gasket
Nozzle Holder Seal
44 (449, 32)
28.5 (290, 21)
Bracket
Injection Pipe Clamp No. 1
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
A96884

1114L–01

REPLACEMENT

1. DISCONNECT BATTERY NEGATIVE TERMINAL

2. DRAIN FUEL

3. CHECK INJECTOR COMPENSATION CODE (see page 05–13)

4. REMOVE ENGINE SIDE COVER SUB–ASSY LH

(a) Remove the bolt and engine side cover.

5. REMOVE VENTILATION PIPE NO. 2

(a) Loosen the 2 clamps and disconnect the 2 hoses from the ventilation pipe.

(b) Remove the 3 bolts and ventilation pipe from the cylinder head.

6. REMOVE INTAKE AIR CONNECTOR PIPE

(a) Loosen the 2 hose clamps and remove the intake air connector pipe.

7. REMOVE OIL FILLER CAP SUB–ASSY

8. REMOVE CYLINDER HEAD COVER NO. 2

(a) Remove the 2 bolts and cylinder head cover.

9. REMOVE CYLINDER HEAD COVER SUB–ASSY

(a) Disconnect the 4 injector connectors.

(b) Remove the 2 bolts and cylinder head cover.

(c) Remove the cushion, stay and gasket from the cylinder head cover.

(d) Remove the 4 gaskets from the 4 injectors.

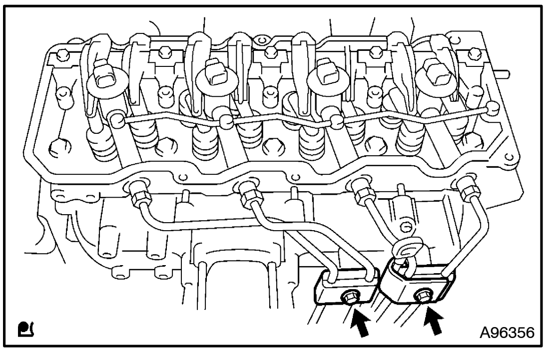
10. REMOVE BREATHER PIPE

(a) Loosen the 2 clamps and disconnect the 2 hoses from the oil separator.

(b) Remove the 2 bolts and breather pipe.

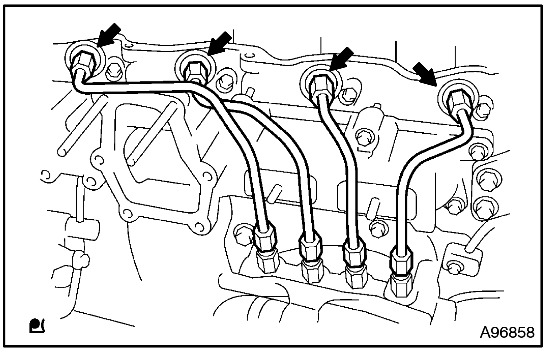
11. REMOVE BRACKET

(a) Remove the 4 bolts and bracket.



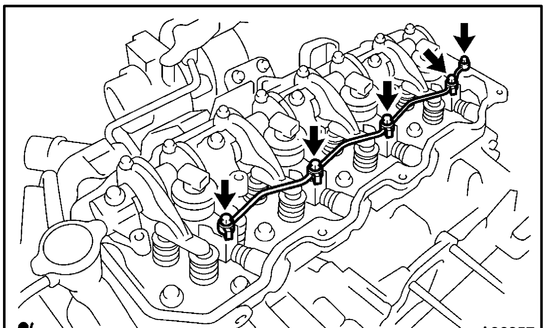
12. REMOVE INJECTION PIPE CLAMP NO. 1

(a) Remove the 2 nuts and 2 clamps.



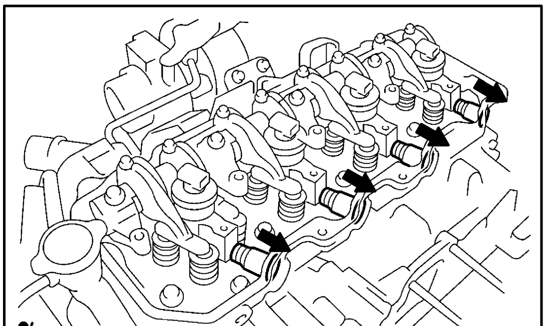
13. REMOVE INJECTOR ASSY

(a) Using SST, disconnect the fuel injection pipe's 4 nuts from the injectors.
SST 09023–12900

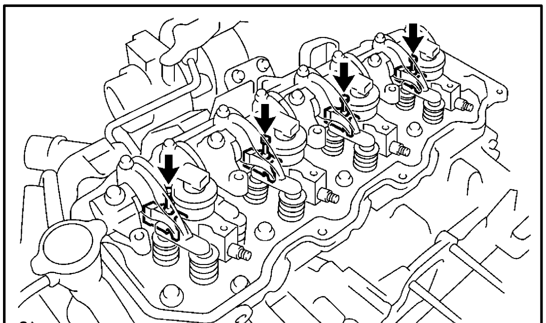

A96357

(b) Remove the 5 union bolts and nozzle leakage pipe No. 1.
(c) Remove the 5 gaskets from the nozzle leakage pipe No. 1.

NOTICE:
When removing the nozzle leakage pipe, place a shop rag under the pipe to protect the cylinder head from the fuel remaining inside the pipe.


A96358

(d) Using a screwdriver, move the 4 nozzle holder seals as shown in illustration.


A96359

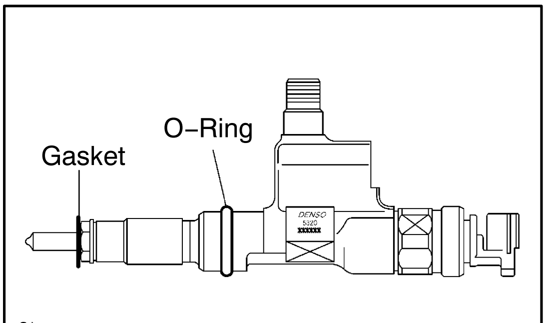
(e) Remove the 4 bolts and 4 nozzle holder clamps.
(f) Remove the 4 injectors.
(g) Remove the 4 O–rings from the injector assy.

NOTICE:
When replacing the injector, store them in the correct order so that they can be returned to the original locations when reassembling.

(h) Remove the 4 gaskets from the cylinder head.

14. REGISTER INJECTOR COMPENSATION CODE (WHEN REPLACING NEW INJECTOR) (See page 05–17)

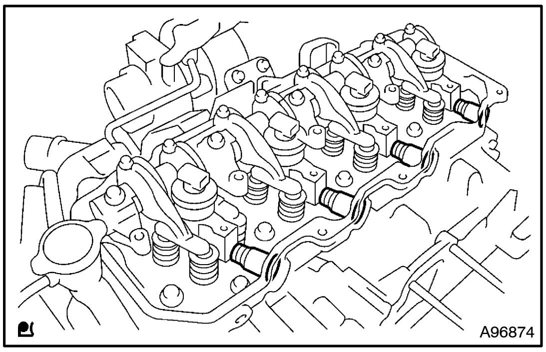
HINT:
Each injector has characteristic fuel injecting behavior.



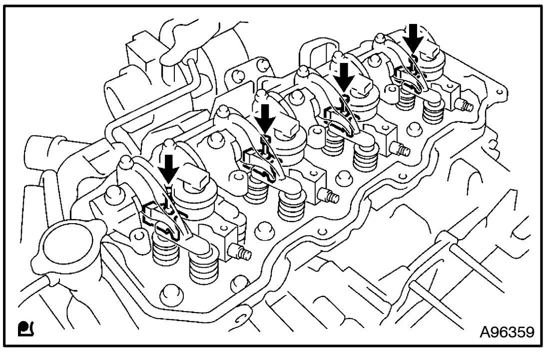
A96362

15. INSTALL INJECTOR ASSY
(a) Apply a light amount of engine oil to the O–rings to each injector.
(b) Install a new O–ring to each injector.
(c) Install a new gasket to each injector.
(d) Install the 4 injectors to the cylinder head.

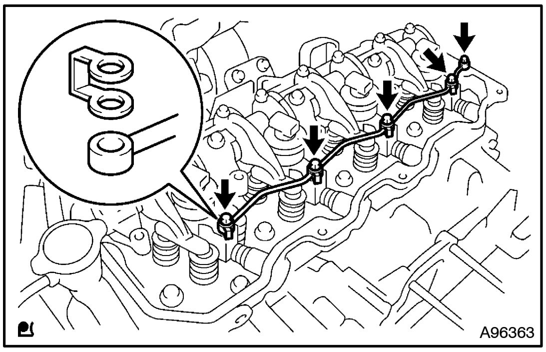
NOTICE:
Fit the injectors to the gaskets.



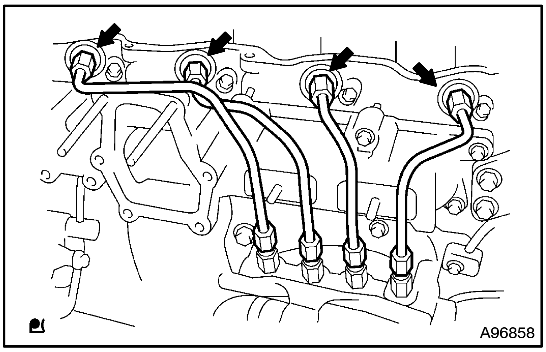
(e) Install the 4 nozzle holder seals and 4 gaskets.



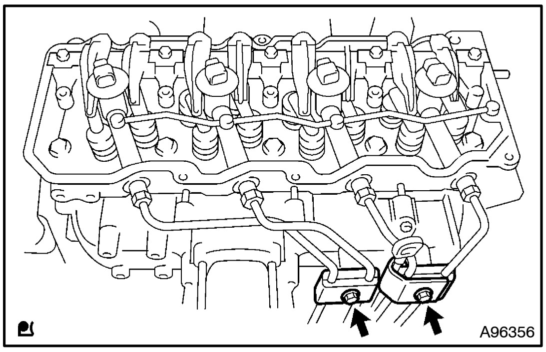
(f) Install the 4 nozzle holder clamps with the 4 bolts.
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)



(g) Install 5 new gaskets and the nozzle leakage pipe with the 5 bolts.
Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)



(h) Using SST, tighten the nuts of the injection pipes.
SST 09023–12900
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)



16. INSTALL INJECTION PIPE CLAMP NO. 1

(a) Use the 2 nuts to install 2 clamps around the 4 pipes. Tighten each nut until each clamp's edges make contact with its respective engine side clamp's edges.

17. INSTALL BRACKET

(a) Install the bracket with the 4 bolts.
Torque: 28.5 N·m (290 kgf·cm, 21 ft·lbf)

18. INSTALL BREATHER PIPE

(a) Install the breather pipe with the 2 bolts.
Torque: 28.5 N·m (290 kgf·cm, 21 ft·lbf)

(b) Connect the 2 hoses to the oil separator with the 2 clamps.

(c) Connect the pipe to the cylinder head cover with the clamp.

19. INSTALL CYLINDER HEAD COVER SUB–ASSY

(a) Install the 4 gaskets to the 4 injectors.

(b) Install the gasket, stay and cushion to the cylinder head cover.

(c) Install the cylinder head cover to the cylinder head with the 2 bolts.
Torque: 28.5 N·m (290 kgf·cm, 21 ft·lbf)

(d) Connect the 4 injector connectors.

20. INSTALL CYLINDER HEAD COVER NO. 2

(a) Install the cylinder head cover with the 2 bolts.
Torque: 28.5 N·m (290 kgf·cm, 21 ft·lbf)

21. INSTALL OIL FILLER CAP SUB–ASSY

22. INSTALL INTAKE AIR CONNECTOR PIPE

(a) Install the connector pipe with the 2 hose clamps.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)

23. INSTALL VENTILATION PIPE NO. 2

(a) Install the ventilation pipe to the cylinder head with the 3 bolts.
Torque: 28.5 N·m (290 kgf·cm, 21 ft·lbf)

(b) Connect the 2 hoses to the ventilation pipe with the 2 clamps.

24. INSTALL ENGINE SIDE COVER SUB–ASSY LH

(a) Install the engine side cover with the bolt.
Torque: 11.5 N·m (117 kgf·cm, 8 ft·lbf)

25. ADD FUEL

26. BLEED AIR FROM FUEL SYSTEM (See page 11–5)

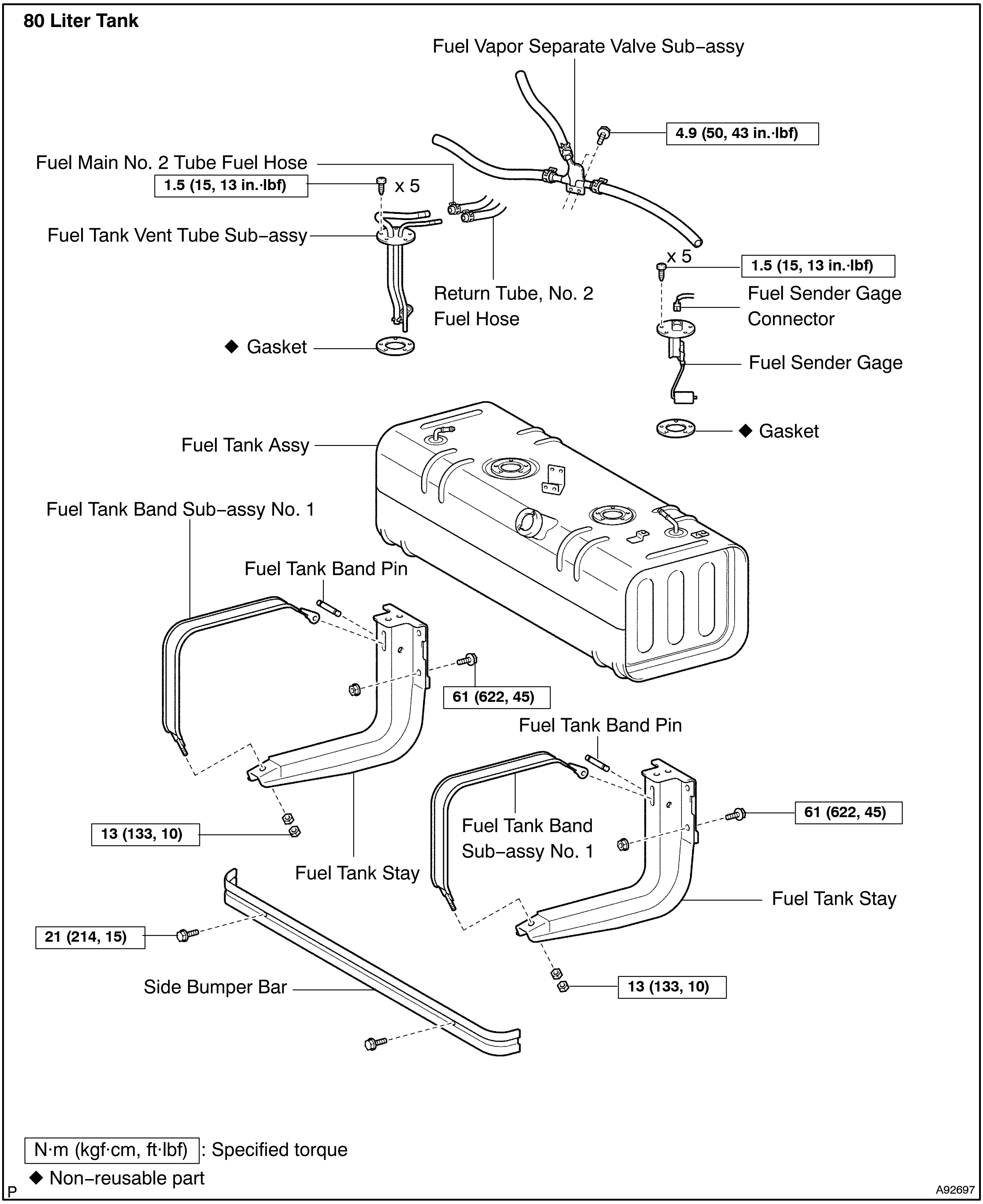
27. CONNECT BATTERY NEGATIVE TERMINAL

28. CHECK FOR FUEL LEAKS (See page 11–2)

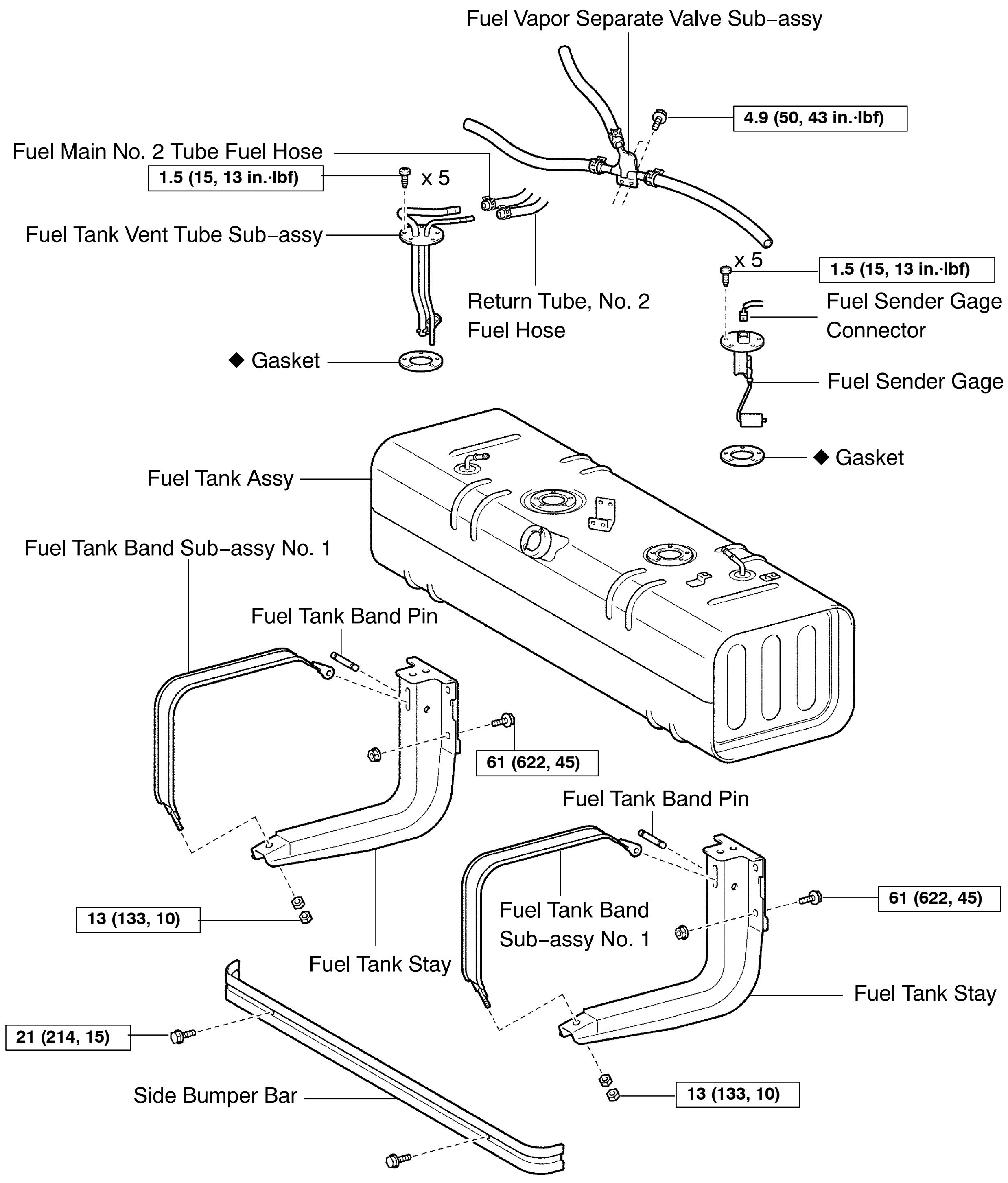
FUEL TANK ASSY (N04C–TF)

COMPONENTS

1114M–01



100 Liter Tank



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

◆ Non–reusable part

P A92698

1114N–01

REPLACEMENT

1. **DISCONNECT BATTERY NEGATIVE TERMINAL**
2. **DRAIN FUEL**
3. **REMOVE SIDE BUMPER BAR**
(a) Remove the 2 bolts and bumper bar.
4. **DISCONNECT FUEL MAIN NO.2 TUBE FUEL HOSE**
5. **DISCONNECT RETURN TUBE, NO.2 FUEL HOSE**
6. **REMOVE FUEL VAPOR SEPARATE VALVE**
(a) Disconnect the 2 hoses from the fuel tank.
(b) Remove the 2 bolts and separate valve.
7. **REMOVE FUEL TANK ASSY**
(a) Disconnect the fuel sender gauge connector.
(b) Remove the 4 nuts, take out the 2 tank bands, and then remove the fuel tank from the 2 tank stays.
8. **REMOVE FUEL TANK VENT TUBE SUB–ASSY**
(a) Remove the 5 screws, vent tube and gasket.
9. **REMOVE FUEL SENDER GAGE ASSY**
(a) Remove the 5 screws, fuel sender gage and gasket.
10. **INSTALL FUEL SENDER GAGE ASSY**
(a) Install the sender gage with a new gasket and the 5 screws.
Torque: 1.5 N·m (15 kgf·cm, 13 in.·lbf)
11. **INSTALL FUEL TANK VENT TUBE SUB–ASSY**
(a) Install the vent tube with a new gasket and the 5 screws.
Torque: 1.5 N·m (15 kgf·cm, 13 in.·lbf)
12. **INSTALL FUEL TANK ASSY**
(a) Install the fuel tank to the fuel tank stays.
(b) Bind the fuel tank with the 2 tank bands.
(c) Install the 4 nuts.
Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)
(d) Connect the sender gage connector.
13. **INSTALL FUEL VAPOR SEPARATE VALVE**
(a) Install the separate valve with the 2 bolts.
Torque: 4.9 N·m (50 kgf·cm, 43 in.·lbf)
(b) Connect the 2 hoses to the fuel tank.
14. **CONNECT RETURN TUBE, NO.2 FUEL HOSE**
15. **CONNECT FUEL MAIN NO.2 TUBE FUEL HOSE**
16. **INSTALL SIDE BUMPER BAR**
(a) Install the side bumper bar with the 2 bolts.
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)
17. **ADD FUEL**
18. **BLEED AIR FROM FUEL SYSTEM (See page 11–5)**
19. **CONNECT BATTERY NEGATIVE TERMINAL**
20. **CHECK FOR FUEL LEAKS (See page 11–2)**

EMISSION CONTROL

EMISSION CONTROL SYSTEM
(N04C–TF) 12–1
ON–VEHICLE INSPECTION 12–1
INSPECTION 12–2

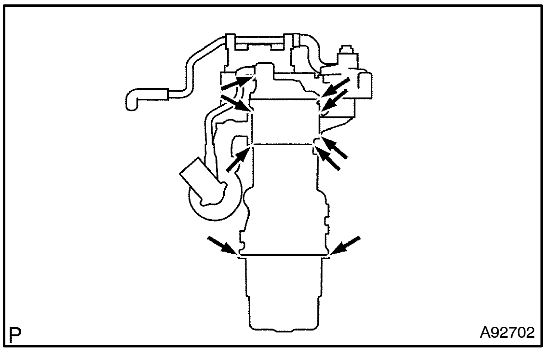
REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)

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

EMISSION CONTROL SYSTEM (N04C–TF)

120ES–01

ON–VEHICLE INSPECTION



1. **VISUALLY CHECK HOSES, CONNECTIONS AND GASKETS**

(a) Check for cracks, leaks or damage.

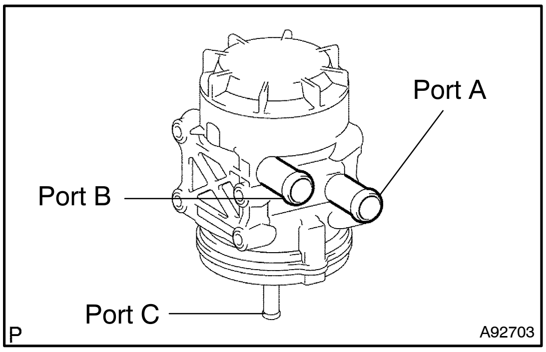
HINT:

Be sure to check the areas indicated by the arrow marks.

If the hoses, gaskets or connections are damaged, repair or replace parts as necessary.

120ET–01

INSPECTION



1. INSPECT OIL SEPARATOR ASSY

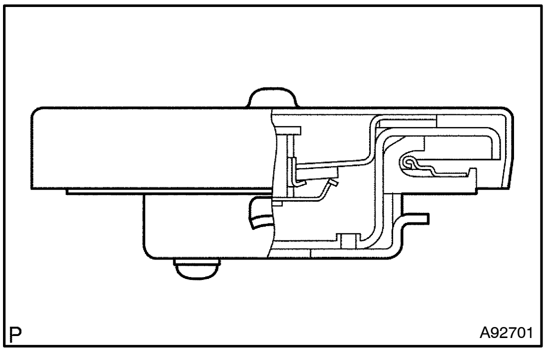
(a) Check oil separator operation.

(1) Check oil separator operations.

OK:

Condition	Specified Condition
Close ports B and C, then apply vacuum to port A (1.96 kPa (14.7 mmHg, 0.58 in.Hg))	No leaks
Close port C, then apply vacuum to port A (1.96 kPa (14.7 mmHg, 0.58 in.Hg))	Air drawn into port B

If the result is not as specified, replace the oil separator.



2. CHECK FUEL TANK CAP ASSY

(a) Visually check if the cap is deformed or damaged.

If necessary, replace the cap.

INTAKE

TURBOCHARGER SYSTEM (N04C−TF) .... 13−1
PRECAUTION .... 13−1
ON−VEHICLE INSPECTION .... 13−3
TURBOCHARGER SUB−ASSY
(N04C−TF) .... 13−5
COMPONENTS .... 13−5
REPLACEMENT .... 13−6
CHARGE AIR COOLER ASSY
(N04C−TF) .... 13−8
COMPONENTS .... 13−8
REPLACEMENT .... 13−9

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1−YXZE05A)

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

TURBOCHARGER SYSTEM (N04C–TF)

PRECAUTION

13094–01

1. MAINTENANCE PRECAUTION

(a) Do not stop the engine immediately after pulling a trailer or after high speed or uphill driving. Idle the engine for 20 to 120 seconds depending on how hard vehicle has been driven.

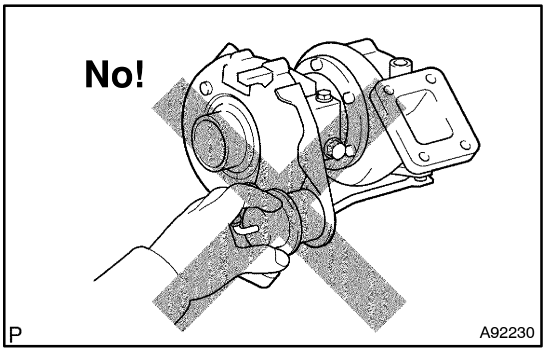
(b) Avoid sudden acceleration or racing immediately after starting a cold engine.

(c) If the turbocharger is defective and must be replaced, check the list below for the cause, and correct the problem:

(1) Engine oil level and quality

(2) Conditions under which the turbocharger was used

(3) Oil lines leading to the turbocharger

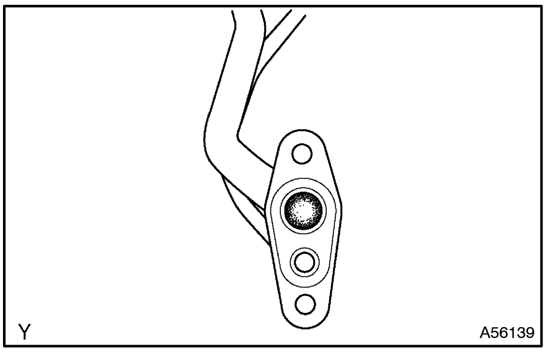


(d) Handle the turbocharger with care.

NOTICE:

- **When installing/removing the turbocharger, do not drop or strike the turbocharger.**
- **When moving the turbochager, do not grasp it by an easily–deformed part such as the actuator and push rod.**

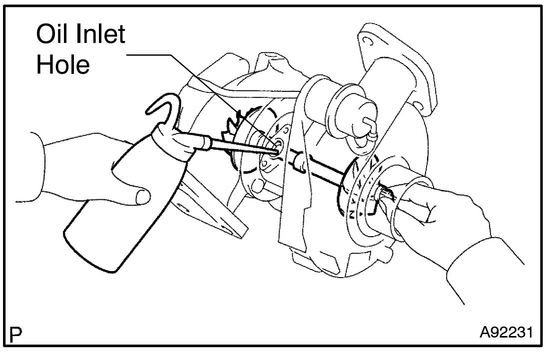
(e) Before removing the turbocharger, plug the intake and exhaust ports and oil inlet to prevent entry of dirt or other foreign material.



(f) If replacing the turbocharger, check for accumulation of hardened oil in the oil pipe. If necessary, replace the oil pipe.

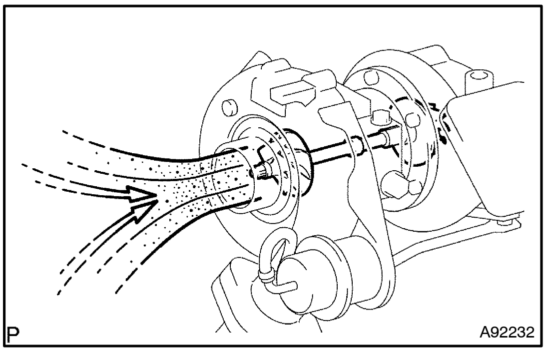
(g) Completely remove the gasket adhered to the lubrication oil pipe flange and turbocharger oil flange.

(h) When replacing the bolts or nuts, use only authorized replacement parts to prevent damage or deformation.



(i) If replacing the turbocharger, put 20 cm^3 (1.2 cu in.) of fresh oil into the turbocharger oil inlet hole and turn the turbine wheel by hand to spread oil to the bearing.

(j) If overhauling the engine, cut the fuel supply after reassembly and crank the engine. Then allow the engine to idle for 60 seconds.



(k) If the engine is running without the air cleaner, case cover and hose, entry of foreign particles will damage the wheels, which run at extremely high speed.

13095–01

ON–VEHICLE INSPECTION

1. CHECK INTAKE AIR SYSTEM

(a) Check for leakage or clogging between the air cleaner housing and turbocharger inlet, and between the turbocharger outlet and cylinder head.

(1) If the air cleaner is clogged, clean or replace the element.

(2) If hoses are collapsed or deformed, repair or replace them.

(3) If connections are leaking, check each connection and repair as necessary.

(4) If components are cracked, replace them.

2. CHECK EXHAUST SYSTEM

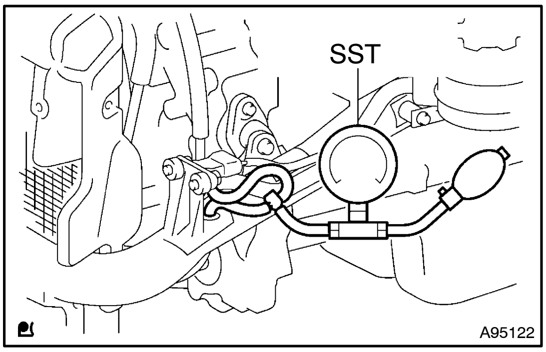
(a) Check for leakage or clogging between the cylinder head and turbocharger inlet, and between the turbocharger outlet and exhaust pipe.

(1) If the air cleaner is clogged, clean or replace the element.

(2) If hoses are collapsed or deformed, repair or replace them.

(3) If connections are leaking, check each connection and repair as necessary.

(4) If components are cracked, replace them.



3. CHECK TURBOCHARGING PRESSURE

(a) Warm up the engine.

(b) Using a 3–way connector, connect SST (turbocharger pressure gauge) to the hose leading to the intake air connector.

SST 09992–00242

(c) While depressing the clutch pedal, fully depress the accelerator pedal. Measure the turbocharging pressure at maximum speed (3,600 to 3,700 rpm).

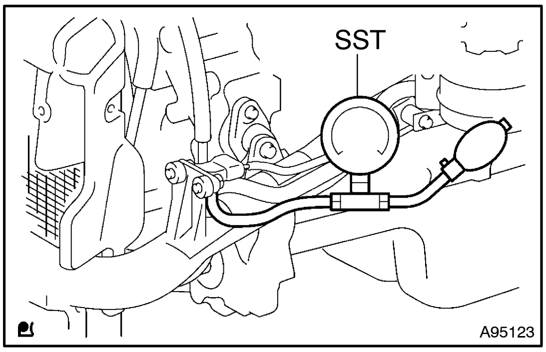
Standard pressure:

35 to 65 kPa (0.3 to 0.6 kgf/cm^2, 4.2 to 8.5 psi)

If the pressure is less than specified, check both the intake air and exhaust systems for leakage.

If there is no leakage, check if the actuator hose has disconnected. If not, check the turbocharger.

If the pressure is greater than specified, check if the actuator hose is disconnected or cracked. If not, check the turbocharger.



4. **CHECK MIL**

(a) Turn the ignition switch ON, and check that the MIL turns ON.

(b) Start the engine, and check that the MIL turns OFF.

(c) Connect SST (turbocharger pressure gauge) to the turbo pressure sensor.

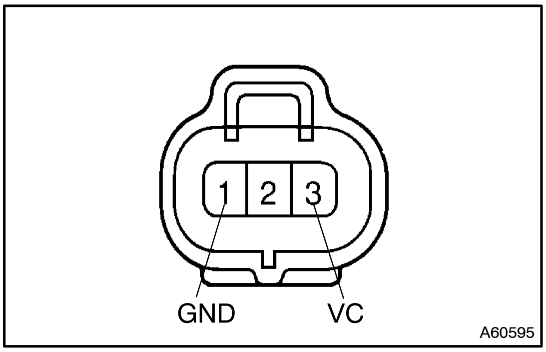
(d) Idle the engine. Check that the MIL turns on when applying pressure with the turbocharger pressure gauge.

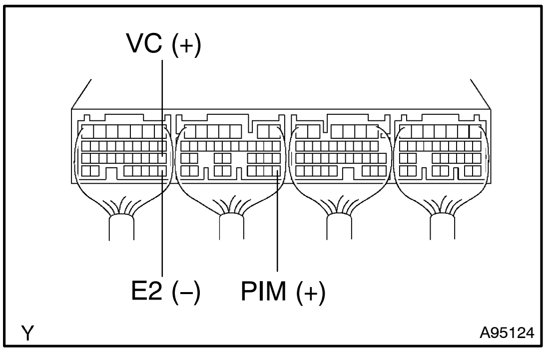
Standard pressure:

150 kPa (1.5 kgf/cm^2, 21 psi)

NOTICE:

After checking the lamp, clear the DTC.





5. **CHECK TURBO PRESSURE SENSOR**

(a) Inspect power source voltage.

(1) Disconnect the turbo pressure sensor connector.

(2) Turn the ignition switch ON.

(3) Using a voltmeter, measure the voltage between connector terminals 3 (VC) and 1 (GND) of the wiring harness side.

Voltage: 4.5 to 5.5 V

(4) Turn the ignition switch OFF.

(5) Reconnect the turbo pressure sensor connector.

(b) Inspect power supply.

(1) Turn the ignition switch ON.

(2) Disconnect the vacuum hose from the turbo pressure sensor.

(3) Connect a voltmeter to terminals PIM and E2 of the ECM and measure the output voltage under atmospheric pressure.

(4) Apply a vacuum to the turbo pressure sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.5 kPa (500 mmHg, 19.96 in.Hg).

(5) Measure the voltage decrease from step (3) above for each segment.

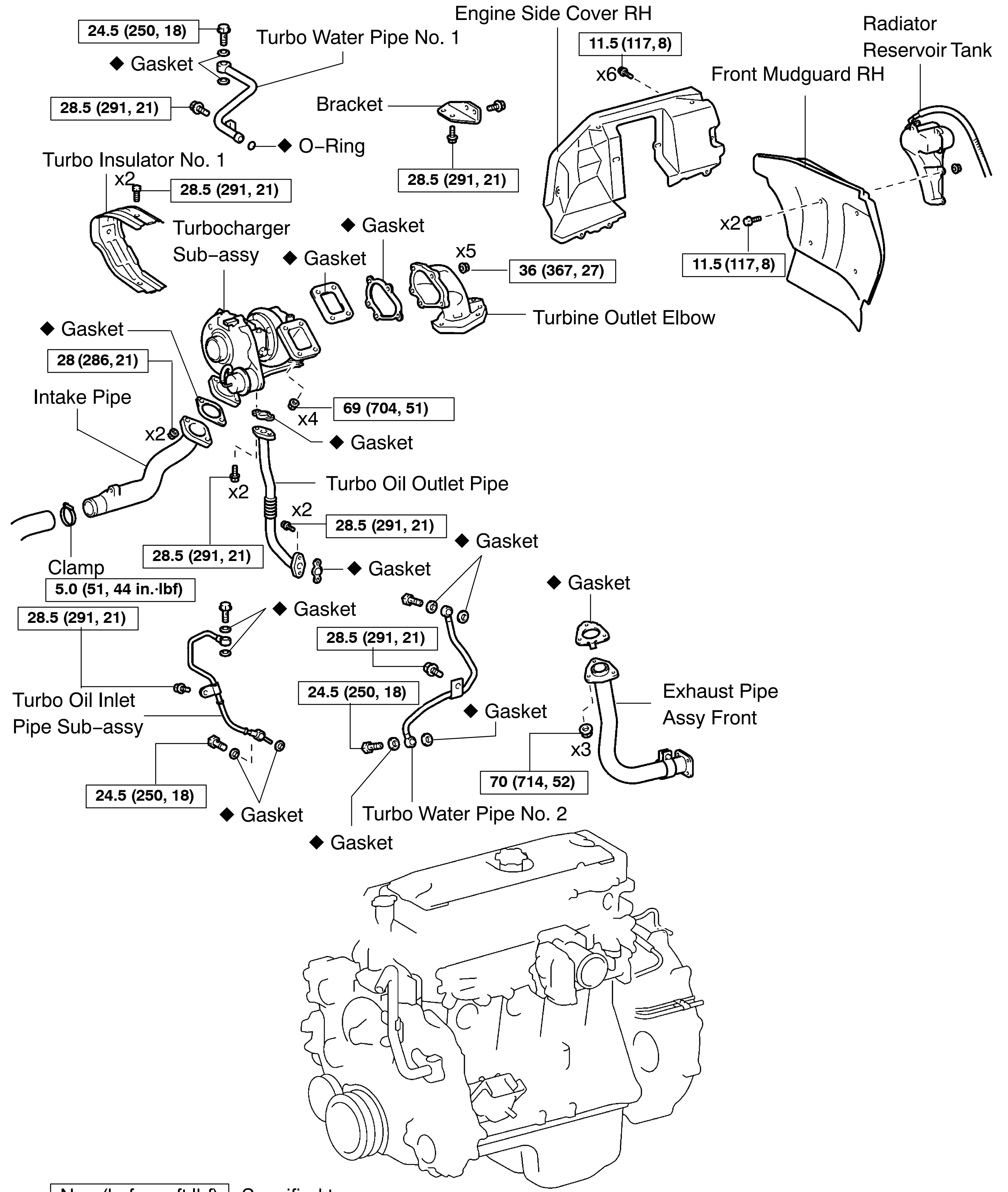
Voltage drop:

Apply Vacuum	Voltage Decrease
93.0 kPa (675 mmHg, 27.5 in.Hg)	0.25 to 0.4 V
150 kPa (1,125 mmHg, 44 in.Hg)	1.0 to 1.4 V

TURBOCHARGER SUB–ASSY (N04C–TF)

COMPONENTS

13096–01



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

◆ Non–reusable part

REPLACEMENT

1. DRAIN ENGINE COOLANT **(See page 16–3)**

2. REMOVE ENGINE SIDE COVER RH

3. REMOVE FRONT MUDGUARD RH

4. REMOVE AIR HOSE ASSY

(a) Loosen the hose clamp.

(b) Remove the 2 bolts and pipe.

5. REMOVE VENTILATION PIPE NO. 2

(a) Disconnect the breather hose.

(b) Remove the 3 bolts and pipe.

6. REMOVE EXHAUST PIPE ASSY FRONT **(See page 15–2)**

7. REMOVE INTAKE PIPE

(a) Loosen the hose clamp.

(b) Disconnect the air hose No. 2.

(c) Remove the 2 nuts and pipe.

8. REMOVE TURBO INSULATOR NO. 1

(a) Remove the 2 bolts and insulator.

9. REMOVE TURBO OIL INLET PIPE SUB–ASSY

(a) Remove the bolt, 2 union bolts, 4 gaskets and pipe.

10. REMOVE TURBO OIL OUTLET PIPE

(a) Remove the 4 bolts, 2 gaskets and pipe.

11. REMOVE TURBO WATER PIPE NO. 1

(a) Remove the bolt, union bolt, 2 gaskets, O–ring and pipe.

12. REMOVE TURBO WATER PIPE NO. 2

(a) Remove the bolt, 2 union bolts, 4 gaskets and pipe.

13. REMOVE BRACKET

(a) Remove the 2 bolts and bracket.

14. REMOVE TURBINE OUTLET ELBOW

(a) Remove the 5 nuts, gasket and elbow.

15. REMOVE TURBOCHARGER SUB–ASSY

(a) Remove the 4 nuts, gasket and turbocharger.

16. INSTALL TURBOCHARGER SUB–ASSY

(a) Install a new gasket and the turbocharger with the 4 nuts.
Torque: 69 N·m (704 kgf·cm, 51 ft·lbf)

17. INSTALL TURBINE OUTLET ELBOW

(a) Install a new gasket and the outlet elbow with the 5 nuts.
Torque: 36 N·m (367 kgf·cm, 27 ft·lbf)

18. INSTALL BRACKET

(a) Install the bracket with the 2 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

19. INSTALL TURBO WATER PIPE NO. 1

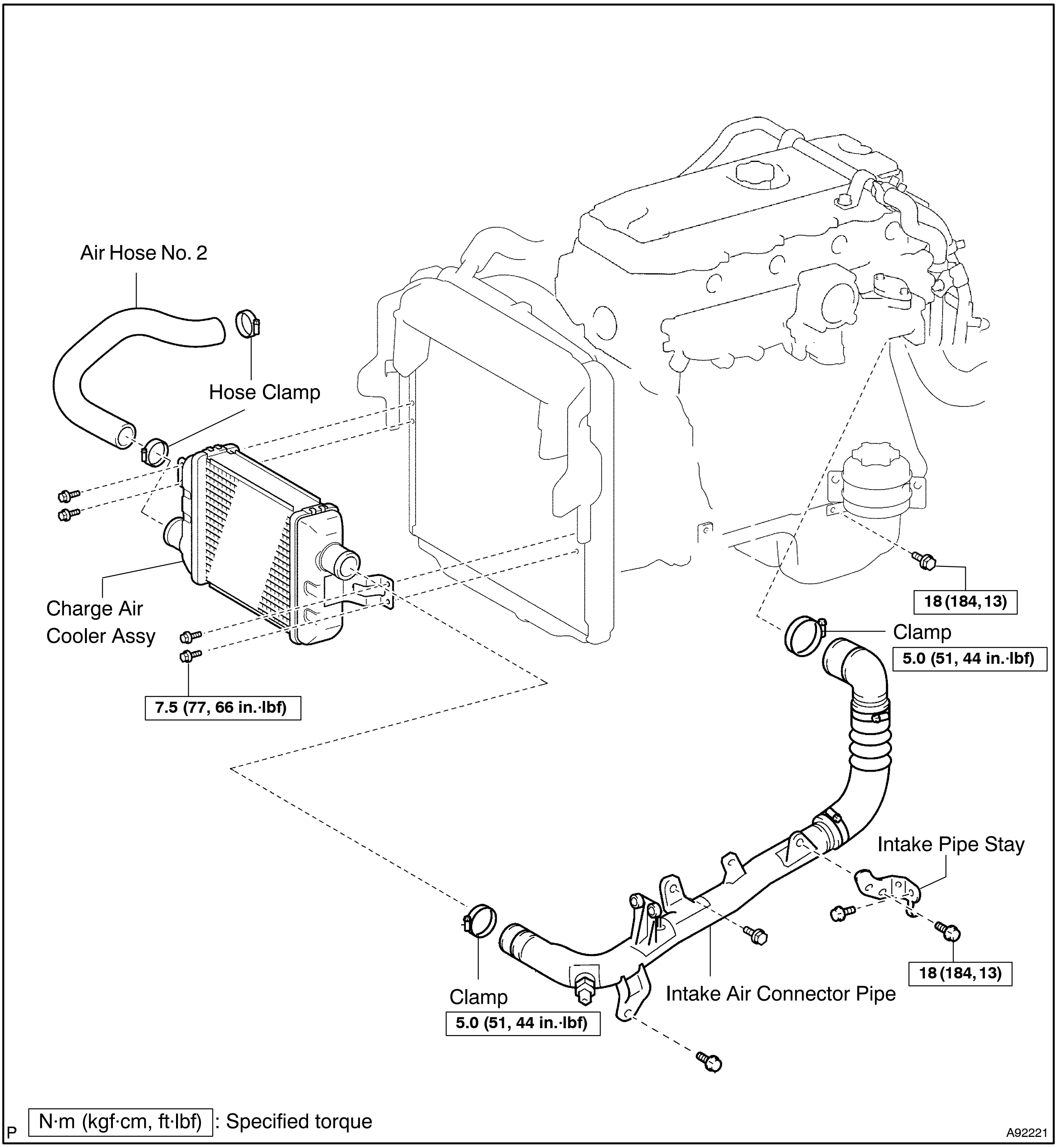
(a) Install 2 new gaskets, new O–ring and the pipe with the bolt and union bolt.
Torque:
24.5 N·m (250 kgf·cm, 18 ft·lbf) for union bolt
28.5 N·m (291 kgf·cm, 21 ft·lbf) for bolt

20. INSTALL TURBO WATER PIPE NO. 2
(a) Install 4 new gaskets and the pipe with the bolt and 2 union bolts.
Torque:
24.5 N·m (250 kgf·cm, 18 ft·lbf) for union bolt
28.5 N·m (291 kgf·cm, 21 ft·lbf) for bolt
21. INSTALL TURBO OIL OUTLET PIPE
(a) Install 2 new gaskets and the pipe with the 4 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
22. INSTALL TURBO OIL INLET PIPE SUB–ASSY
(a) Install 4 new gaskets and the pipe with the bolt and 2 union bolts.
Torque:
24.5 N·m (250 kgf·cm, 18 ft·lbf) for union bolt
28.5 N·m (291 kgf·cm, 21 ft·lbf) for bolt
23. INSTALL TURBO INSULATOR NO. 1
(a) Install the insulator with the 2 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
24. INSTALL BRACKET
25. INSTALL INTAKE PIPE
(a) Install a new gasket and the pipe with the 2 nuts.
Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)
(b) Connect the air hose No. 2.
(c) Tighten the hose clamp.
26. INSTALL EXHAUST PIPE ASSY FRONT (See page 15–2)
27. INSTALL VENTILATION PIPE NO. 2
(a) Install the pipe with the 3 bolts.
(b) Connect the breather hose.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
28. INSTALL AIR HOSE ASSY
(a) Install the pipe with the 2 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
(b) Tighten the hose clamp.
29. INSTALL FRONT MUDGUARD RH
30. INSTALL ENGINE SIDE COVER RH
31. ADD ENGINE COOLANT (See page 16–3)
32. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)
33. CHECK FOR EXHAUST GAS LEAKS

CHARGE AIR COOLER ASSY (N04C–TF)

COMPONENTS

13098–01



13099–01

REPLACEMENT

1. REMOVE INTAKE AIR CONNECTOR PIPE

(a) Disconnect the IAT sensor and vacuum sensor connectors.
(b) Remove the 2 bolts.
(c) Loosen the 2 clamps and disconnect the pipe.

2. DISCONNECT AIR HOSE NO. 2

(a) Loosen the 2 clamps and disconnect the hose.

3. REMOVE CHARGE AIR COOLER ASSY

(a) Remove the 4 bolts and cooler.

4. INSTALL CHARGE AIR COOLER ASSY

(a) Install the cooler with the 4 bolts.
Torque: 7.5 N·m (77 kgf·cm, 66 in.·lbf)

5. CONNECT AIR HOSE NO. 2

(a) Connect the hose.
(b) Tighten the 2 clamps.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)

6. INSTALL INTAKE AIR CONNECTOR PIPE

(a) Connect the pipe.
(b) Tighten the 2 clamps.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)
(c) Install the 2 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
(d) Connect the IAT sensor and vacuum sensor connectors.

ENGINE MECHANICAL

ENGINE (N04C–TF)	14–1
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CAMSHAFT (N04C–TF)	14–24
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REPLACEMENT	14–29
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REPLACEMENT	14–34
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REPLACEMENT	14–36

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)

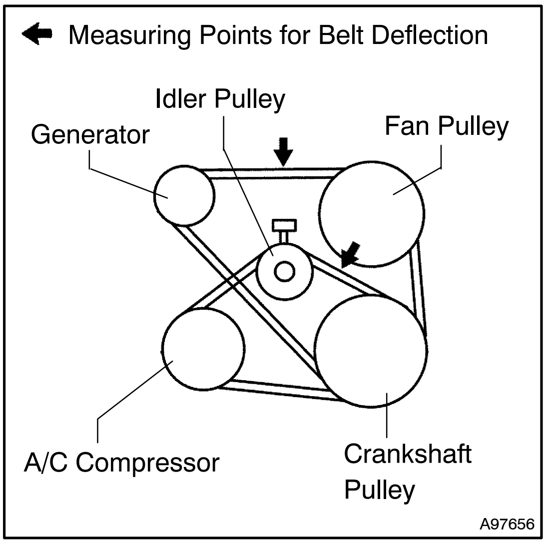
NOTE: The following pages contain only the points which differ from the above listed manuals.

ENGINE (N04C–TF)

141UI–01

INSPECTION

1. **INSPECT COOLANT (See page 16–3)**
2. **INSPECT ENGINE OIL (See page 17–3)**
3. **INSPECT BATTERY**
4. **INSPECT AIR CLEANER FILTER ELEMENT SUB–ASSY**



5. **INSPECT DRIVE BELT**

(a) Check the belt deflection by pressing on the belt at the points indicated by the arrow marks in the illustration with 98 N·m (10 kgf·cm, 22 ft·lbf).

Deflection:

Item		Specified Condition
Belt (for generator)	New belt	10.5 to 12.5 mm (0.413 to 0.492 in.)
Belt (for generator)	Used belt	12.5 to 16 mm (0.413 to 0.629 in.)
Belt (for A/C compressor)	New belt	8.5 to 10 mm (0.334 to 0.393 in.)
Belt (for A/C compressor)	Used belt	10 to 12 mm (0.393 to 0.472 in.)

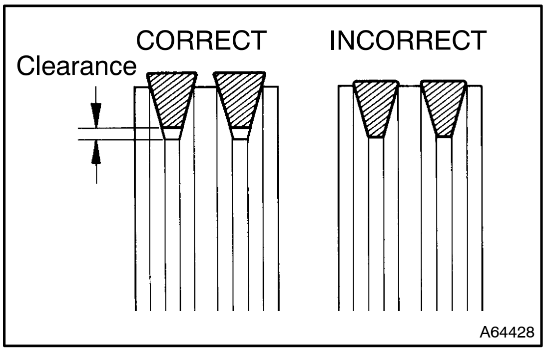
If the belt deflection is not as specified, adjust it.

(b) Reference:
Using a tension gauge, check the belt tension.

Tension:

Item		Specified Condition
Belt (for generator)	New belt	370 to 490 N·m (38 to 50 kgf·cm, 84 to 110 ft·lbf)
Belt (for generator)	Used belt	245 to 315 N·m (25 to 32 kgf·cm, 55 to 71 ft·lbf)
Belt (for A/C compressor)	New belt	345 to 390 N·m (35 to 40 kgf·cm, 77 to 88 ft·lbf)
Belt (for A/C compressor)	Used belt	225 to 295 to N·m (23 to 30 kgf·cm, 51 to 66 ft·lbf)

If the belt tension is not as specified, adjust it.



HINT:

- After installing the belt, check that it fits properly in the ribbed grooves. Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- A ”new belt” is a belt which has been used for less than 5 minutes on a running engine.
- A ”used belt” is a belt which has been used on a running engine for 5 minutes or more.

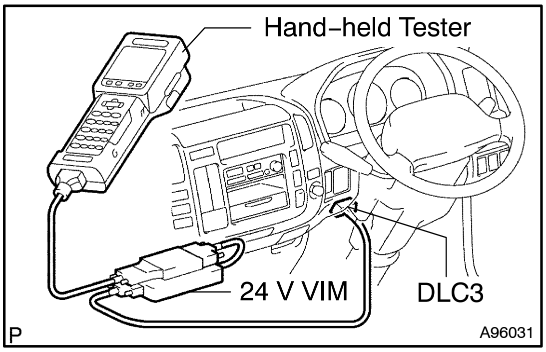
- After installing a new belt, run the engine for approximately 5 minutes and then recheck the tension.

6. CHECK TAPPET FOR ABNORMAL NOISE

7. INSPECT IDLE SPEED AND MAXIMUM SPEED

HINT:
The check should be done under the following conditions:

- Engine at normal operating temperature
- Air cleaner installed
- All pipes and hoses of air induction system connected
- All accessories switched OFF
- All vacuum lines properly connected
- ECD system wiring connectors fully plugged
- Valve clearance set correctly



(a) Connect the hand–held tester (with 24 V VIM) to the DLC3.

HINT:
Refer to the hand–held tester operator's manual for further details.

NOTICE:
Be sure to use the 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

(b) Inspect the idle speed.
   (1) Start the engine and check the idle speed.
   Idle speed: 600 to 700 rpm

If the maximum speed is not as specified, check the problem symptoms table in the diagnostic section.

(c) Inspect the maximum speed.
   (1) Start the engine.
   (2) Fully depress the accelerator pedal.
   (3) Check the maximum speed.
   Maximum speed: 3,600 to 3,700 rpm

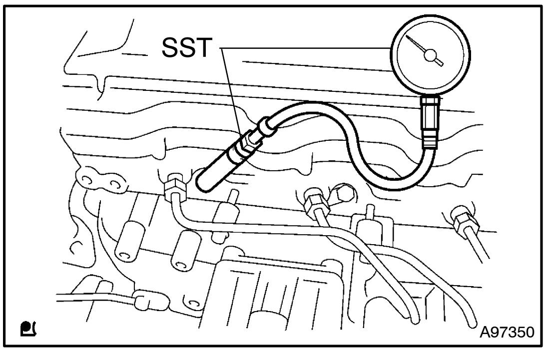
If the idle speed is not as specified, check the problem symptoms table in the diagnostic section.

(d) Disconnect the hand–held tester from the DLC3.

8. INSPECT COMPRESSION

HINT:
If the power is short, the oil consumption is excessive and the fuel economy is poor, measure the compression pressure.

(a) Allow the engine to warm up to the normal operating temperature.



(b) Check the compression pressure.

(1) Install the gasket and SST (attachment) to the injection nozzle hole with the holder clamp and bolt.

SST S0955–21060, S0955–21090

Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)

(2) Connect a SST (compression gauge) to the SST (attachment).

SST 09992–00025 (09992–00211)

(3) While cranking the engine, measure the compression pressure.

HINT:

Always use a fully charged battery when the engine is running at 280 rpm or more.

(4) Repeat steps (1) through (3) for each cylinder.

NOTICE:

This measurement must be done in as short a time as possible.

Compression pressure:
3,200 kPa (33 kgf/cm^2, 469 psi)
Minimum pressure: 2,700 kPa (28 kgf/cm^2, 398 psi)
Difference between each cylinder:
290 kPa (3.0 kgf/cm^2, 43 psi) or less

(5) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the injector hole and repeat steps (2) through (4) for the cylinder with low compression.

- If the compression becomes high by adding oil, it shows that the piston rings and/or cylinder bore are worn or damaged.
- If the pressure remains low, a valve may be sticking or seated improperly, or there may be leakage through the gasket.

(6) Remove the SST.

(c) Start the engine and check for leaks.

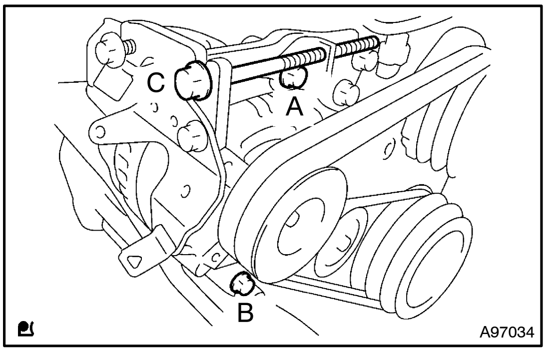
9. INSPECT DIESEL SMOKE

Standard (Black smoke): 10 % or less

DRIVE BELT (N04C–TF)

REPLACEMENT

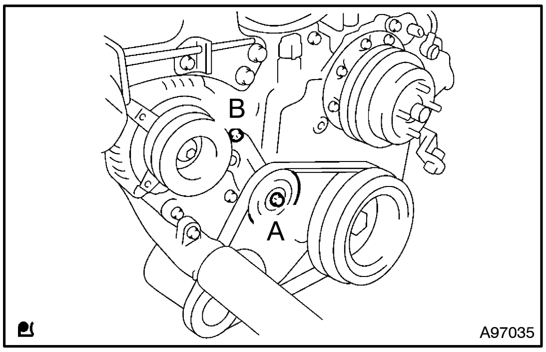
141UA–01



1. REMOVE FAN AND GENERATOR V BELT

(a) Loosen bolts A and B.

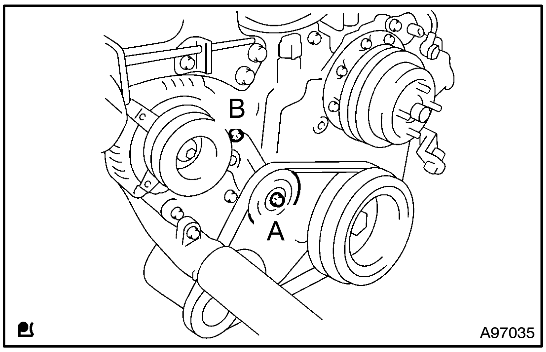
(b) Loosen the adjusting bolt C and remove the belt.



2. REMOVE A/C COMPRESSOR V BELT

(a) Loosen bolt A.

(b) Loosen the adjusting bolt B and remove the belt.



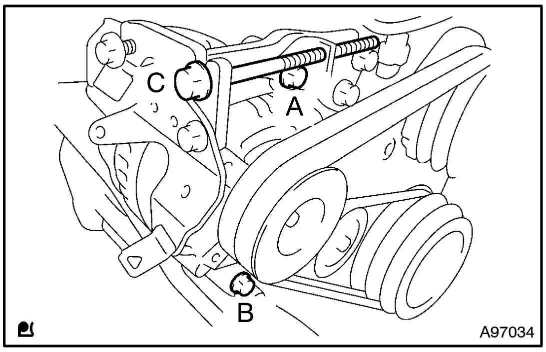
3. INSTALL A/C COMPRESSOR V BELT

(a) Install the belt on each pulley.

(b) Tighten the adjusting bolt B and adjust the belt deflection (see page 14–1).

(c) Tighten bolt A.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

(d) Retighten bolt B.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)



4. INSTALL FAN AND GENERATOR V BELT

(a) Install the belt on each pulley.

(b) Tighten the adjusting bolt C and adjust the belt deflection (see page 14–1).

(c) First tighten bolt B, then bolt A.
Torque:
28.5 N·m (291 kgf·cm, 21 ft·lbf) for bolt A
55 N·m (561 kgf·cm, 41 ft·lbf) for bolt B

(d) Retighten bolt C.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)

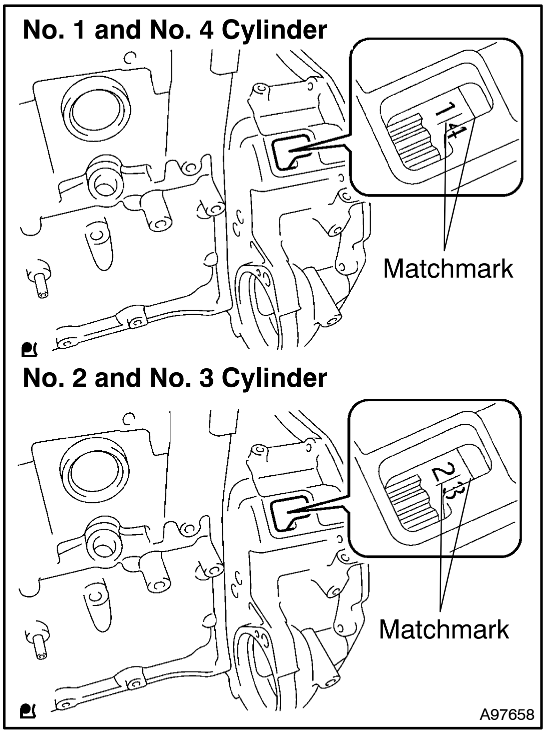
5. INSPECT DRIVE BELT DEFLECTION (See page 14–1)

VALVE CLEARANCE (N04C–TF)

141UB–01

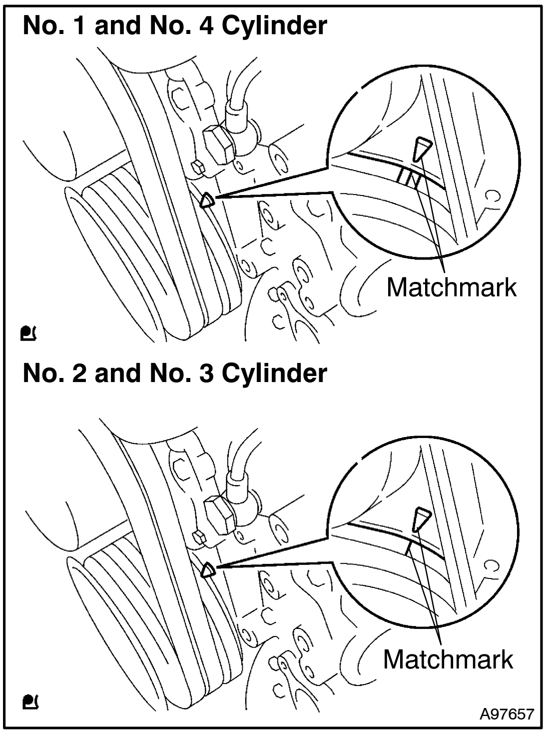
ADJUSTMENT

1. **DISCONNECT BATTERY NEGATIVE TERMINAL**
2. **DRAIN FUEL**
3. **DRAIN ENGINE COOLANT (See page 16–3)**
4. **REMOVE VENTILATION PIPE NO. 2 (See page 14–14)**
5. **REMOVE INTAKE AIR CONNECTOR PIPE (See page 14–14)**
6. **REMOVE OIL FILLER CAP SUB–ASSY**
7. **REMOVE CYLINDER HEAD COVER NO. 2 (See page 11–20)**
8. **REMOVE CYLINDER HEAD COVER SUB–ASSY (See page 11–20)**
9. **REMOVE BREATHER PIPE**
10. **REMOVE BRACKET (See page 14–14)**
11. **REMOVE FUEL PIPE CLAMP (See page 11–20)**
12. **REMOVE INJECTOR ASSY (See page 11–20)**



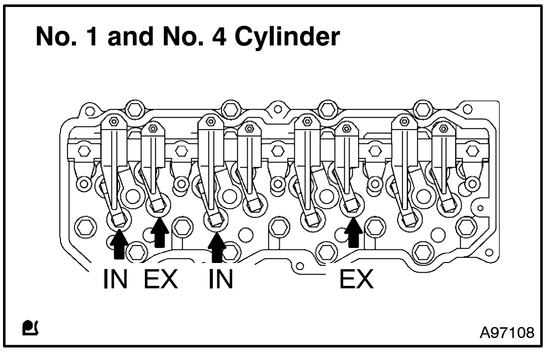
13. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**

(a) Flyheel housing side:
Turn the crankshaft clockwise to align the matchmark on the flywheel the line between the 2 numbers with the edge on the flywheel housing.



(b) Crankshaft pulley side:
Turn the crankshaft clockwise to align the matchmark on the crankshaft pulley with the pointer on the Timing chain or belt cover.

HINT:
If not, turn the crankshaft 1 revolution (360°) to align the matchmark.

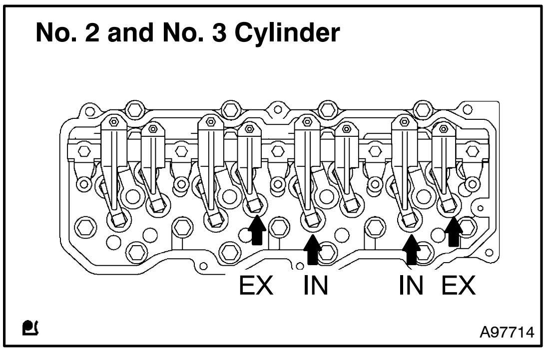


14. INSPECT VALVE CLEARANCE

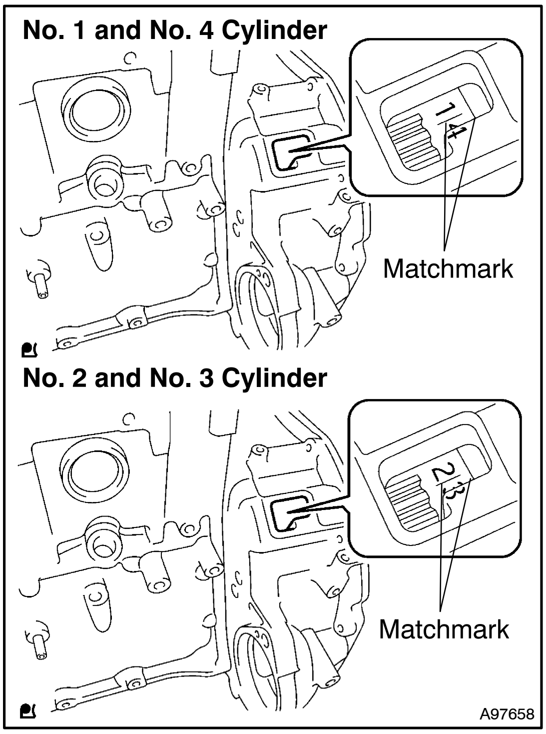
(a) Check only the 4 valves indicated in the illustration.
   (1) Using a feeler gauge, measure the clearance between the adjusting screw on the valve rocker arm and the valve step cap.
   (2) Record the out–of–specification valve clearance measurements.

Valve clearance (Cold):

Item	Specified Condition
Intake	0.30 mm (0.012 in.)
Exhaust	0.45 mm (0.018 in.)

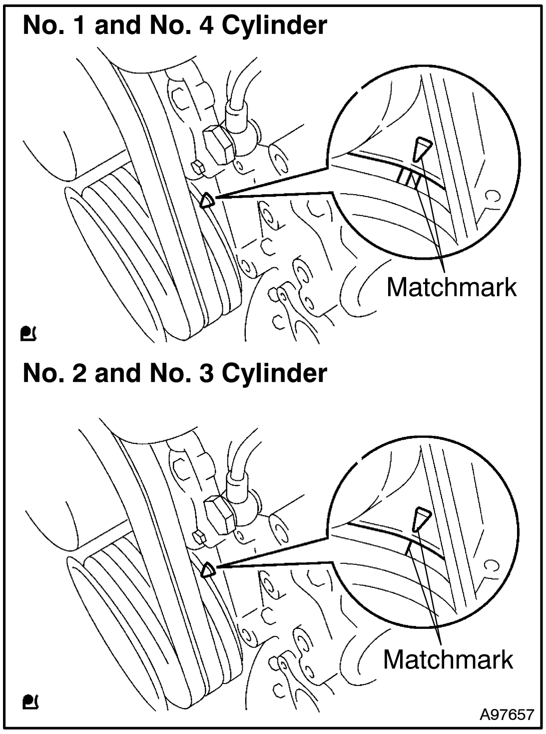


(b) Turn the crankshaft pulley 1 revolution (360˚) to align the matchmark (see step 13).
(c) Check only the 4 valves indicated as shown in the illustration. Measure the valve clearance (see step (a)).



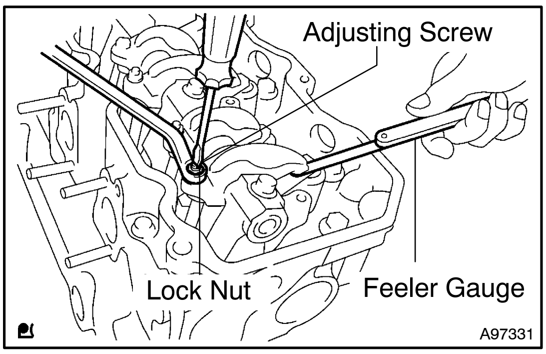
15. ADJUST VALVE CLEARANCE

(a) Flywheel side:
Turn the crankshaft clockwise to align the matchmark on the flywheel the line between the 2 numbers with the edge on the flywheel housing.



(b) Crankshaft pulley side:
Turn the crankshaft clockwise to align the matchmark on the crankshaft pulley with the pointer on the Timing chain or belt cover.

HINT:
If not, turn the crankshaft 1 revolution (360°) to align the matchmark.



(c) With the No. 1 piston positioned at TDC on the compression stroke, using a feeler gauge, adjust the each valve clearance.
Valve clearance (Cold):

Intake	0.30 mm (0.0118 in.)
Exhaust	0.45 mm (0.0177 in.)

HINT:
The feeler gauge should move with a very slight pull.

(d) Loosen the lock nut on the valve rocker arm and loosen the adjusting screw.

(e) Insert a 0.30 mm (0.012 in.) feeler gauge for the intake or a 0.45 mm (0.018 in.) feeler gauge for the exhaust between the adjusting screw on the valve rocker arm and the valve bridge.

(f) Turn the adjusting screw on the valve rocker arm until the feeler gauge slides with a very slight drag, and lock the adjusting screw with the lock nut.

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

(g) Recheck the clearance.

(h) Adjust the other valves.

(1) Turn the crankshaft 1 revolution (360°) clockwise.

(2) Adjust the valve clearance for each cylinder in the firing order.

Firing order: 1 – 3 – 4 – 2

(Determine each cylinder's number by counting from the timing gear side.)

16. INSTALL INJECTOR ASSY (See page 11–20)

17. INSTALL FUEL PIPE CLAMP (See page 11–20)

18. INSTALL BRACKET (See page 14–14)

19. INSTALL BREATHER PIPE

20. INSTALL CYLINDER HEAD COVER SUB–ASSY (See page 11–20)

21. INSTALL CYLINDER HEAD COVER NO. 2 (See page 11–20)

22. INSTALL OIL FILLER CAP SUB–ASSY

23. INSTALL INTAKE AIR CONNECTOR PIPE (See page 14–14)

24. INSTALL VENTILATION PIPE NO. 2 (See page 14–14)

25. ADD ENGINE COOLANT (See page 16–3)

26. ADD FUEL

27. BLEED AIR FROM FUEL SYSTEM (See page 11–1)

28. CONNECT BATTERY NEGATIVE TERMINAL

29. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)

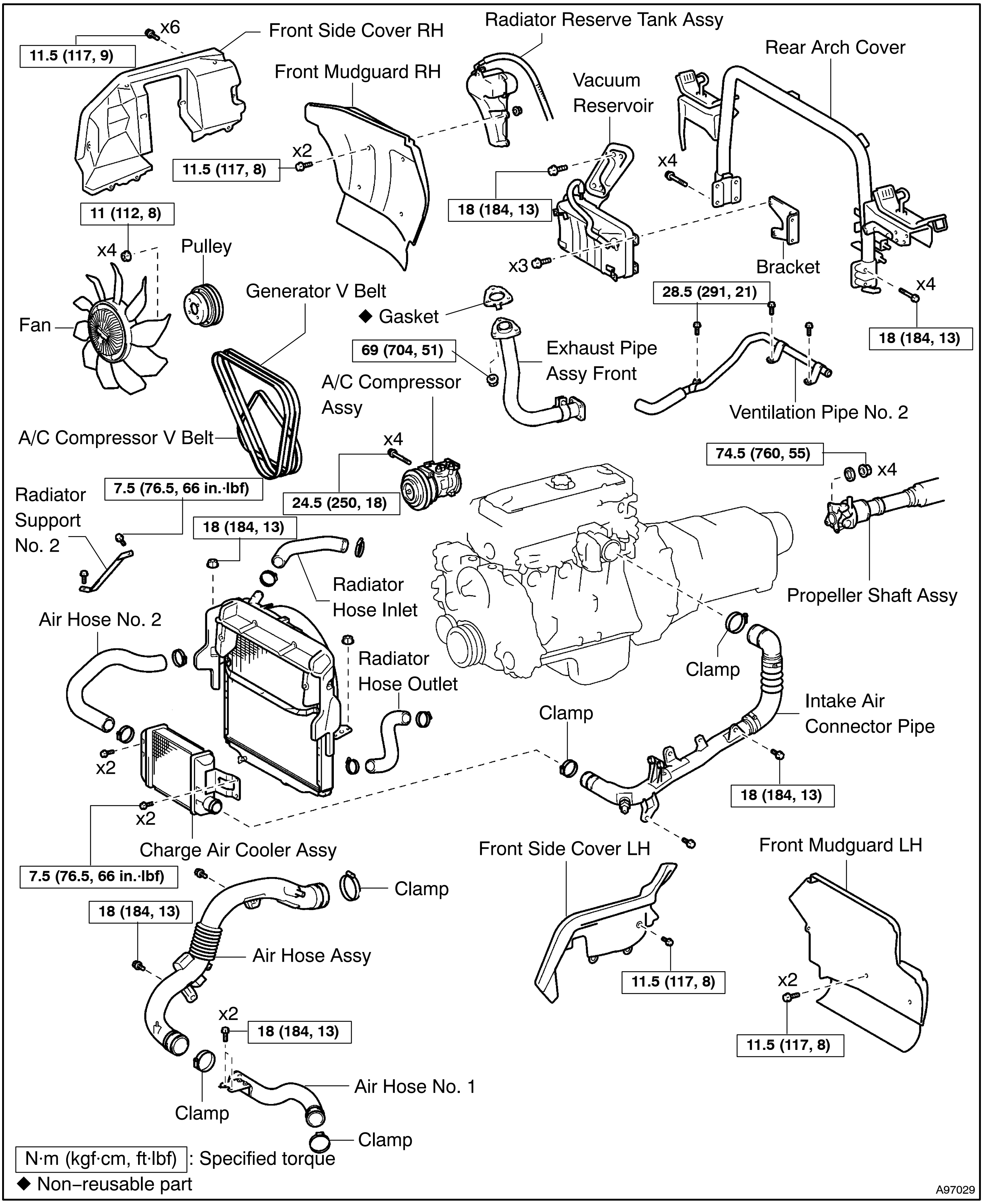
30. CHECK FOR FUEL LEAKS (See page 11–2)

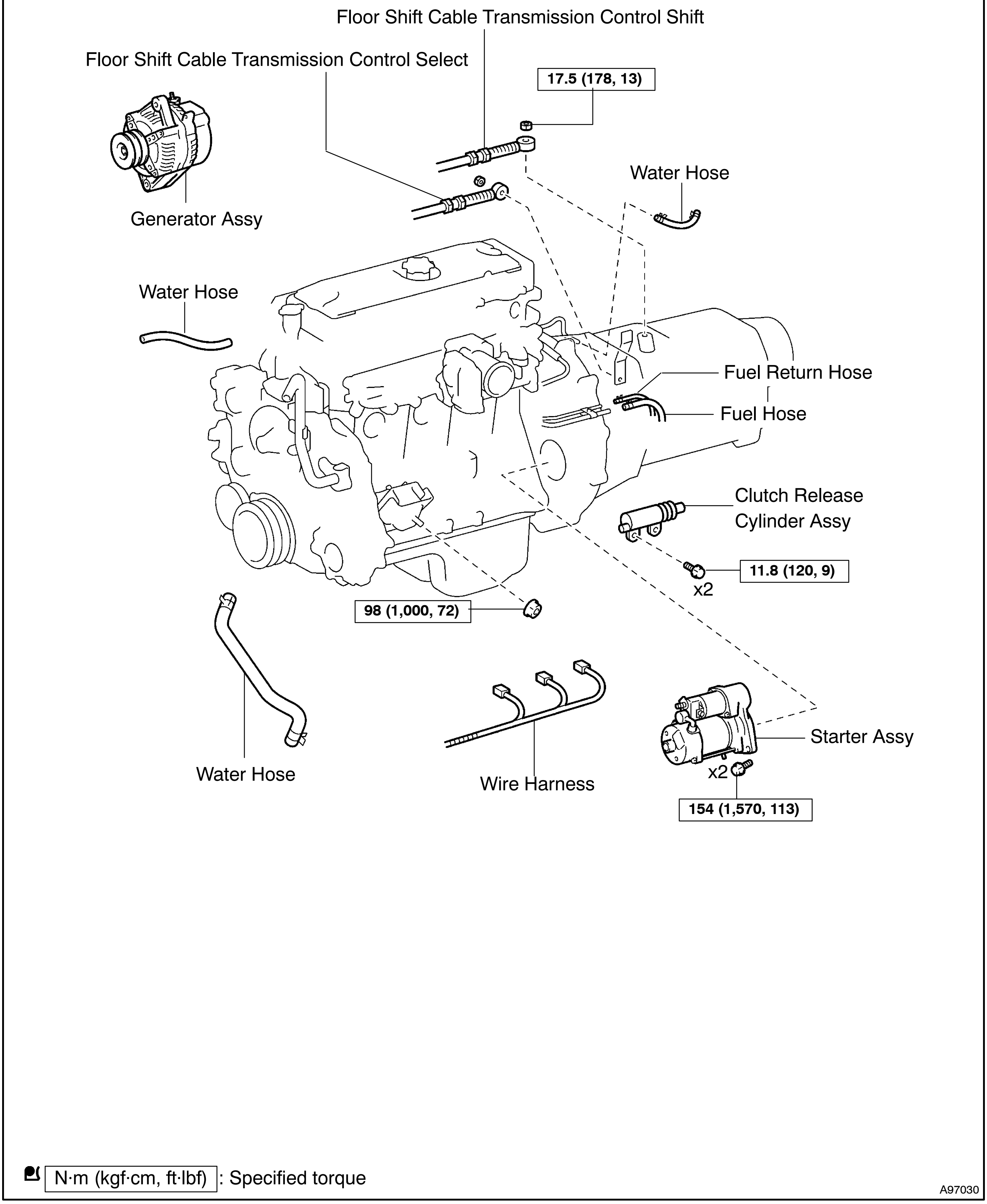
31. CHECK FOR ENGINE OIL LEAKS

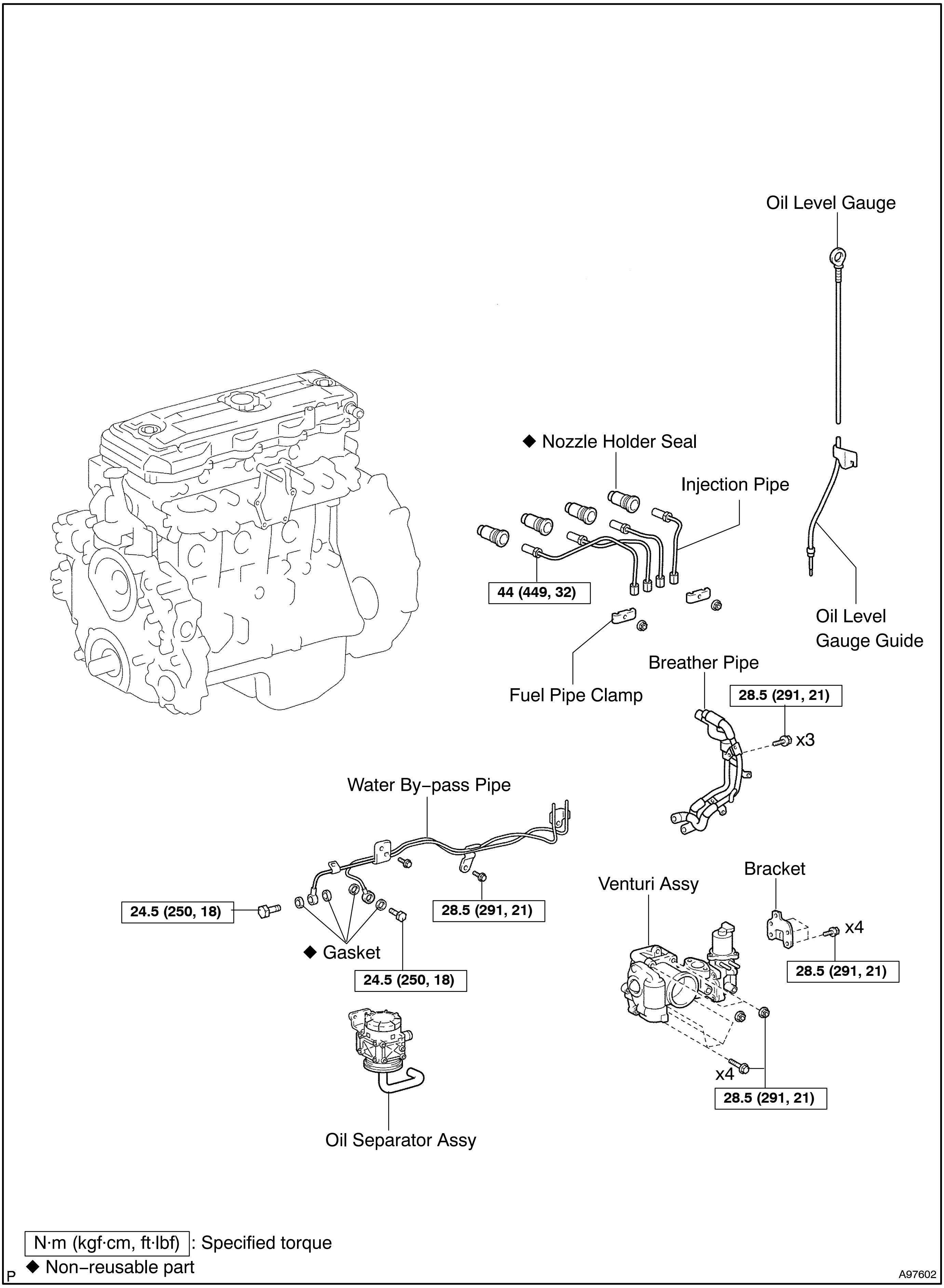
PARTIAL ENGINE ASSY (N04C–TF)

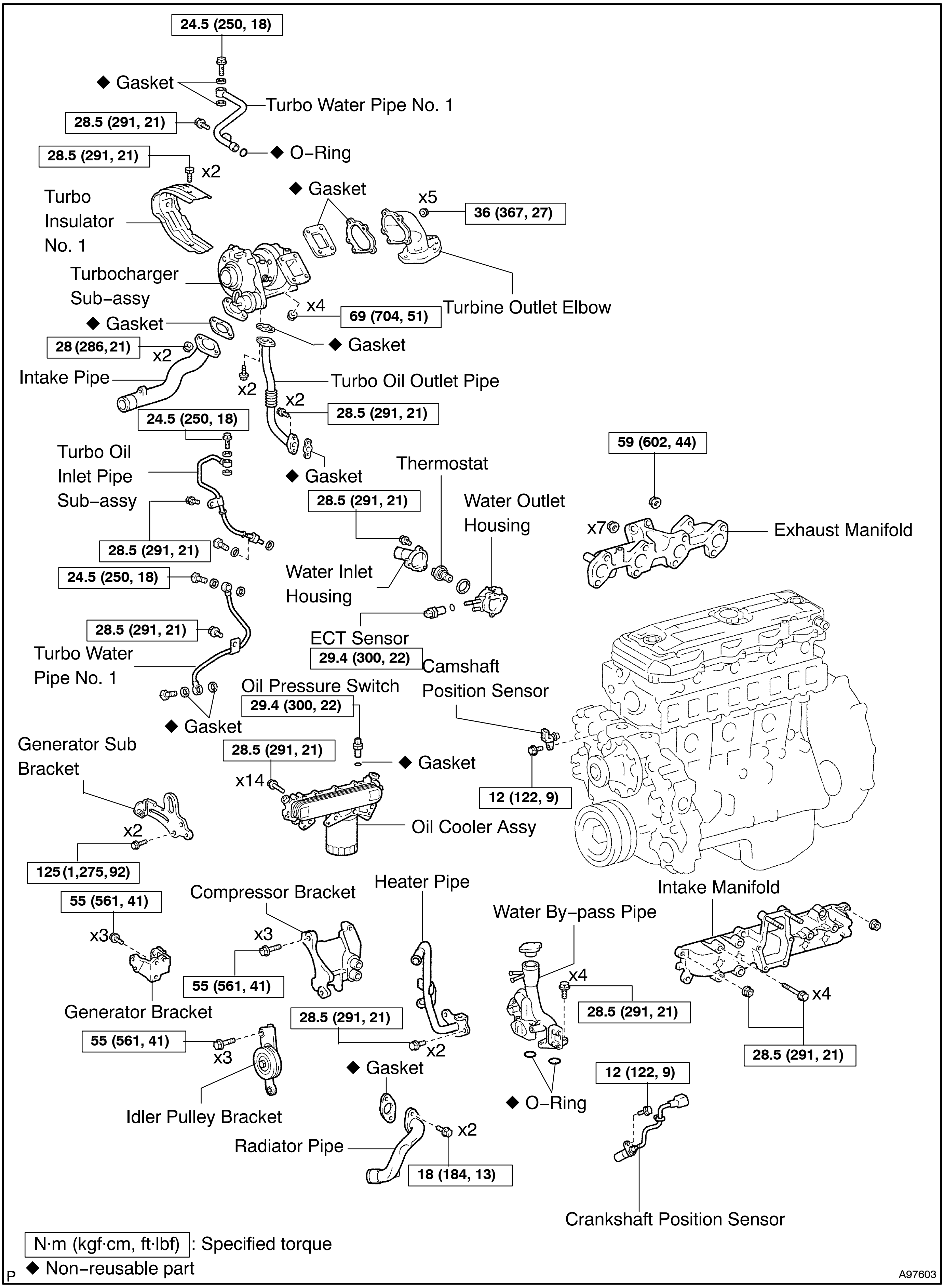
COMPONENTS

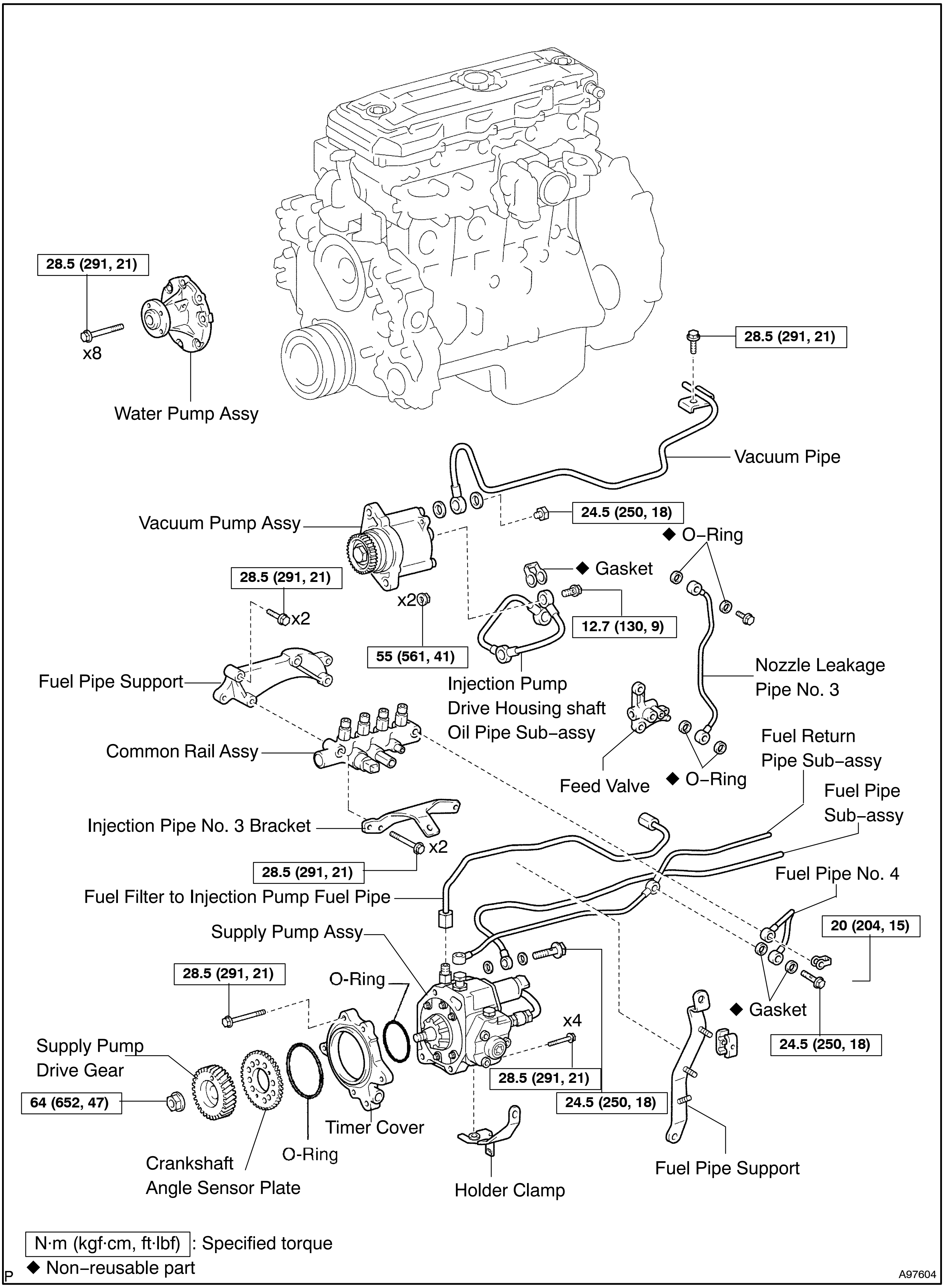
141UH–01




Floor Shift Cable Transmission Control Shift
Floor Shift Cable Transmission Control Select
17.5 (178, 13)
Water Hose
Generator Assy
Water Hose
Fuel Return Hose
Fuel Hose
Clutch Release
Cylinder Assy
11.8 (120, 9)
x2
98 (1,000, 72)
Water Hose
Wire Harness
Starter Assy
x2
154 (1,570, 113)
N·m (kgf·cm, ft·lbf) : Specified torque
A97030

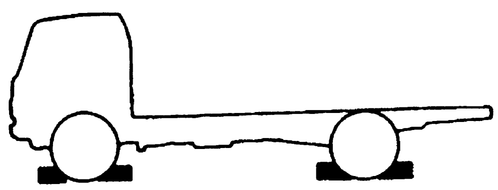

Oil Level Gauge
◆ Nozzle Holder Seal
Injection Pipe
44 (449, 32)
Oil Level Gauge Guide
Fuel Pipe Clamp
Breather Pipe
28.5 (291, 21)
x3
Water By–pass Pipe
24.5 (250, 18)
28.5 (291, 21)
◆ Gasket
24.5 (250, 18)
Venturi Assy
Bracket
x4
28.5 (291, 21)
x4
28.5 (291, 21)
Oil Separator Assy
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
P
A97602


24.5 (250, 18)
◆ Gasket
Turbo Water Pipe No. 1
28.5 (291, 21)
◆ O–Ring
28.5 (291, 21)
x2
Turbo Insulator No. 1
◆ Gasket
x5
36 (367, 27)
Turbocharger Sub–assy
x4
69 (704, 51)
Turbine Outlet Elbow
◆ Gasket
28 (286, 21)
x2
◆ Gasket
Intake Pipe
x2
Turbo Oil Outlet Pipe
x2
28.5 (291, 21)
24.5 (250, 18)
Turbo Oil Inlet Pipe Sub–assy
◆ Gasket
Thermostat
59 (602, 44)
28.5 (291, 21)
Water Outlet Housing
x7
Exhaust Manifold
28.5 (291, 21)
24.5 (250, 18)
Water Inlet Housing
28.5 (291, 21)
ECT Sensor
29.4 (300, 22)
Turbo Water Pipe No. 1
Camshaft Position Sensor
Oil Pressure Switch
29.4 (300, 22)
◆ Gasket
Generator Sub Bracket
28.5 (291, 21)
◆ Gasket
x14
12 (122, 9)
Oil Cooler Assy
x2
125 (1,275, 92)
55 (561, 41)
Compressor Bracket
Heater Pipe
Intake Manifold
Water By–pass Pipe
x3
x3
55 (561, 41)
x4
28.5 (291, 21)
x4
Generator Bracket
28.5 (291, 21)
55 (561, 41)
x2
28.5 (291, 21)
x3
◆ Gasket
12 (122, 9)
◆ O–Ring
Idler Pulley Bracket
x2
Radiator Pipe
18 (184, 13)
Crankshaft Position Sensor
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
P
A97603


28.5 (291, 21)
x8
Water Pump Assy
28.5 (291, 21)
Vacuum Pipe
Vacuum Pump Assy
24.5 (250, 18)
◆ O–Ring
◆ Gasket
28.5 (291, 21)
x2
x2
12.7 (130, 9)
55 (561, 41)
Nozzle Leakage
Pipe No. 3
Fuel Pipe Support
Injection Pump
Drive Housing shaft
Oil Pipe Sub–assy
Fuel Return
Pipe Sub–assy
Common Rail Assy
Feed Valve
◆ O–Ring
Fuel Pipe
Sub–assy
Injection Pipe No. 3 Bracket
x2
28.5 (291, 21)
Fuel Pipe No. 4
Fuel Filter to Injection Pump Fuel Pipe
20 (204, 15)
Supply Pump Assy
28.5 (291, 21)
O–Ring
◆ Gasket
x4
Supply Pump
Drive Gear
24.5 (250, 18)
28.5 (291, 21)
64 (652, 47)
24.5 (250, 18)
Timer Cover
O–Ring
Crankshaft
Angle Sensor Plate
Fuel Pipe Support
Holder Clamp
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
P
A97604

141UC–01

REPLACEMENT



A64407

1. **BLOCK WHEEL OF VEHICLE**
2. **DISCONNECT BATTERY NEGATIVE TERMINAL**
3. **DRAIN ENGINE OIL (See page 17–3)**
4. **DRAIN ENGINE COOLANT (See page 16–3)**
5. **DRAIN FUEL**
6. **DRAIN POWER STEERING FLUID**
7. **REMOVE FRONT MUDGUARD RH**
8. **REMOVE FRONT MUDGUARD LH**
9. **REMOVE RADIATOR RESERVE TANK ASSY**
10. **REMOVE ENGINE SIDE COVER RH**
11. **REMOVE ENGINE SIDE COVER LH**
12. **REMOVE VACUUM RESERVOIR**

(a) Disconnect the air hose.
(b) Remove the 4 bolts and reservoir.

13. **REMOVE REAR ARCH COVER**

(a) Remove the 8 bolts and cover.

14. **REMOVE AIR HOSE ASSY**

(a) Remove the 2 bolts.
(b) Loosen the 2 clamps and remove the hose.

15. **REMOVE AIR HOSE NO. 1**

(a) Loosen the clamp.
(b) Remove the 2 bolts and hose.

16. **REMOVE INTAKE AIR CONNECTOR PIPE**

(a) Disconnect the ECT sensor and vacuum sensor connectors.
(b) Remove the 2 bolts.
(c) Loosen the 2 clamps and remove the pipe.

17. **REMOVE AIR HOSE NO. 2**

(a) Loosen the 2 clamps and remove the hose.

18. **REMOVE CHARGE AIR COOLER ASSY (See page 13–9)**
19. **REMOVE FAN**

(a) Stretch the belt tight and loosen the 4 nuts.
(b) Remove the fan and generator V belt.
(c) Remove the 4 nuts, pulley and fan.

20. **REMOVE A/C COMPRESSOR V BELT (See page 14–4)**
21. **DISCONNECT RADIATOR HOSE INLET**
22. **DISCONNECT RADIATOR HOSE OUTLET**

23. REMOVE RADIATOR ASSY (See page 16–10)

24. REMOVE VENTILATION PIPE NO. 2

(a) Disconnect the breather hose.

(b) Remove the 3 bolts and ventilation pipe.

25. SEPARATE A/C COMPRESSOR ASSY

(a) Disconnect the compressor connector.

(b) Remove the 4 bolts and compressor.

HINT:

Hang up the compressor instead of detaching it.

26. REMOVE EXHAUST PIPE ASSY FRONT (See page 15–2)

27. REMOVE PROPELLER SHAFT ASSY (See pub. No. RM1008E, on pages 30–6 and 30–14)

28. REMOVE GENERATOR ASSY (See page 19–7)

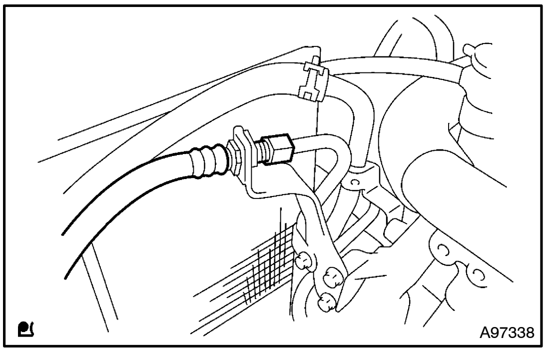
29. REMOVE STARTER ASSY (See page 19–3)

30. DISCONNECT WATER HOSE

31. SEPARATE CLUTCH RELEASE CYLINDER ASSY (See page 41–3)

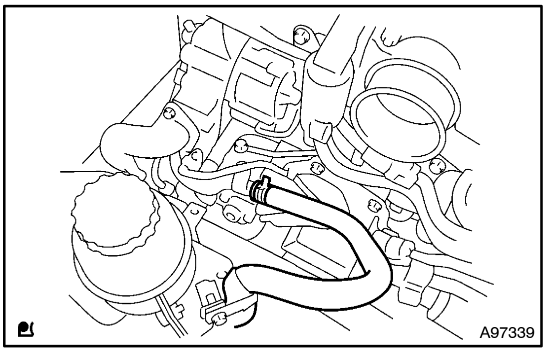
32. DISCONNECT FLOOR SHIFT CABLE TRANSMISSION CONTROL SHIFT (See page 41–8)

33. DISCONNECT FLOOR SHIFT CABLE TRANSMISSION CONTROL SELECT (See page 41–8)



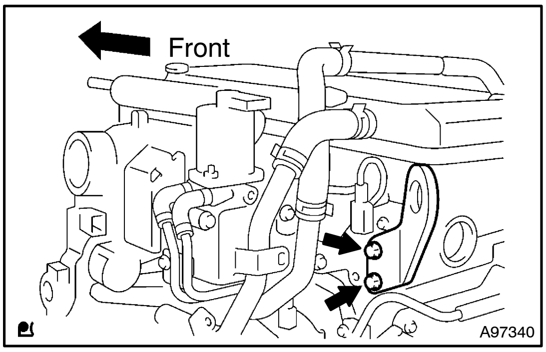
34. DISCONNECT VANE PUMP HOSE

(a) Using SST, disconnect the pump hose.
SST 09023–12900



35. DISCONNECT VANE PUMP RESERVOIR HOSE

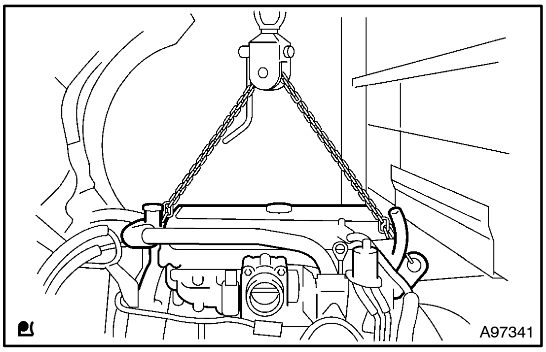
36. DISCONNECT WIRE HARNESS



37. REMOVE ENGINE ASSY

(a) Install the engine hanger with the 2 bolts as shown in the illustration.

Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)



(b) Using a chain block and an engine sling device, hang the engine together with the transmission.

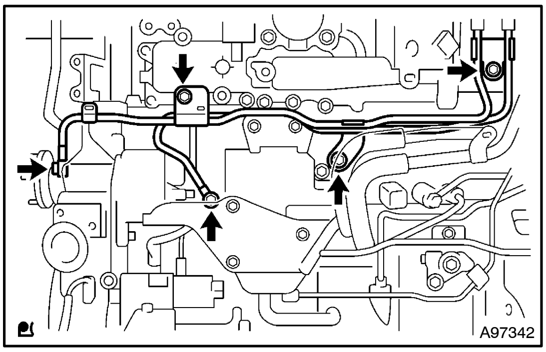
(c) Remove the transmission (see page 41–3).

(d) Remove the 2 nuts and engine from the engine mounting brackets.

38. REMOVE BREATHER PIPE

39. REMOVE BRACKET

(a) Remove the 4 bolts and bracket.



40. REMOVE WATER BY–PASS PIPE

(a) Remove the 3 bolts, 2 union bolts, 4 gaskets and pipe.

41. REMOVE VENTURI ASSY

(a) Remove the 4 bolts, 2 nuts and venturi from the intake manifold.

42. REMOVE FUEL PIPE CLAMP (See page 11–20)

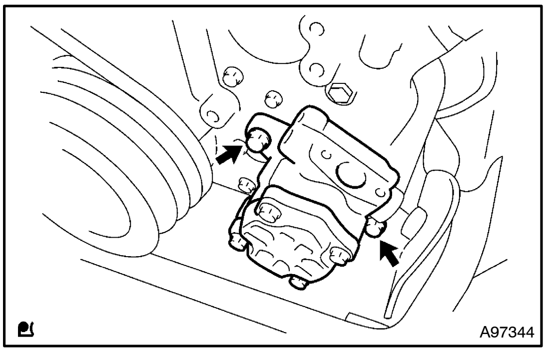
43. REMOVE OIL LEVEL GAUGE GUIDE

44. REMOVE INTAKE PIPE

(a) Remove the 2 nuts, gasket and pipe.

45. REMOVE RADIATOR PIPE

(a) Remove the 2 bolts, gasket and pipe.



46. REMOVE VANE PUMP ASSY

(a) Remove the 2 bolts and pump.

47. REMOVE TURBO INSULATOR NO. 1 (See page 13–6)

48. REMOVE TURBO OIL INLET PIPE SUB–ASSY (See page 13–6)

49. REMOVE TURBO OIL OUTLET PIPE (See page 13–6)

50. REMOVE TURBO WATER PIPE NO. 1 (See page 13–6)

51. REMOVE TURBO WATER PIPE NO. 2 (See page 13–6)

52. REMOVE TURBOCHARGER SUB–ASSY (See page 13–6)

53. REMOVE EXHAUST MANIFOLD

(a) Remove the 8 nuts and manifold.

54. REMOVE INTAKE MANIFOLD

(a) Remove the 4 bolts 2 nuts and manifold.

55. REMOVE OIL PRESSURE SWITCH

56. REMOVE ECT SENSOR

57. REMOVE CAMSHAFT POSITION SENSOR

(a) Remove the bolt and sensor.

58. REMOVE CRANKSHAFT POSITION SENSOR

(a) Remove the bolt and sensor.

59. REMOVE OIL COOLER ASSY (See page 17–7)

60. REMOVE IDLER PULLEY BRACKET

(a) Remove the 3 bolts and bracket.

61. REMOVE COMPRESSOR BRACKET

(a) Remove the 3 bolts and bracket.

62. REMOVE GENERATOR SUB BRACKET

(a) Remove the 2 bolts and sub bracket.

63. REMOVE GENERATOR BRACKET

(a) Remove the 3 bolts and bracket.

64. REMOVE THERMOSTAT (See page 16–7)

65. REMOVE WATER OUTLET HOUSING

(a) Remove the 3 bolts and housing.

66. REMOVE HEATER PIPE

(a) Remove the 2 bolts and pipe.

67. REMOVE WATER BY–PASS PIPE

(a) Remove the 4 bolts, 2 O–rings and pipe.

68. REMOVE WATER PUMP ASSY (See page 16–5)

69. REMOVE VACUUM PIPE

(a) Remove the bolt, union bolt, 2 gaskets and pipe.

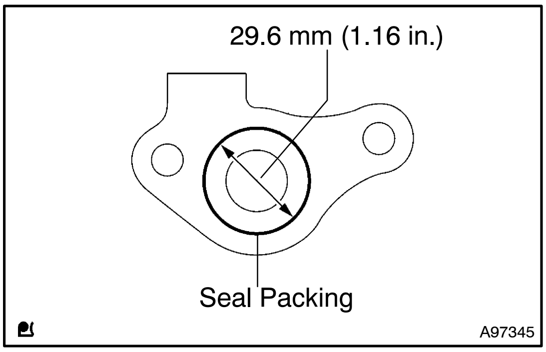
70. REMOVE INJECTION PUMP DRIVE HOUSING SHAFT OIL PIPE SUB–ASSY

(a) Remove the 3 union bolts, 3 gaskets and pipe.

71. REMOVE VACUUM PUMP ASSY

(a) Remove the 2 nuts and pump.

72. REMOVE FUEL PIPE NO. 4
(a) Remove the 2 union bolts, 4 gaskets and pipe.
73. REMOVE FUEL FILTER TO INJECTION PUMP FUEL PIPE
(a) Remove the nut and clamp.
(b) Using SST, remove the fuel pipe.
SST 09023–12900
74. REMOVE COMMON RAIL ASSY
(a) Remove the 2 bolts, bracket and common rail.
75. REMOVE FUEL PIPE SUPPORT
(a) Remove the 2 bolts and support.
76. REMOVE FUEL RETURN PIPE SUB–ASSY
(a) Remove the union bolt, 2 gaskets and pipe.
77. REMOVE SUPPLY PUMP ASSY (See page 11–10)
78. REPLACE PARTIAL ENGINE ASSY
79. INSTALL SUPPLY PUMP ASSY (See page 11–10)
80. INSTALL FUEL RETURN PIPE SUB–ASSY
(a) Install 2 new gaskets and the return pipe with the union bolt.
Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf)
81. INSTALL FUEL PIPE SUPPORT
(a) Install the pipe support with the 2 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
82. INSTALL COMMON RAIL ASSY
(a) Install the common rail and bracket with the 2 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
83. INSTALL FUEL FILTER TO INJECTION PUMP FUEL PIPE
(a) Using SST, install the fuel pipe.
SST 09023–12900
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)
(b) Install the clamp with the nut.
Torque: 14 N·m (143 kgf·cm, 10 ft·lbf)
84. INSTALL FUEL PIPE NO. 4
(a) Install 4 new gaskets and the pipe with the 2 union bolts.
Torque:
20 N·m (204 kgf·cm, 15 ft·lbf) for union bolt (M10)
24.5 N·m (250 kgf·cm, 18 ft·lbf) for union bolt (M12)
85. INSTALL VACUUM PUMP ASSY
(a) Install the pump with the 2 nuts.
Torque: 55 N·m (561 kgf·cm, 41 ft·lbf)
86. INSTALL INJECTION PUMP DRIVE HOUSING SHAFT OIL PIPE SUB–ASSY
(a) Install 3 new gaskets and the pipe with the 3 union bolts.
Torque: 12.7 N·m (130 kgf·cm, 9 ft·lbf)
87. INSTALL VACUUM PIPE
(a) Install 2 new gaskets and the pipe with the bolt and union bolt.
Torque:
28.5 N·m (291 kgf·cm, 21 ft·lbf) for bolt
24.5 N·m (250 kgf·cm, 18 ft·lbf) for union bolt
88. INSTALL WATER PUMP ASSY (See page 16–5)
89. INSTALL WATER BY–PASS PIPE
(a) Install 2 new O–rings and the pipe with the 4 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)



90. INSTALL HEATER PIPE

(a) Remove any oil packing material from the contact surface.

(b) Apply a continuous bead of seal packing (diameter: 1.5 to 2.5 mm (0.06 to 0.10 in.)) as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Install the heater pipe within 3 minutes after applying seal packing.**
- **Do not expose the seal packing to engine oil for at least 2 hours after installing.**

(c) Install the pipe with the 2 bolts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

91. INSTALL WATER OUTLET HOUSING

(a) Remove any oil packing material from the contact surface.

(b) Apply a continuous bead of seal packing.

Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Install the water outlet housing within 3 minutes after applying seal packing.**
- **Do not expose the seal packing to engine oil for at least 2 hours after installing.**

(c) Install the housing with the 3 bolts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

92. INSTALL THERMOSTAT (See page 16–7)

93. INSTALL GENERATOR BRACKET

(a) Install the bracket with the 3 bolts.

Torque: 55 N·m (561 kgf·cm, 41 ft·lbf)

94. INSTALL GENERATOR SUB BRACKET

(a) Install the sub bracket with the 2 bolts.

Torque: 125 N·m (1,275 kgf·cm, 92 ft·lbf)

95. INSTALL COMPRESSOR BRACKET

(a) Install the bracket with the 3 bolts.

Torque: 55 N·m (561 kgf·cm, 41 ft·lbf)

96. INSTALL IDLER PULLEY BRACKET

(a) Install the bracket with the 3 bolts.

Torque: 55 N·m (561 kgf·cm, 41 ft·lbf)

97. INSTALL OIL COOLER ASSY (See page 17–7)

98. INSTALL CRANKSHAFT POSITION SENSOR

(a) Install the sensor with the bolt.

Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)

99. INSTALL CAMSHAFT POSITION SENSOR

(a) Install the sensor with the bolt.

Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)

100. INSTALL ECT SENSOR

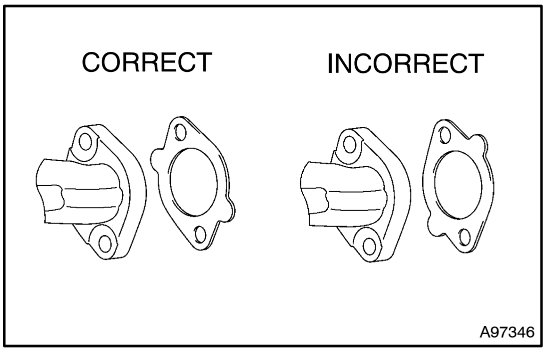
(a) Install a new gasket and the ECT sensor.

Torque: 29.4 N·m (300 kgf·cm, 22 ft·lbf)

101. INSTALL OIL PRESSURE SWITCH

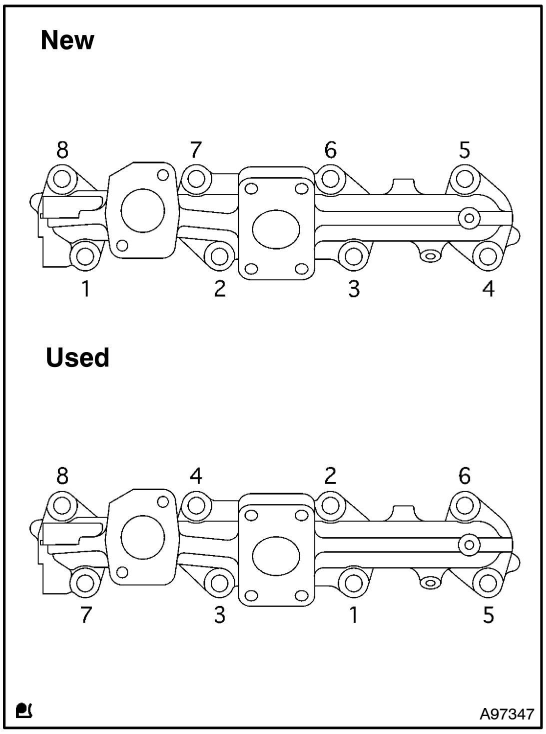
(a) Install a new gasket and the switch.

Torque: 29.4 N·m (300 kgf·cm, 22 ft·lbf)



102. INSTALL EXHAUST MANIFOLD

(a) Install a new gasket to the cylinder head as shown in the illustration.



(b) Install the manifold with the 8 bolts. Uniformly, tighten the 8 nuts in the order shown in the illustration.
Torque: 59 N·m (602 kgf·cm, 44 ft·lbf)

(c) Retighten the bolts in the same order as step (b).

103. INSTALL INTAKE MANIFOLD

(a) Install a new gasket to the cylinder head.

(b) Install the manifold with the 4 bolts and 2 nuts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

104. INSTALL TURBOCHARGER SUB–ASSY (See page 13–6)

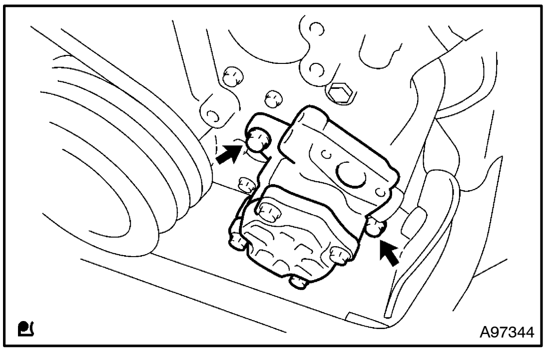
105. INSTALL TURBO WATER PIPE NO. 1 (See page 13–6)

106. INSTALL TURBO WATER PIPE NO. 2 (See page 13–6)

107. INSTALL TURBO OIL OUTLET PIPE (See page 13–6)

108. INSTALL TURBO OIL INLET PIPE SUB–ASSY (See page 13–6)

109. REMOVE TURBO INSULATOR NO. 1 (See page 13–6)



110. INSTALL VANE PUMP ASSY

(a) Install a new O–ring and the pump with the 2 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

111. INSTALL RADIATOR PIPE

(a) Install a new gasket and the pipe with the 2 bolts.

Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

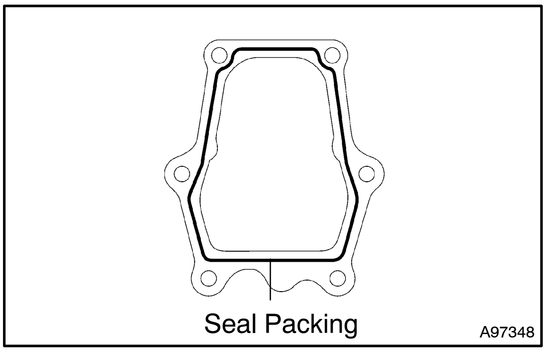
112. INSTALL INTAKE PIPE

(a) Install a new gasket and the pipe with the 2 nuts.

Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

113. INSTALL OIL LEVEL GAUGE GUIDE

114. INSTALL FUEL PIPE CLAMP (See page 11–20)



115. INSTALL VENTURI ASSY

(a) Remove any oil packing material from the contact surface.

(b) Apply a continuous bead of seal packing (diameter: 1.5 to 2.5 mm (0.06 to 0.10 in.)) as shown in the illustration.

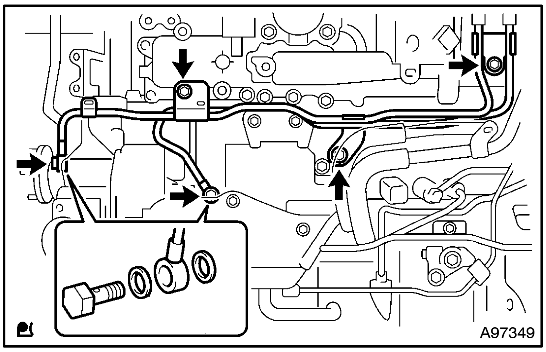
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Install the venturi assy within 3 minutes after applying seal packing.**
- **Do not expose the seal packing to engine oil for at least 2 hours after installing.**

(c) Install the venturi to the intake manifold with the 4 bolts and 2 nuts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)



116. INSTALL WATER BY–PASS PIPE

(a) Install 4 new gaskets and the pipe with the 3 bolts and 2 union bolts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf) for bolt

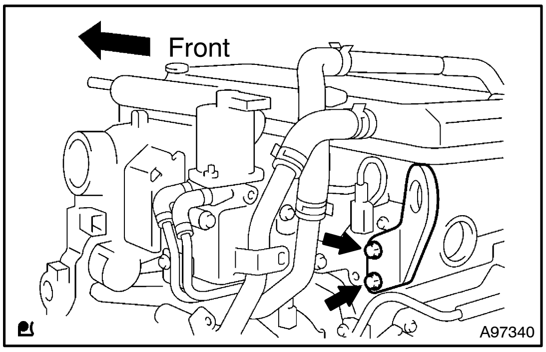
Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf) for union bolt

117. INSTALL BRACKET

(a) Install the bracket with the 4 bolts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

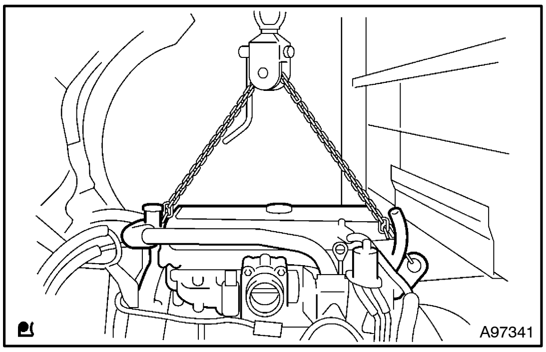
118. INSTALL BREATHER PIPE



119. INSTALL ENGINE ASSY

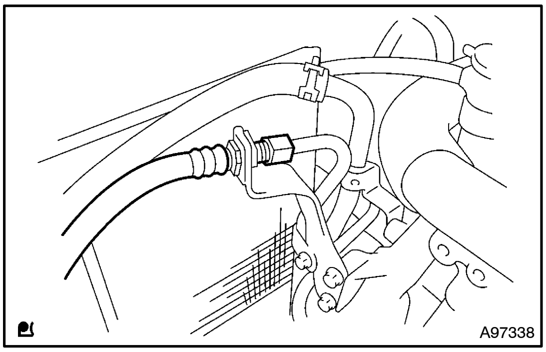
(a) Install the engine hanger with the 2 bolts as shown in the illustration.

Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)



(b) Using a chain block and an engine sling device, hang the engine assy together.
(c) Install the transmission (see page 41–3).
(d) Install the engine to the engine mounting brackets with the 2 nuts.
Torque: 98 N·m (1,000 kgf·cm, 72 ft·lbf)

120. CONNECT WIRE HARNESS
121. CONNECT VANE PUMP RESERVOIR HOSE



122. CONNECT VANE PUMP HOSE
(a) Using SST, connect the pump hose.
SST 09023–12900
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)

123. CONNECT FLOOR SHIFT CABLE TRANSMISSION CONTROL SHIFT (See page 41–8)
124. CONNECT FLOOR SHIFT CABLE TRANSMISSION CONTROL SELECT (See page 41–8)
125. CONNECT CLUTCH RELEASE CYLINDER ASSY (See page 41–3)
126. CONNECT WATER HOSE
127. INSTALL STARTER ASSY (See page 19–3)
128. INSTALL GENERATOR ASSY (See page 19–7)
129. INSTALL PROPELLER SHAFT ASSY
(See pub. No. RM1008E, on pages 30–6 and 30–14)
130. INSTALL EXHAUST PIPE ASSY FRONT (See page 15–2)
131. INSTALL A/C COMPRESSOR ASSY
(a) Install the compressor with the 4 bolts.
Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf)
(b) Connect the compressor connector.
132. INSTALL VENTILATION PIPE NO. 2
(a) Install the ventilation pipe with the 3 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
(b) Connect the breather hose.
133. INSTALL RADIATOR ASSY (See page 16–10)
134. CONNECT RADIATOR HOSE INLET
135. CONNECT RADIATOR HOSE OUTLET
136. INSTALL A/C COMPRESSOR V BELT (See page 14–4)

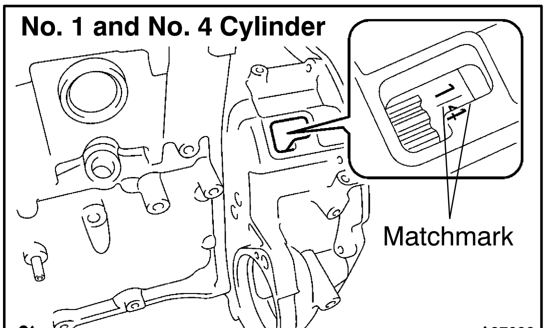
137. INSTALL FAN
(a) Install the fan pulley and fan temporarily with the 4 nuts.
(b) Install the fan and generator V belt.
(c) Holding the V belt, tighten the 4 nuts completely to install the fan pulley and fan properly.
Torque: 11 N·m (112 kgf·cm, 8 ft·lbf)
138. INSTALL CHARGE AIR COOLER ASSY (See page 13–9)
139. INSTALL AIR HOSE NO. 2
(a) Install the hose and tighten the 2 clamps.
140. INSTALL INTAKE AIR CONNECTOR PIPE
(a) Install the pipe and tighten the 2 clamps.
(b) Install the 2 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
(c) Connect the ECT sensor and vacuum sensor connectors.
141. INSTALL AIR HOSE NO. 1
(a) Install the 2 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
(b) Tighten the clamp.
142. INSTALL AIR HOSE ASSY
(a) Install the hose and tighten the 2 clamps.
(b) Install the 2 bolts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)
143. INSTALL RADIATOR RESERVE TANK ASSY
144. INSTALL REAR ARCH COVER
(a) Install the cover with the 8 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
145. INSTALL VACUUM RESERVOIR
(a) Install the reservoir with the 4 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
(b) Connect the air hose.
146. INSTALL ENGINE SIDE COVER RH
147. INSTALL ENGINE SIDE COVER LH
148. INSTALL FRONT MUDGUARD RH
149. INSTALL FRONT MUDGUARD LH
150. ADD ENGINE OIL (See page 17–3)
151. ADD ENGINE COOLANT (See page 16–3)
152. ADD POWER STEERING FLUID (See pub. No. S1–YXZE05A, on page 51–3)
153. ADD FUEL
154. BLEED AIR FROM FUEL SYSTEM (See page 11–5)
155. CONNECT BATTERY NEGATIVE TERMINAL
156. BLEED AIR FROM STEERING SYSTEM (See pub. No. S1–YXZE05A, on page 51–3)
157. CHECK STEERING SYSTEM FOR LEAKS (See pub. No. S1–YXZE05A, on page 51–3)
158. CHECK FOR ENGINE OIL LEAKS
159. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)
160. CHECK FOR FUEL LEAKS (See page 11–2)
161. CHECK FOR EXHAUST GAS LEAKS

CAMSHAFT (N04C–TF)

141UD–01

REPLACEMENT

1. DISCONNECT BATTERY NEGATIVE TERMINAL
2. DRAIN FUEL
3. DRAIN ENGINE OIL (See page 17–3)
4. DRAIN ENGINE COOLANT (See page 16–3)
5. DRAIN POWER STEERING FLUID
6. REMOVE FRONT MUDGUARD RH
7. REMOVE FRONT MUDGUARD LH
8. REMOVE RADIATOR RESERVE TANK ASSY
9. REMOVE ENGINE SIDE COVER RH
10. REMOVE ENGINE SIDE COVER LH
11. REMOVE INTAKE AIR CONNECTOR PIPE (See page 14–14)
12. REMOVE AIR HOSE NO. 2 (See page 14–14)
13. REMOVE CHARGE AIR COOLER ASSY (See page 13–9)
14. REMOVE FAN (See page 14–14)
15. REMOVE A/C COMPRESSOR V BELT (See page 14–4)
16. DISCONNECT RADIATOR HOSE INLET
17. DISCONNECT RADIATOR HOSE OUTLET
18. REMOVE RADIATOR ASSY (See page 16–10)
19. REMOVE VENTILATION PIPE NO. 2 (See page 14–14)
20. REMOVE A/C COMPRESSOR ASSY (See page 14–14)
21. REMOVE EXHAUST PIPE ASSY FRONT (See page 15–2)
22. REMOVE GENERATOR ASSY (See page 19–7)
23. REMOVE INTAKE AIR CONNECTOR PIPE (See page 14–14)
24. REMOVE OIL FILLER CAP SUB–ASSY
25. REMOVE CYLINDER HEAD COVER NO. 2 (See page 11–20)
26. REMOVE CYLINDER HEAD COVER SUB–ASSY (See page 11–20)
27. REMOVE BREATHER PIPE
28. REMOVE BRACKET (See page 14–14)
29. REMOVE WATER BY–PASS PIPE (See page 14–14)
30. REMOVE VENTURI ASSY (See page 10–7)
31. REMOVE FUEL PIPE CLAMP (See page 11–20)
32. REMOVE OIL LEVEL GAGE GUIDE
33. REMOVE INJECTOR ASSY (See page 11–20)
34. REMOVE INTAKE PIPE (See page 14–14)
35. REMOVE RADIATOR PIPE (See page 14–14)
36. REMOVE VANE PUMP ASSY (See page 14–14)
37. REMOVE TURBOCHARGER SUB–ASSY (See page 13–6)
38. REMOVE IDLER PULLEY BRACKET (See page 14–14)
39. REMOVE COMPRESSOR BRACKET (See page 14–14)
40. REMOVE GENERATOR SUB BRACKET (See page 14–14)
41. REMOVE GENERATOR BRACKET (See page 14–14)
42. REMOVE WATER BY–PASS PIPE (See page 14–14)
43. REMOVE WATER PUMP ASSY (See page 16–5)



A97092

44. SET NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft clockwise to align the matchmark (the line between the 1 and 4) on the flywheel with the edge on the flywheel housing.

HINT:

If not, turn the crankshaft 1 revolution (360°) to align the mark.

45. REMOVE VALVE ROCKER SHAFT SUB–ASSY NO.1 (See page 14–29)

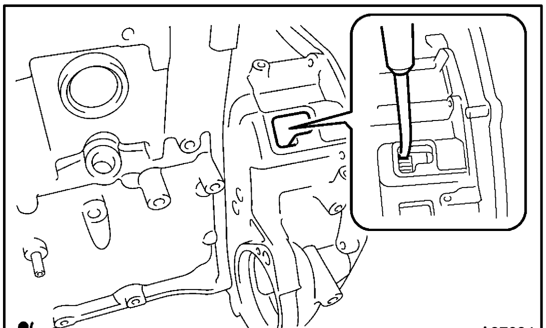
46. REMOVE VALVE PUSH ROD (See page 14–29)

47. REMOVE VALVE BRIDGE (See page 14–29)

48. REMOVE CYLINDER HEAD SUB–ASSY (See page 14–29)

49. INSPECT CYLINDER HEAD BOLT (See page 14–29)

50. REMOVE VALVE LIFTER (See page 14–29)



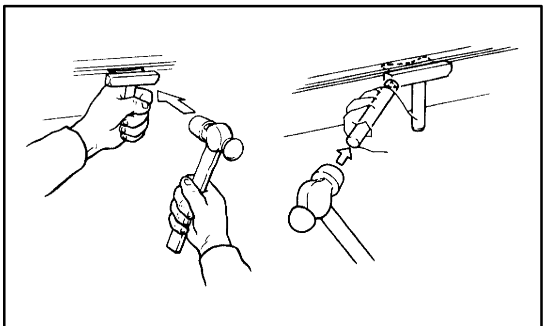
A97094

51. REMOVE CRANKSHAFT PULLEY

(a) Using a 46 mm socket wrench, remove the nut, spacer and pulley.

HINT:

Insert a screwdriver through the inspection hole of the flywheel housing into the ring gear of the flywheel to keep it from turning together with the crankshaft.



A00019

52. REMOVE OIL PAN SUB–ASSY

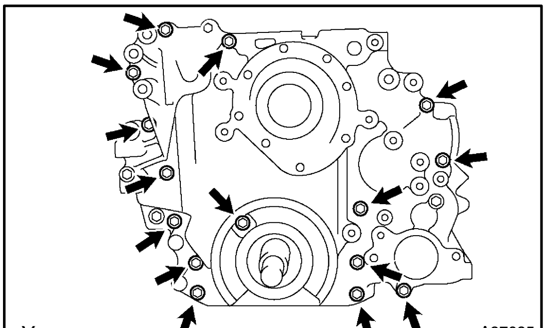
(a) Remove the 26 bolts from the oil pan.

(b) Insert the blade of SST between the crankcase and oil pan. Cut through the applied sealer and remove the oil pan.

SST 09032–00100

NOTICE:

Do not damage the contact surface of the cylinder block and oil pan.



A97095

53. REMOVE TIMING CHAIN OR BELT COVER SUB–ASSY

(a) Remove the 15 bolts.

(b) Using a screwdriver, pry out the cover.

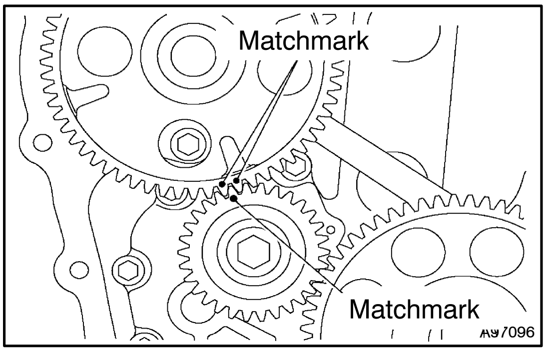
NOTICE:

Do not damage the contact surfaces of the timing chain or belt cover, cylinder block and cylinder head.

54. REMOVE OIL SEAL (See page 14–34)

55. REMOVE CAMSHAFT

(a) Remove the 2 bolts and camshaft.



56. INSTALL CAMSHAFT

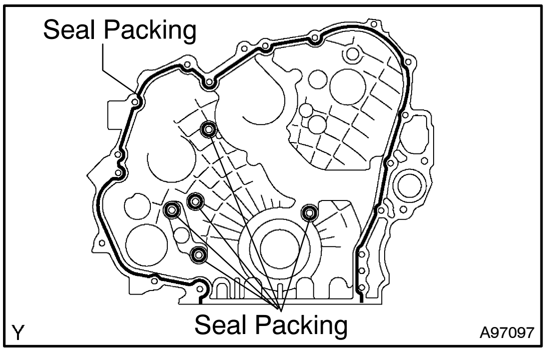
(a) Apply engine oil to the camshaft journal and bearing.

(b) Match the matchmarks of the camshaft timing gear and oil pump gear and install the camshaft.

(c) Install the thrust plate with the 2 bolts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

57. INSTALL OIL SEAL (See page 14–34)



58. INSTALL TIMING CHAIN OR BELT COVER SUB–ASSY

(a) Remove any oil packing material from the contact surface.

(b) Apply a continuous bead of seal packing (diameter: 3 to 4 mm (0.11 to 0.15 in.)) as shown in the illustration.

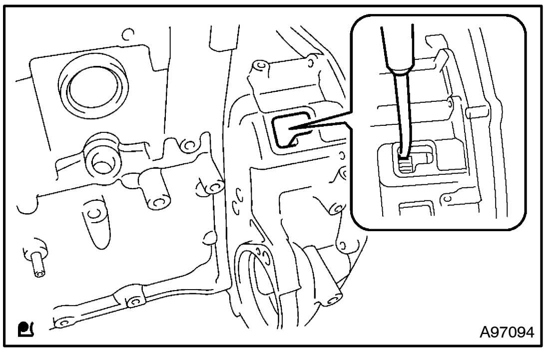
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Install the belt cover within 3 minutes after applying seal packing.**
- **Do not expose the seal packing engine oil for at least 2 hours after installing.**

(c) Install the timing gear case with the 15 bolts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)



59. INSTALL CRANKSHAFT PULLEY

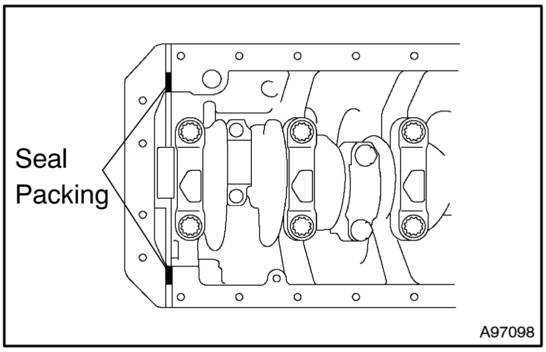
(a) Install the pulley and spacer to the crankshaft.

(b) Using a 46 mm socket wrench, tighten the nut.

Torque: 519 N·m (5,294 kgf·cm, 383 ft·lbf)

HINT:

Insert a screwdriver through the inspection hole of the flywheel housing into the ring gear of the flywheel to keep it from turning together with the crankshaft.



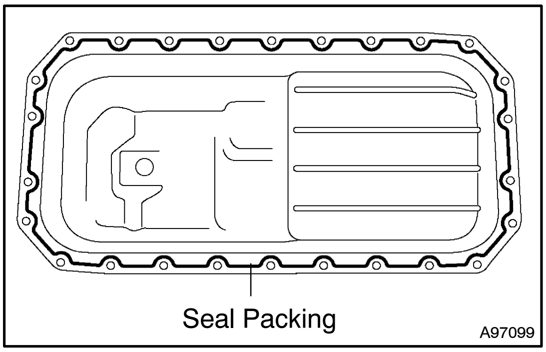
60. INSTALL OIL PAN SUB–ASSY

(a) Remove any oil packing material from the contact surface.

(b) Apply a continuous bead of seal packing (diameter: 3 to 4 mm (0.11 to 0.15 in.)) as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Install the oil pan sub–assy within 3 minutes after applying seal packing.**
- **Do not expose the seal packing engine oil for at least 2 hours after installing.**



(c) Install the oil pan with the 26 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

61. INSTALL VALVE LIFTER (See page 14–29)
62. INSTALL CYLINDER HEAD SUB–ASSY (See page 14–29)
63. INSTALL VALVE BRIDGE (See page 14–29)
64. INSTALL VALVE PUSH ROD (See page 14–29)
65. INSTALL VALVE ROCKER SHAFT SUB–ASSY NO.1 (See page 14–29)
66. ADJUST VALVE CLEARANCE (See page 14–5)
67. INSTALL WATER PUMP ASSY (See page 16–5)
68. INSTALL WATER BY–PASS PIPE (See page 14–14)
69. INSTALL GENERATOR BRACKET (See page 14–14)
70. INSTALL GENERATOR SUB BRACKET (See page 14–14)
71. INSTALL COMPRESSOR BRACKET (See page 14–14)
72. INSTALL IDLER PULLEY BRACKET (See page 14–14)
73. INSTALL TURBOCHARGER SUB–ASSY (See page 13–6)
74. INSTALL VANE PUMP ASSY (See page 14–14)
75. INSTALL RADIATOR PIPE (See page 14–14)
76. INSTALL INTAKE PIPE (See page 14–14)
77. INSTALL INJECTOR ASSY (See page 11–20)
78. INSTALL OIL LEVEL GAGE GUIDE
79. INSTALL FUEL PIPE CLAMP (See page 11–20)
80. INSTALL VENTURI ASSY (See page 10–7)
81. INSTALL WATER BY–PASS PIPE (See page 14–14)
82. INSTALL BRACKET (See page 14–14)
83. INSTALL BREATHER PIPE
84. INSTALL CYLINDER HEAD COVER SUB–ASSY (See page 11–20)
85. INSTALL CYLINDER HEAD COVER NO. 2 (See page 11–20)

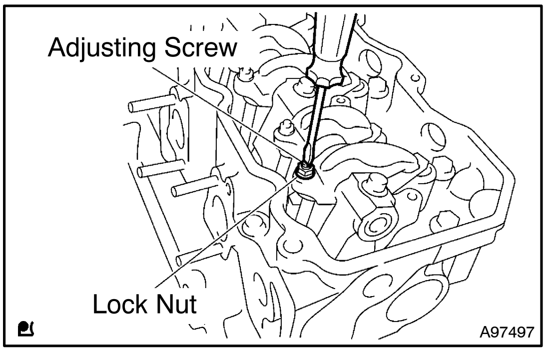
86. INSTALL OIL FILLER CAP SUB–ASSY
87. INSTALL INTAKE AIR CONNECTOR PIPE (See page 14–14)
88. INSTALL GENERATOR ASSY (See page 19–7)
89. INSTALL EXHAUST PIPE ASSY FRONT (See page 15–2)
90. INSTALL A/C COMPRESSOR ASSY (See page 14–14)
91. INSTALL VENTILATION PIPE NO. 2 (See page 14–14)
92. INSTALL RADIATOR ASSY (See page 16–10)
93. CONNECT RADIATOR HOSE INLET
94. CONNECT RADIATOR HOSE OUTLET
95. INSTALL A/C COMPRESSOR V BELT (See page 14–4)
96. INSTALL FAN (See page 14–14)
97. INSTALL CHARGE AIR COOLER ASSY (See page 13–9)
98. INSTALL AIR HOSE NO. 2 (See page 14–14)
99. INSTALL INTAKE AIR CONNECTOR PIPE (See page 14–14)
100. INSTALL ENGINE SIDE COVER RH
101. INSTALL ENGINE SIDE COVER LH
102. INSTALL RADIATOR RESERVE TANK ASSY
103. INSTALL FRONT MUDGUARD RH
104. INSTALL FRONT MUDGUARD LH
105. ADD ENGINE OIL (See page 17–3)
106. ADD ENGINE COOLANT (See page 16–3)
107. ADD POWER STEERING FLUID (See pub. No. S1–YXZE05A, on page 51–3)
108. ADD FUEL
109. BLEED AIR FROM FUEL SYSTEM (See page 11–5)
110. CONNECT BATTERY NEGATIVE TERMINAL
111. BLEED AIR FROM STEERING SYSTEM (See pub. No. S1–YXZE05A, on page 51–3)
112. CHECK STEERING SYSTEM FOR LEAKS (See pub. No. S1–YXZE05A, on page 51–3)
113. CHECK FOR ENGINE OIL LEAKS
114. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)
115. CHECK FOR FUEL LEAKS (See page 11–2)
116. CHECK FOR EXHAUST GAS LEAKS

CYLINDER HEAD GASKET (N04C–TF)

141UE–01

REPLACEMENT

1. **DISCONNECT BATTERY NEGATIVE TERMINAL**
2. **DRAIN FUEL**
3. **DRAIN ENGINE OIL (See page 17–3)**
4. **DRAIN ENGINE COOLANT (See page 16–3)**
5. **DRAIN POWER STEERING FLUID**
6. **REMOVE FRONT MUDGUARD RH**
7. **REMOVE FRONT MUDGUARD LH**
8. **REMOVE RADIATOR RESERVE TANK ASSY**
9. **REMOVE ENGINE SIDE COVER RH**
10. **REMOVE ENGINE SIDE COVER LH**
11. **REMOVE INTAKE AIR CONNECTOR PIPE (See page 14–14)**
12. **REMOVE AIR HOSE NO. 2 (See page 14–14)**
13. **REMOVE CHARGE AIR COOLER ASSY (See page 13–9)**
14. **REMOVE FAN (See page 14–14)**
15. **REMOVE A/C COMPRESSOR V BELT (See page 14–4)**
16. **DISCONNECT RADIATOR HOSE INLET**
17. **DISCONNECT RADIATOR HOSE OUTLET**
18. **REMOVE RADIATOR ASSY (See page 16–10)**
19. **REMOVE VENTILATION PIPE NO. 2 (See page 14–14)**
20. **REMOVE EXHAUST PIPE ASSY FRONT (See page 15–2)**
21. **REMOVE GENERATOR ASSY (See page 19–7)**
22. **REMOVE INTAKE AIR CONNECTOR PIPE (See page 14–14)**
23. **REMOVE OIL FILLER CAP SUB–ASSY**
24. **REMOVE CYLINDER HEAD COVER NO. 2 (See page 11–20)**
25. **REMOVE CYLINDER HEAD COVER SUB–ASSY (See page 11–20)**
26. **REMOVE BREATHER PIPE**
27. **REMOVE BRACKET (See page 14–14)**
28. **REMOVE WATER BY–PASS PIPE (See page 14–14)**
29. **REMOVE VENTURI ASSY (See page 10–7)**
30. **REMOVE FUEL PIPE CLAMP (See page 11–20)**
31. **REMOVE OIL LEVEL GAGE GUIDE**
32. **REMOVE INJECTOR ASSY (See page 11–20)**
33. **REMOVE INTAKE PIPE (See page 14–14)**
34. **REMOVE RADIATOR PIPE (See page 14–14)**
35. **REMOVE TURBOCHARGER SUB–ASSY (See page 13–6)**
36. **SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page 14–5)**

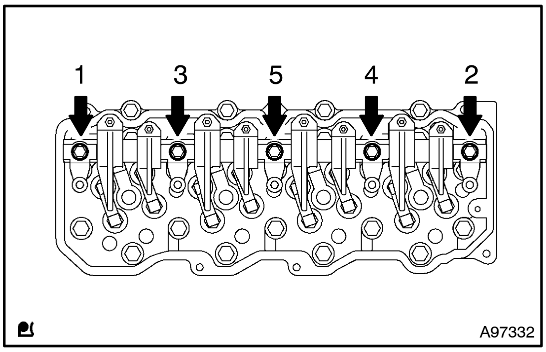


A97497

37. **REMOVE VALVE ROCKER SHAFT SUB–ASSY NO.1**

(a) Loosen the lock nut at the top of the rocker arm, then tighten the adjusting screw completely.

NOTICE:
If the adjusting screw is left untightened or too loose, the rocker shaft may bend when the rocker arm support is loosened.



(b) Loosen the rocker arm support bolts in the order as shown in the illustration.

38. REMOVE VALVE PUSH ROD

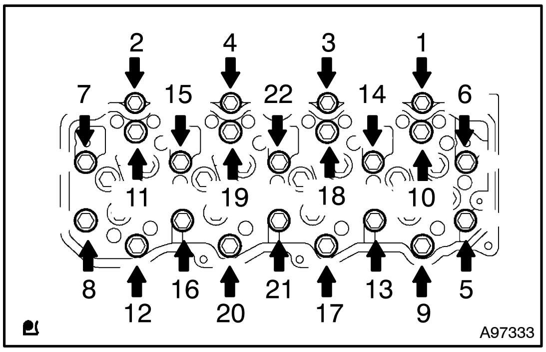
NOTICE:

Organize the parts so that each parts location can be remembered for reassembly.

39. REMOVE VALVE BRIDGE

NOTICE:

Organize the parts so that each parts location can be remembered for reassembly.



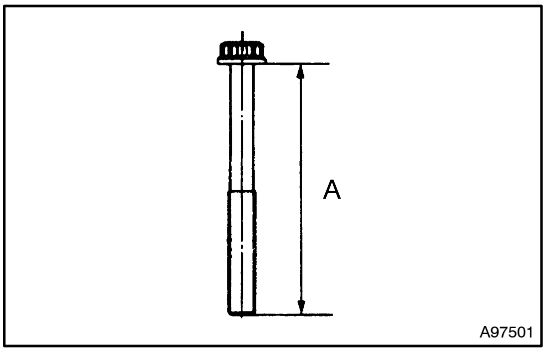
40. REMOVE CYLINDER HEAD SUB–ASSY

(a) Remove the cylinder head bolts in the order as shown in the illustration.

(b) Lift and remove the cylinder head from the cylinder block.

41. REMOVE CYLINDER HEAD GASKET

42. INSTALL CYLINDER HEAD GASKET

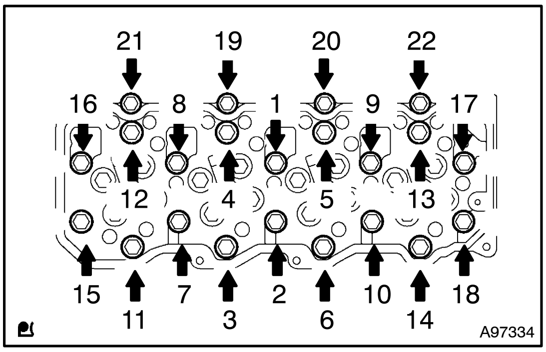


43. INSPECT CYLINDER HEAD BOLT

(a) Measure the length of the M12 head bolts No. 1 to No. 18.

Maximum length (A): 129 mm (5.07 in.)

If the length is greater than the maximum, replace them with new bolts.

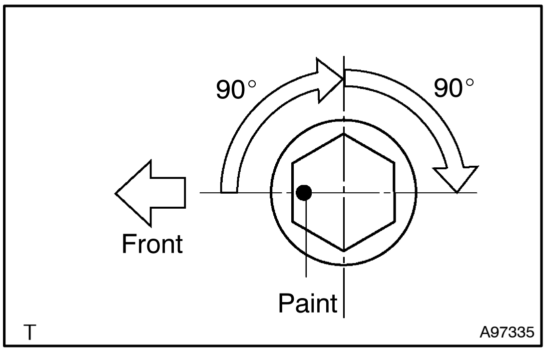


44. INSTALL CYLINDER HEAD SUB–ASSY

HINT:

Since the cylinder head bolts are unique to this engine, do not substitute them with ordinary bolts for them.

(a) Uniformly install and tighten the 18 cylinder head bolts in the order shown in the illustration.
Torque: 60 N·m (612 kgf·cm, 44 ft·lbf)

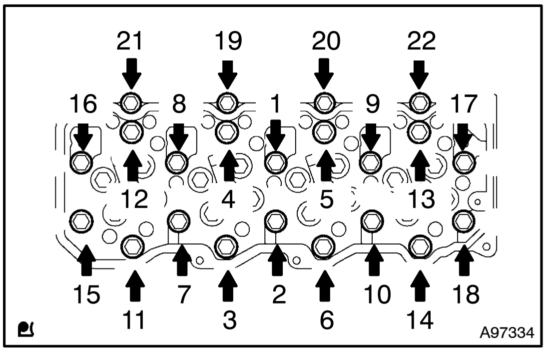


(b) Mark the front side of each cylinder head bolt head with paint as shown in the illustration.

(c) Retighten the cylinder head bolts by 90° in the same order as step (a).

(d) Perform step (c) again.

(e) Check that each painted mark is now at a 180° angle to the front.



(f) Uniformly install and tighten the 19 to 22 cylinder head bolts in the order shown in the illustration.
Torque: 55 N·m (561 kgf·cm, 41 ft·lbf)

45. INSTALL VALVE BRIDGE

NOTICE:

Be sure to install the bridge to its original location.

46. INSTALL VALVE PUSH ROD

NOTICE:

Be sure to install the push rod to its original location.

47. INSTALL VALVE ROCKER SHAFT SUB–ASSY NO.1

(a) Lubricate the rocker arm shaft and bush.

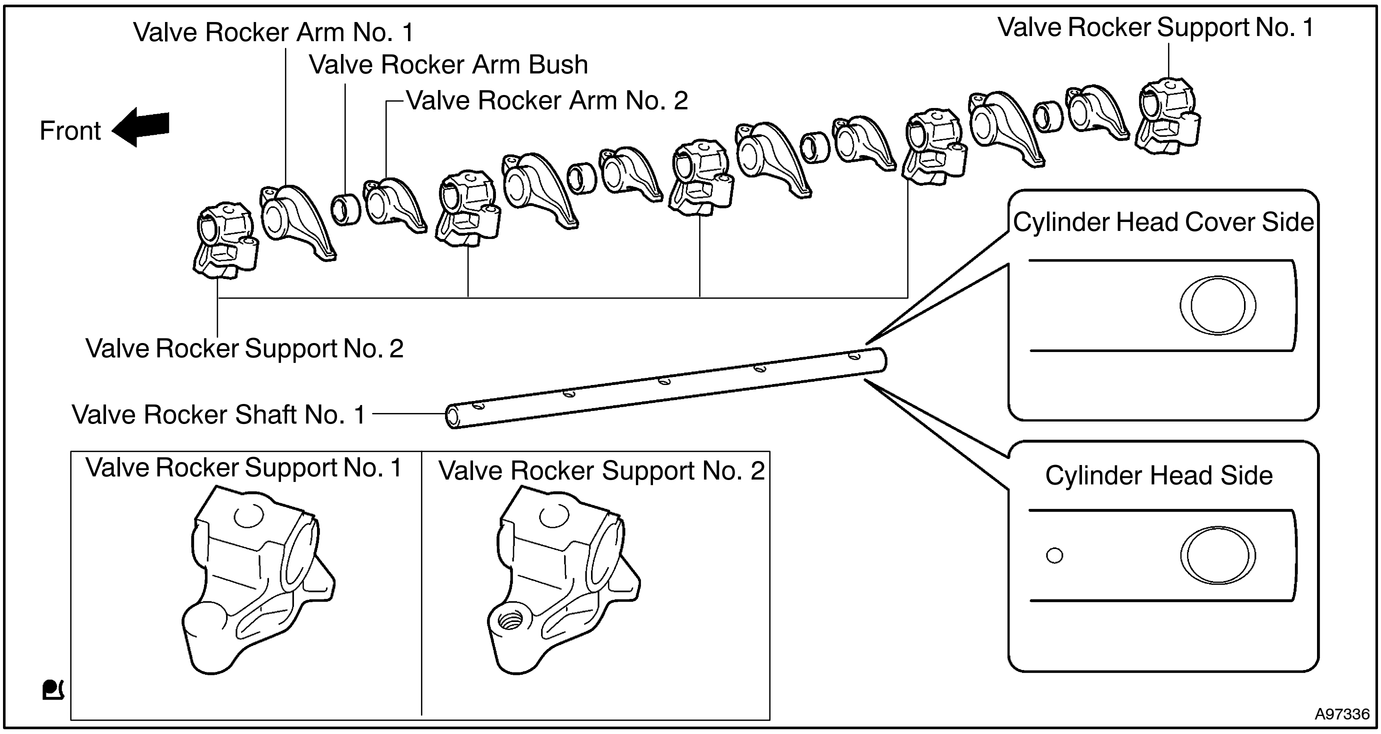
NOTICE:

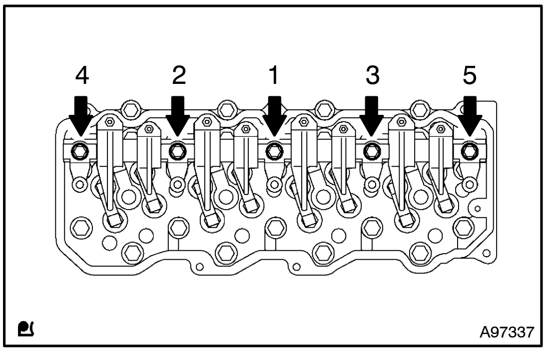
Confirm that oil hole of the rocker arm No. 1 support aligns with the shaft oil hole. Improper installation will result in burning of the entire valve assy.

(b) Install the rocker arm No. 1 and No. 2, the rocker support No.1 and No. 2 and the rocker arm bush to the rocker shaft No. 1.

NOTICE:

When the installing, face the hole on the cylinder head side of the rocker shaft No. 1 as shown in the illustration.





(c) Install the rocker shaft to the cylinder head.

(d) Apply engine oil to the rocker arm and push rod.

(e) Install the bolts in the order shown in the illustration.

Torque: 69 N·m (704 kgf·cm, 51 ft·lbf)

NOTICE:

Be careful not to interfere the push rod with the adjusting screw.

48. ADJUST VALVE CLEARANCE (See page 14–5)
49. INSTALL TURBOCHARGER SUB–ASSY (See page 13–6)
50. INSTALL RADIATOR PIPE (See page 14–14)
51. INSTALL INTAKE PIPE (See page 14–14)
52. INSTALL INJECTOR ASSY (See page 11–20)
53. INSTALL OIL LEVEL GAGE GUIDE
54. INSTALL FUEL PIPE CLAMP (See page 11–20)
55. INSTALL VENTURI ASSY (See page 10–7)

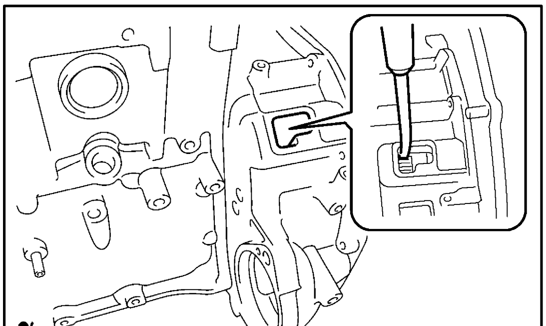
56. **INSTALL WATER BY–PASS PIPE (See page 14–14)**
57. **INSTALL BRACKET (See page 14–14)**
58. **INSTALL BREATHER PIPE**
59. **INSTALL CYLINDER HEAD COVER SUB–ASSY (See page 11–20)**
60. **INSTALL CYLINDER HEAD COVER NO. 2 (See page 11–20)**
61. **INSTALL OIL FILLER CAP SUB–ASSY**
62. **INSTALL INTAKE AIR CONNECTOR PIPE (See page 14–14)**
63. **INSTALL GENERATOR ASSY (See page 19–7)**
64. **INSTALL EXHAUST PIPE ASSY FRONT (See page 15–2)**
65. **INSTALL VENTILATION PIPE NO. 2 (See page 14–14)**
66. **INSTALL RADIATOR ASSY (See page 16–10)**
67. **CONNECT RADIATOR HOSE INLET**
68. **CONNECT RADIATOR HOSE OUTLET**
69. **INSTALL A/C COMPRESSOR V BELT (See page 14–4)**
70. **INSTALL FAN (See page 14–14)**
71. **INSTALL CHARGE AIR COOLER ASSY (See page 13–9)**
72. **INSTALL AIR HOSE NO. 2 (See page 14–14)**
73. **INSTALL INTAKE AIR CONNECTOR PIPE (See page 14–14)**
74. **INSTALL ENGINE SIDE COVER RH**
75. **INSTALL ENGINE SIDE COVER LH**
76. **INSTALL RADIATOR RESERVE TANK ASSY**
77. **INSTALL FRONT MUDGUARD RH**
78. **INSTALL FRONT MUDGUARD LH**
79. **ADD ENGINE OIL (See page 17–3)**
80. **ADD ENGINE COOLANT (See page 16–3)**
81. **ADD POWER STEERING FLUID (See pub. No. S1–YXZE05A, on page 51–3)**
82. **ADD FUEL**
83. **BLEED AIR FROM FUEL SYSTEM (See page 11–5)**
84. **CONNECT BATTERY NEGATIVE TERMINAL**
85. **BLEED AIR FROM STEERING SYSTEM (See pub. No. S1–YXZE05A, on page 51–3)**
86. **CHECK STEERING SYSTEM FOR LEAKS (See pub. No. S1–YXZE05A, on page 51–3)**
87. **CHECK FOR ENGINE OIL LEAKS**
88. **CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)**
89. **CHECK FOR FUEL LEAKS (See page 11–2)**
90. **CHECK FOR EXHAUST GAS LEAKS**

OIL PUMP SEAL (N04C–TF)

141UF–01

REPLACEMENT

1. **DRAIN ENGINE OIL (See page 17–3)**
2. **DRAIN ENGINE COOLANT (See page 16–3)**
3. **REMOVE CHARGE AIR COOLER ASSY (See page 13–9)**
4. **REMOVE RADIATOR ASSY (See page 16–10)**



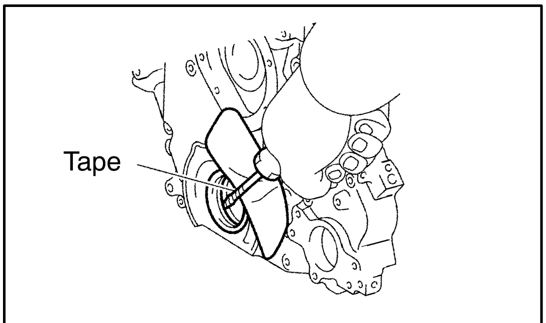
A97094

5. **REMOVE CRANKSHAFT PULLEY**

(a) Using a 46 mm socket wrench, remove the nut, spacer and pulley.

HINT:

Insert a screwdriver through the inspection hole of the flywheel housing into the ring gear of the flywheel to keep it from turning together with the crankshaft.



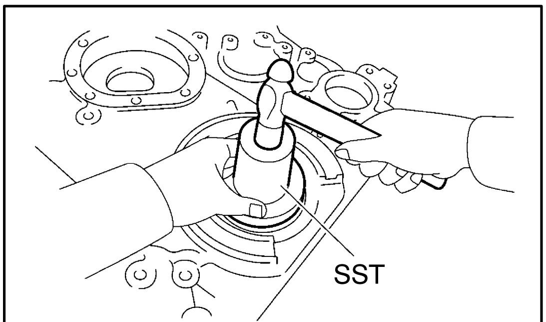
A97104

6. **REMOVE OIL PUMP SEAL**

(a) Using a screwdriver, pry out the housing.

HINT:

Tape the screwdriver tip before use.



A97105

7. **INSTALL OIL PUMP SEAL**

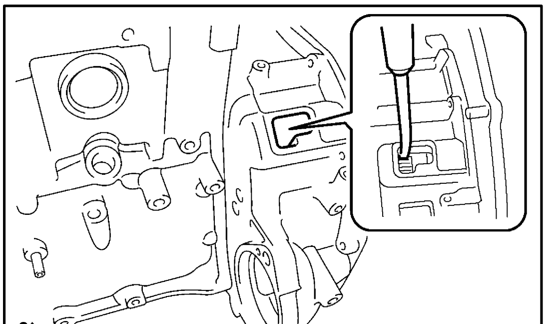
(a) Using SST and a hammer, tap in the oil seal to the timing gear case so that oil seal is flush with the timing gear edge.

SST 09223–78010

NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Keep the gap between the gear case edge and the oil seal free of foreign matter.**

(b) Apply MP grease to the oil seal lip.



A97094

8. **INSTALL CRANKSHAFT PULLEY**

(a) Install the pulley and spacer to the crankshaft.

HINT:

Align the pulley set key with the key groove of the pulley.

(b) Using a 46 mm socket wrench, tighten the nut.

Torque: 519 N·m (5,294 kgf·cm, 383 ft·lbf)

HINT:

Insert a screwdriver through the inspection hole of the flywheel housing into the ring gear of the flywheel to keep it from turning together with the crankshaft.

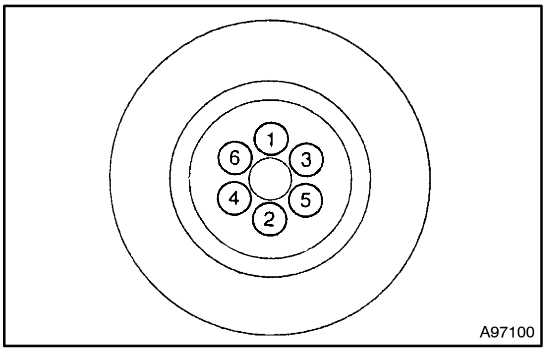
9. **INSTALL RADIATOR ASSY (See page 16–10)**
10. **INSTALL CHARGE AIR COOLER ASSY (See page 13–9)**
11. **ADD ENGINE COOLANT (See page 16–3)**
12. **ADD ENGINE OIL (See page 17–3)**
13. **CHECK FOR ENGINE OIL LEAKS**
14. **CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)**

ENGINE REAR OIL SEAL (N04C–TF)

141UG–01

REPLACEMENT

1. **DRAIN ENGINE OIL (See page 17–3)**
2. **REMOVE TRANSMISSION ASSY (See page 41–3)**
3. **REMOVE CLUTCH DISC ASSY (See page 42–2)**

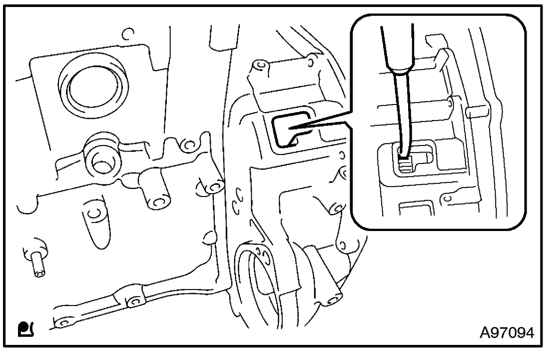


A97100

4. **REMOVE FLYWHEEL SUB–ASSY**

(a) Uniformly loosen and remove the 6 bolts in the order shown in the illustration.

(b) Remove the flywheel.


A97094

HINT:
Insert a screwdriver through the inspection hole of the flywheel housing into the ring gear of the flywheel to keep it from turning together with the crankshaft.

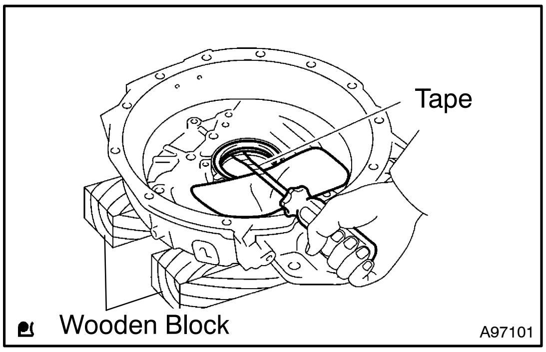
NOTICE:
The flywheel is heavy. When removing, be careful not to drop it on your feet.

5. **REMOVE FLYWHEEL HOUSING**

(a) Remove the 14 bolts from the cylinder block.

(b) Using a screwdriver, pry out the housing.

HINT:
Tape the screwdriver tip before use.

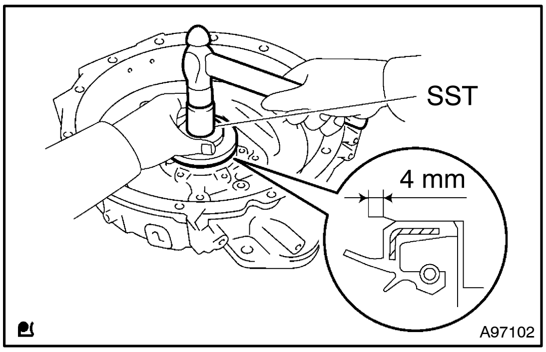


A97101

6. **REMOVE ENGINE REAR OIL SEAL RETAINER**

(a) Using a screwdriver, pry out the retainer.

HINT:
Tape the screwdriver tip before use.



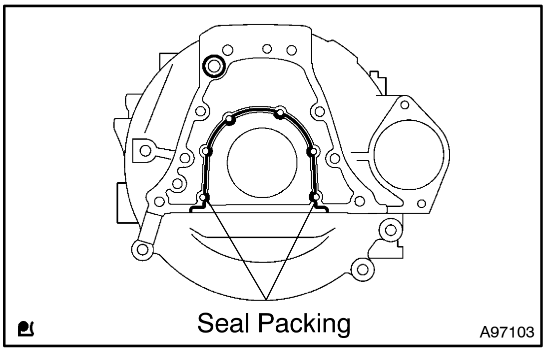
7. INSTALL ENGINE REAR OIL SEAL RETAINER

(a) Using SST and a hammer, tap in a new retainer until it lowers by 4 mm (0.16 in.) from the upper edge of the flywheel housing.
SST 09223–78010

NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Keep the gap between the rear oil seal retainer edge and the oil seal free of foreign matter.**

(b) Apply MP grease to the oil seal lip.



8. INSTALL FLYWHEEL HOUSING

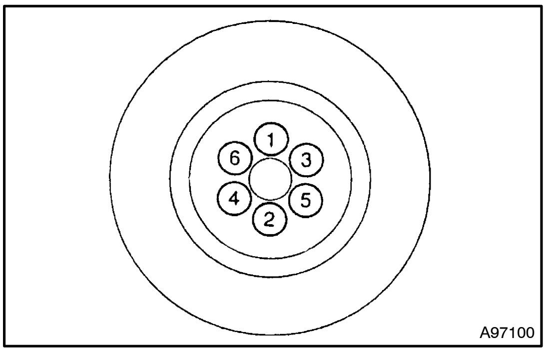
(a) Remove any oil packing material from the contact surface.

(b) Apply a continuous bead of seal packing (diameter: 1.5 to 2.5 mm (0.06 to 0.10 in.)) as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Install the oil seal retainer within 3 minutes after applying seal packing.**
- **Do not put in to engine oil for at least 2 hours after installing.**

(c) Install the flywheel housing with the 14 bolts.
Torque:
132 N·m (1,346 kgf·cm, 97 ft·lbf) for bolt (M14)
28.5 N·m (291 kgf·cm, 21 ft·lbf) for bolt (M8)



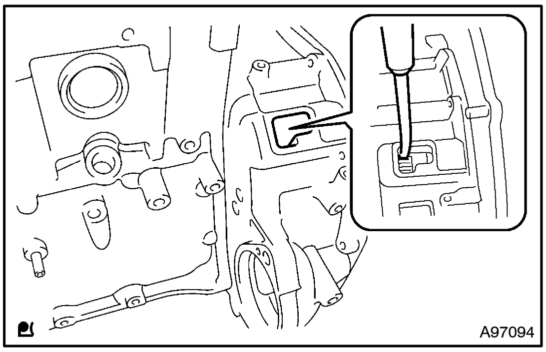
9. INSTALL FLYWHEEL SUB–ASSY

(a) Insert the flywheel slowly until it contacts the collar knock in order to prevent impact on the guide bar. Adjust the position, then insert it completely.

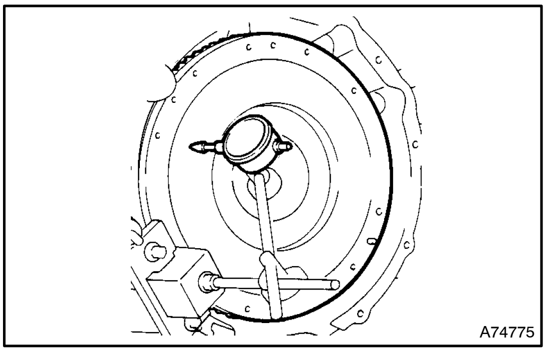
NOTICE:
The flywheel is heavy. When removing, be careful not to drop it on your feet.

(b) Apply clean engine oil to the threads of the flywheel bolt and the flywheel bolt seat.

(c) Tighten the flywheel bolts in the order shown in the illustration.
Torque: 190 N·m (1,938 kgf·cm, 140 ft·lbf)



HINT:
Insert a screwdriver through the inspection hole of the flywheel housing into the ring gear of the flywheel to keep it from turning together with the crankshaft.



(d) Using a dial indicator, measure the runout of the flywheel.
Maximum runout: 0.15 mm (0.0059 in.)

If the runout is greater than the maximum, resurface the sliding surface.

10. INSTALL CLUTCH DISC ASSY (See page 42–2)
11. INSTALL TRANSMISSION ASSY (See page 41–3)
12. ADD ENGINE OIL (See page 17–3)
13. CHECK FOR ENGINE OIL LEAKS

EXHAUST

EXHAUST PIPE ASSY (N04C−TF) .... 15−1

COMPONENTS .... 15−1

REPLACEMENT .... 15−2

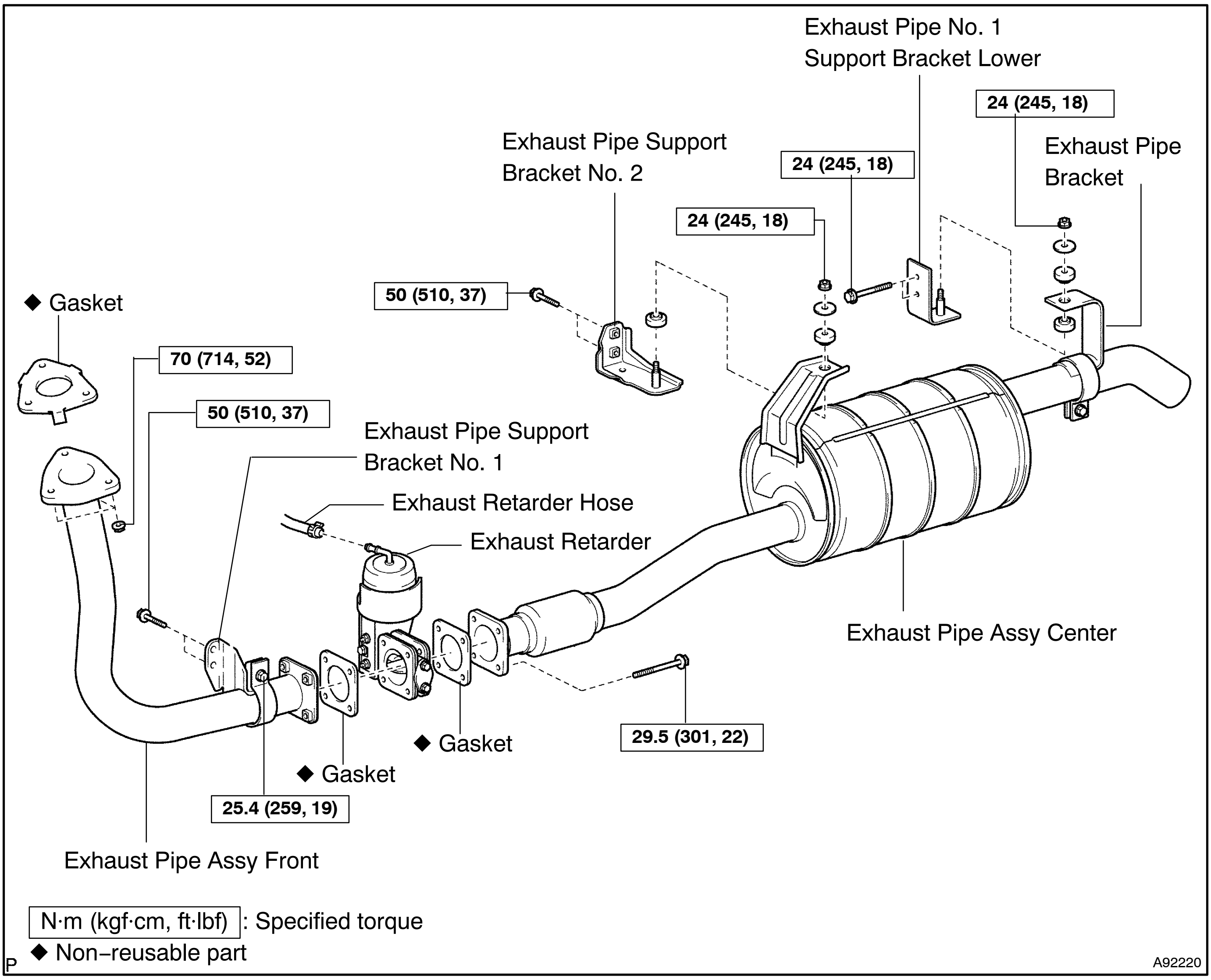
REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1−YXZE05A)

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

EXHAUST PIPE ASSY (N04C–TF)

COMPONENTS

150CY–01



150CZ–01

REPLACEMENT

1. REMOVE EXHAUST PIPE ASSY CENTER

(a) Disconnect the exhaust retarder hose.
(b) Remove the 4 bolts, exhaust retarder and 2 gaskets from the exhaust pipes.
(c) Remove the 2 nuts from the bracket No. 2 and bracket lower.
(d) Remove the 4 washers, 4 cushions and pipe from the brackets.

2. REMOVE EXHAUST PIPE ASSY FRONT

(a) Remove the 2 bolts from the bracket No. 1.
(b) Remove the bolt and clamp from the exhaust pipe.
(c) Remove the 3 nuts, gasket and pipe.

3. INSTALL EXHAUST PIPE ASSY FRONT

(a) Install a new gasket on the pipe.
(b) Install the pipe with the 3 nuts.
Torque: 70 N·m (714 kgf·cm, 52 ft·lbf)
(c) Install the bracket No. 1 to the body with the 2 bolts.
Torque: 50 N·m (510 kgf·cm, 37 ft·lbf)
(d) Install the bracket No. 1 and clamp to the pipe with the bolt.
Torque: 25.4 N·m (259 kgf·cm, 19 ft·lbf)

4. INSTALL EXHAUST PIPE ASSY CENTER

(a) Install the 4 washers, 4 cushions and pipe to the bracket No. 2 and bracket lower.
(b) Instal the 2 nuts to the bracket No. 2 and bracket lower.
Torque: 24 N·m (245 kgf·cm, 18 ft·lbf)
(c) Install a new gasket to both sides of the retarder.
(d) Install the pipe center and pipe front to the retarder with the 4 bolts.
Torque: 29.5 N·m (301 kgf·cm, 22 ft·lbf)
(e) Connect the exhaust retarder hose.

5. CHECK FOR EXHAUST GAS LEAKS

COOLING

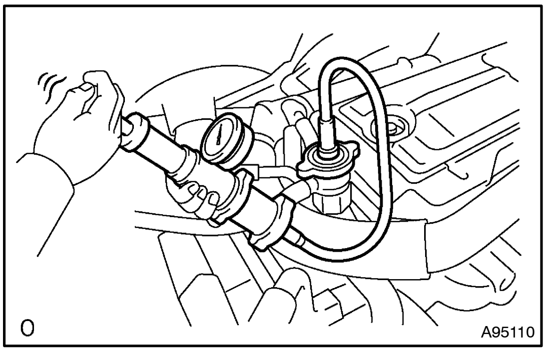
COOLING SYSTEM (N04C–TF) 16–1
ON–VEHICLE INSPECTION 16–1
INSPECTION 16–2
COOLANT (N04C–TF) 16–3
REPLACEMENT 16–3
WATER PUMP ASSY (N04C–TF) 16–5
REPLACEMENT 16–5
THERMOSTAT (N04C–TF) 16–7
REPLACEMENT 16–7
RADIATOR ASSY (N04C–TF) 16–9
ON–VEHICLE CLEANING 16–9
REPLACEMENT 16–10

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

COOLING SYSTEM (N04C–TF)

ON–VEHICLE INSPECTION

160WX–01



1. **INSPECT COOLING SYSTEM FOR LEAKS**

CAUTION:

Do not remove the radiator cap while the engine and rediator are still hot. Pressurized, hot engine coolant and steam may be released and cause serious burns.

(a) Fill the radiator with coolant and attach a radiator cap tester.
(b) Warm up the engine.
(c) Using the radiator cap tester, increase the pressure inside the radiator to 137 kPa (1.4 kgf/cm^2, 20.3 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.

2. **CHECK ENGINE COOLANT LEVEL AT RESERVOIR**

(a) The engine coolant level should be between the ”LOW” and ”FULL” lines, when the engine is cold. If low, check for leaks and add ”HINO Long Life Coolant” or similar high quality ethylene glycol based non–silicate, non–amine, non–nitrite, non–borate coolant with long–life hybrid organic acid technology up to the ”FULL” line.

3. **CHECK ENGINE COOLANT QUALITY**

(a) Remove the radiator cap.

CAUTION:

Do not remove the radiator cap while the engine and radiator are still hot. Pressurized, hot engine coolant and steam may be released and cause serious burns.

(b) Check for excessive deposits of rust or scale around the radiator cap and radiator filler hole. Also, the coolant should be free from oil.

HINT:

If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.

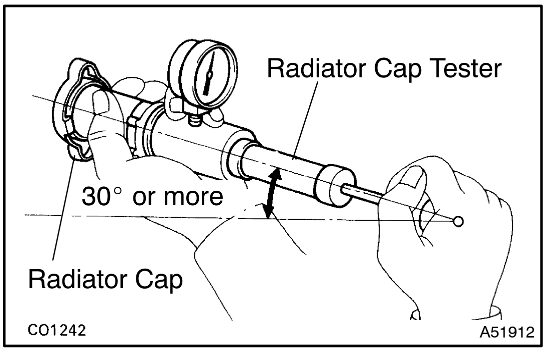
160WY–01

INSPECTION

1. INSPECT RADIATOR CAP SUB–ASSY

NOTICE:

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



(a) Using a radiator cap tester, slowly pump the tester and check that air is being released from the vacuum valve.

Pump speed: 1 push every 3 seconds or more

NOTICE:
Push the pump at a constant speed.

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

(b) Pump the tester and measure the relief valve opening pressure.

Pump speed: 1 push within 1 second

NOTICE:
The pump speed above should be followed for the first pump only. It will close the vacuum valve. Once the vacuum valve is closed, the pump speed can be reduced.

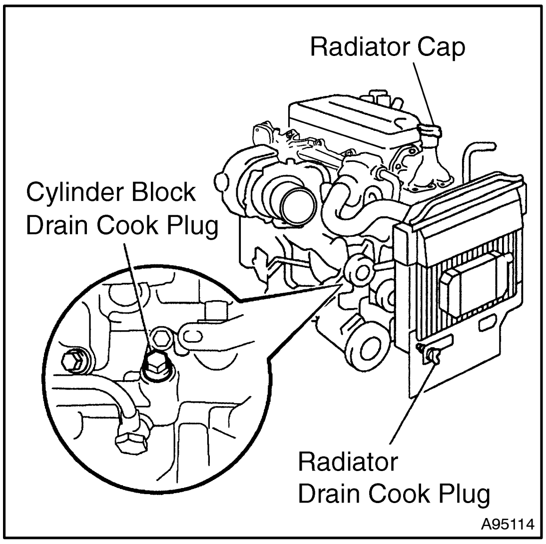
Standard opening pressure:
108 kPa (1.1 kgf/cm^2, 15.9 psi)
Minimum opening pressure:
93.3 kPa (0.951 kgf/cm^2, 13.5 psi)

HINT:
Pay attention to the tester's maximum reading of the opening pressure. If the maximum reading is less than the minimum opening pressure above, replace the reservoir cap.

COOLANT (N04C–TF)

REPLACEMENT

160WZ–01



1. DRAIN ENGINE COOLANT

(a) Remove the radiator cap.

CAUTION:

Do not remove the radiator cap while the engine and radiator are still hot. Pressurized, hot engine coolant and steam may be released and cause serious burns.

(b) Drain engine coolant by loosening the radiator drain cock plug and the engine's cylinder block drain cock plug.

HINT:

Engine coolant inside the radiator is drained from the drain hole located on the bottom of the engine under cover.

(c) Tighten the cylinder block drain cock plug.

Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)

2. ADD ENGINE COOLANT

(a) Tighten the radiator drain plug.

(b) Add engine coolant into the radiator until it overflows.

Capacity: 14.4 liters (15.2 US qts, 13.3 Imp. qts)

HINT:

- Use of improper coolants may damage the engine cooling system.
- Only use "HINO Long Life Coolant" or similar high quality ethylene glycol based non–silicate, non–amine, non–nitrite, non–borate coolant with long–life hybrid organic acid technology. (Coolant with long–life hybrid organic acid technology consists of a combination of low phosphates and organic acids.)
- New HINO vehicles are filled with HINO Long Life Coolant. When replacing the coolant, HINO Long Life Coolant is recommended.
- Observe the coolant amount inside the radiator by pressing the inlet and outlet radiator hoses several times by hand. If the coolant amount goes down, add coolant.

(c) Install the radiator cap.

(d) Bleed the cooling system.

(1) Start the engine, and open the heater water valve.

(2) Maintain the engine speed at 2,000 to 2,500 rpm and warm up the engine.

(e) Stop the engine and wait until the engine coolant cools down.

(f) Refill coolant into the reservoir up to the "FULL" line.

NOTICE:

Do not use plain water alone.

(g) Pour coolant into the radiator reservoir tank until the coolant reaches the "FULL" line.

(h) Install the radiator cap.

(i) Warm up the engine.

HINT:

As the engine warms up, press the inlet and outlet radiator hoses several times by hand.

(j) Stop the engine and wait until the coolant cools down to the room temperature.

(k) Remove the radiator cap and check the coolant amount inside the radiator.

(l) If the coolant amount is below the ”FULL” line, repeat steps (c) to (g) until the coolant amount stays the same from steps (c) to (g).

(m) Install the radiator cap and then check the radiator reservoir tank coolant amount. If it is below the ”FULL” line, add coolant.

3. CHECK FOR ENGINE COOLANT LEAKS

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

(b) Increase the pressure inside the radiator to 137 kPa (1.4 kgf/cm^2, 20.3 psi) and check for leakage.

WATER PUMP ASSY (N04C–TF)

160X0–01

REPLACEMENT

1. **DRAIN ENGINE COOLANT (See page 16–3)**
2. **REMOVE ENGINE SIDE COVER RH**
3. **REMOVE ENGINE SIDE COVER LH**
4. **DISCONNECT RADIATOR HOSE INLET**
5. **DISCONNECT RADIATOR RESERVE TANK ASSY**
6. **DISCONNECT RADIATOR HOSE NO. 5**
7. **REMOVE A/C COMPRESSOR V BELT (See page 14–4)**
8. **REMOVE FAN AND GENERATOR V BELT**

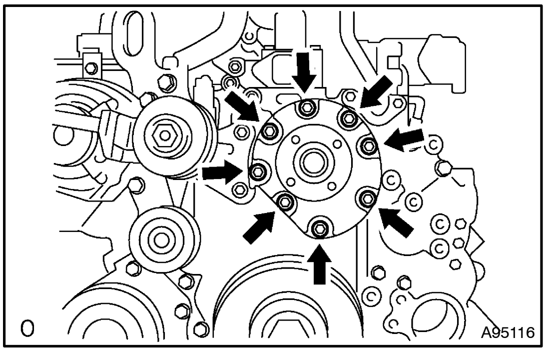
(a) Stretch the belt tight, and loosen the 4 pulley set nuts.

(b) Remove the V belt.

9. **REMOVE FAN**

(a) Remove the 4 nuts and fan.

10. **REMOVE FAN PULLEY**



11. **REMOVE WATER PUMP ASSY**

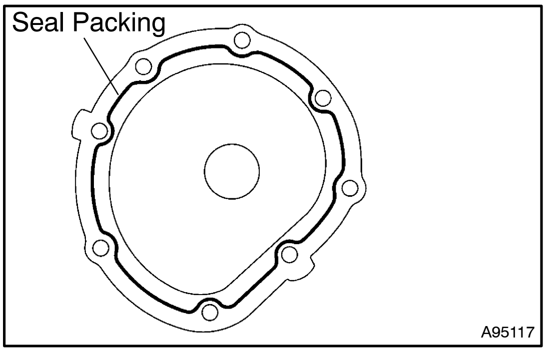
(a) Remove the 8 bolts and pump.

12. **INSTALL WATER PUMP ASSY**

(a) Remove any old packing (FIPG) materials and be careful not to drop any oil on the contact surfaces of the water pump and cylinder block.

HINT:

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) materials from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all loose material.
- Using a non–residue solvent, clean both sealing surfaces.



(b) Apply seal packing to the water pump as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Apply seal packing to the inner side of the oil holes.**
- **Install the water pump within 3 minutes after applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installing the water pump.**

(c) Install the pump with the 8 bolts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

13. **INSTALL FAN PULLEY**
14. **INSTALL FAN**

(a) Temporarily install the fan with the 4 nuts.

15. INSTALL FAN AND GENERATOR V BELT

(a) Install the V belt.

(b) Stretch the belt tight and tighten the 4 nuts.

Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

16. INSTALL A/C COMPRESSOR V BELT (See page 14–4)

17. INSPECT DRIVE BELT DEFLECTION AND TENSION (See page 14–1)

18. CONNECT RADIATOR HOSE NO. 5

19. CONNECT RADIATOR RESERVE TANK ASSY

20. CONNECT RADIATOR HOSE INLET

21. ADD ENGINE COOLANT (See page 16–3)

22. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)

23. INSTALL ENGINE SIDE COVER RH

24. INSTALL ENGINE SIDE COVER LH

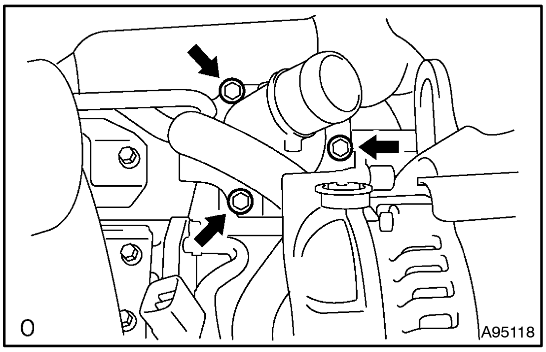
THERMOSTAT (N04C–TF)

160X1–01

REPLACEMENT

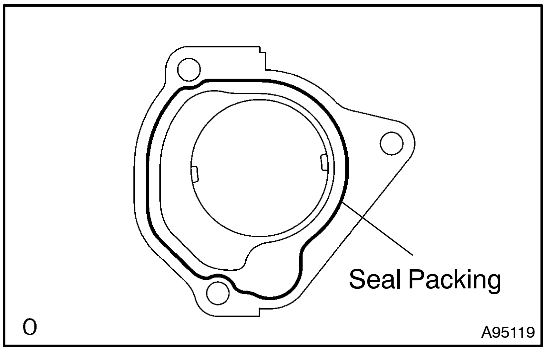
1. **DRAIN ENGINE COOLANT (See page 16–3)**
2. **REMOVE ENGINE SIDE COVER RH**
3. **DISCONNECT RADIATOR HOSE INLET**
4. **REMOVE AIR HOSE NO. 1**

(a) Remove the 2 hose clamps.
(b) Remove the 2 bolts and hose.



5. **REMOVE THERMOSTAT**

(a) Remove the 3 bolts and water inlet.
(b) Remove the thermostat and gasket from the cylinder block.

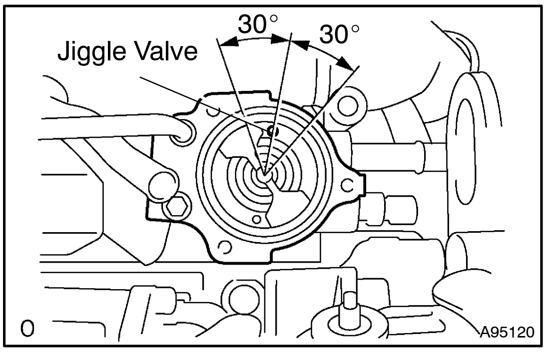


6. **INSTALL THERMOSTAT**

(a) Apply a continuous bead of seal packing as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Apply seal packing to the inner side of the bolt holes.**
- **Install the thrmostat within 3 minutes after applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installing the thermostat.**



(b) Install a new gasket to the thermostat.
(c) Install the thermostat with the jiggle valve facing up.

HINT:
The jiggle valve may be set within 30° of either side of the prescribed position.

(d) Install the water inlet with the 3 bolts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)

7. INSTALL AIR HOSE NO. 1

(a) Install the 2 hose clamps.

(b) Install the hose with the 2 bolts.

Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

8. CONNECT RADIATOR HOSE INLET

9. ADD ENGINE COOLANT (See page 16–3)

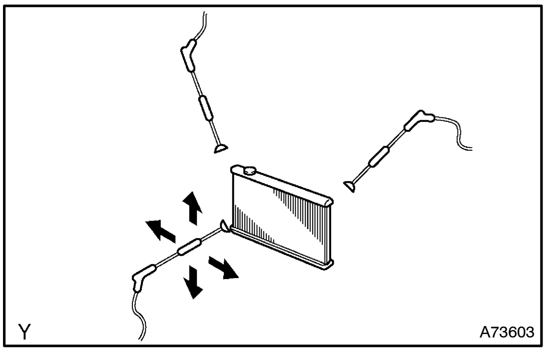
10. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)

11. INSTALL ENGINE SIDE COVER RH

RADIATOR ASSY (N04C–TF)

ON–VEHICLE CLEANING

160X2–01



1. INSPECT FINS BLOCKAGE

(a) If the fins are clogged, wash them with water or use a steam cleaner. Dry with compressed air.

NOTICE:

- **If the distance between the steam cleaner and the core is too close, the fins may become damaged. Maintain the following distance and pressure level. Standard:**

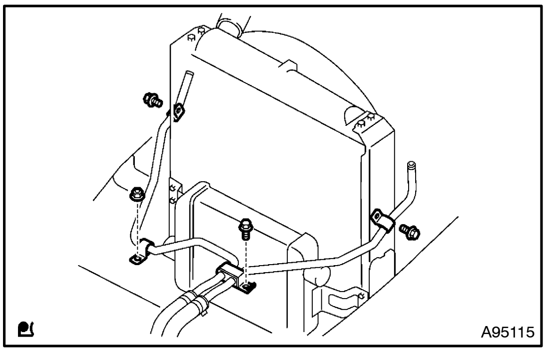
Distance	Pressure Level
300 mm (11.81 in.)	2,942 to 4,903 kPa (30 to 50 kgf/cm^2, 427 to 711 psi)
500 mm (19.69 in.)	4,903 to 7,845 kPa (50 to 80 kgf/cm^2, 711 to 1,138 psi)

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

160X3–01

REPLACEMENT

1. DRAIN ENGINE COOLANT (See page 16–3)
2. REMOVE ENGINE SIDE COVER RH
3. REMOVE ENGINE SIDE COVER LH
4. DISCONNECT RADIATOR HOSE INLET
5. DISCONNECT RADIATOR HOSE OUTLET
6. DISCONNECT RADIATOR RESERVE TANK ASSY
7. DISCONNECT RADIATOR HOSE NO. 5
8. DISCONNECT HEATER INLET WATER HOSE
9. DISCONNECT HEATER OUTLET HOSE B
10. REMOVE A/C COMPRESSOR V BELT (See page 14–4)
11. REMOVE FAN AND GENERATOR V BELT
(a) Stretch the belt tight and loosen the 4 pulley set nuts.
(b) Remove the V belt.
12. REMOVE FAN
(a) Remove the 4 nuts and fan.
13. REMOVE FAN PULLEY
14. DISCONNECT AIR HOSE NO. 1
15. DISCONNECT AIR HOSE NO. 2
16. REMOVE INTAKE AIR CONNECTOR PIPE
(a) Disconnect the IAT sensor and vacuum sensor connectors.
(b) Loosen the hose clamp.
(c) Remove the 2 bolts and pipe.
17. REMOVE CHARGE AIR COOLER ASSY
(a) Remove the 4 bolts and cooler.
18. REMOVE CONDENSER ASSY W/RECEIVER
(a) Remove the 4 bolts and condenser.
HINT:
Do not disconnect the cooler hose. Hang up the condenser with a rope so that the radiator can be removed.
19. REMOVE RADIATOR SUPPORT NO.1



20. REMOVE RADIATOR ASSY
(a) Remove the 4 bolts, 4 clamps and heater pipe as shown in the illustration.
(b) Remove the 3 bolts, nut and radiator.

21. REMOVE RADIATOR SUPPORT NO.2
(a) Remove the 2 bolts and support.
22. REMOVE FAN SHROUD
(a) Remove the 4 bolts and shroud.

23. REMOVE RADIATOR BRACKET NO.3
(a) Remove the 3 bolts and bracket.
24. REMOVE SUPPORT SEAL NO. 1
25. INSTALL SUPPORT SEAL NO. 1
26. INSTALL RADIATOR BRACKET NO.3
(a) Install the bracket with the 3 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
27. INSTALL FAN SHROUD
(a) Install the shroud with the 4 bolts.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)
28. INSTALL RADIATOR SUPPORT NO.2
(a) Install the support with the 2 bolts.
Torque: 7.5 N·m (77 kgf·cm, 66 in.·lbf)
29. INSTALL RADIATOR ASSY
(a) Install the radiator with the 3 bolts and nut.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
(b) Install the heater pipe with the 4 blots and 4 clamps.
Torque: 19.5 N·m (199 kgf·cm, 14 ft·lbf)
30. INSTALL RADIATOR SUPPORT NO.1
(a) Install the support with the 2 bolts.
Torque: 7.5 N·m (77 kgf·cm, 66 in.·lbf)
31. INSTALL CONDENSER ASSY W/RECEIVER
(a) Install the condenser with the 4 bolts.
Torque: 7.5 N·m (77 kgf·cm, 66 in.·lbf)
32. INSTALL CHARGE AIR COOLER ASSY
(a) Install the cooler with the 4 bolts.
Torque: 7.5 N·m (77 kgf·cm, 66 in.·lbf)
33. INSTALL INTAKE AIR CONNECTOR PIPE
(a) Install the pipe with the 2 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
(b) Install the hose clamp.
(c) Connect the IAT sensor and vacuum sensor connectors.
34. CONNECT AIR HOSE NO. 2
35. CONNECT AIR HOSE NO. 1
36. INSTALL FAN PULLEY
37. INSTALL FAN
(a) Temporarily install the fan with the 4 nuts.
38. INSTALL FAN AND GENERATOR V BELT
(a) Install the V belt.
(b) Stretch the belt tight and install the 4 nuts.
Torque: 28.5 N·m (291 kgf·cm, 21 ft·lbf)
39. INSTALL A/C COMPRESSOR V BELT (See page 14–4)
40. INSPECT DRIVE BELT DEFLECTION AND TENSION (See page 14–1)
41. CONNECT HEATER OUTLET HOSE B
42. CONNECT HEATER INLET WATER HOSE
43. CONNECT RADIATOR HOSE NO. 5
44. CONNECT RADIATOR RESERVE TANK ASSY
45. CONNECT RADIATOR HOSE OUTLET
46. CONNECT RADIATOR HOSE INLET
47. ADD ENGINE COOLANT (See page 16–3)

48. CHECK FOR ENGINE COOLANT LEAKS **(See page 16–1)**

49. INSTALL ENGINE SIDE COVER RH

50. INSTALL ENGINE SIDE COVER LH

LUBRICATION

LUBRICATION SYSTEM (N04C−TF) .... 17−1
ON−VEHICLE INSPECTION .... 17−1
OIL FILTER SUB−ASSY (N04C−TF) .... 17−3
REPLACEMENT .... 17−3
OIL PUMP ASSY (N04C−TF) .... 17−5
REPLACEMENT .... 17−5
OIL COOLER ASSY (N04C−TF) .... 17−7
REPLACEMENT .... 17−7

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1−YXZE05A)

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

LUBRICATION SYSTEM (N04C–TF)

170LA–01

ON–VEHICLE INSPECTION

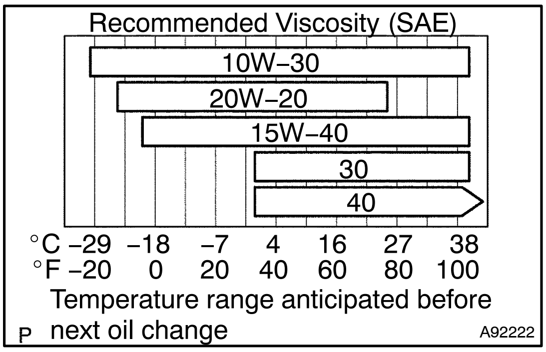
1. CHECK ENGINE OIL LEVEL

(a) Warm up the engine, stop the engine and wait 5 minutes. The oil level should be between the level gauge guide low level mark and full level mark.

If the oil level is low, check for leakage and add oil up to the full level mark.

NOTICE:

Do not fill with engine oil above the full level mark.



2. CHECK ENGINE OIL QUALITY

(a) Check the oil for deterioration, water contamination, discoloring or thinning.

If the quality is visibly poor, replace the oil.

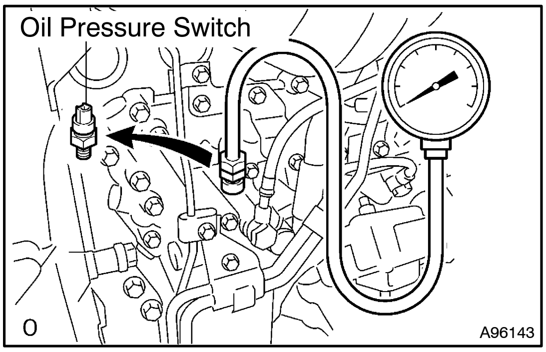
Oil grade: API CD, CE, CF, CH–4 or CI–4

If SAE 10W–30 or higher viscosity oil is used in extremely low temperatures, the engine may become difficult to start. SAE 5W–30 engine oil is recommended.

3. REMOVE OIL PRESSURE SWITCH ASSY

(a) Disconnect the oil pressure switch connector.

(b) Using a 24 mm deep socket wrench, remove the oil pressure switch.



4. INSTALL OIL PRESSURE GAUGE

(a) Using a 24 mm deep socket wrench, remove the oil pressure switch.

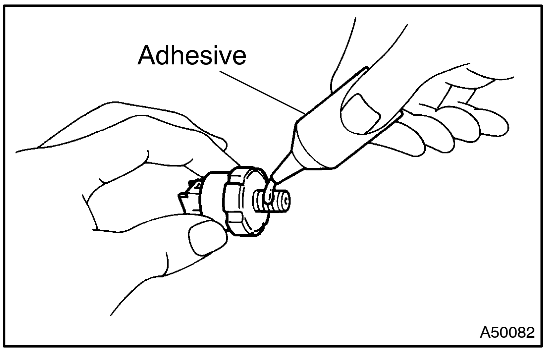
(b) Install the oil pressure gauge.

5. WARM UP ENGINE

6. CHECK OIL PRESSURE

Standard:

Item	Oil Pressure
Idle	190 kPa (1.9 kgf/cm^2, 27 psi) or more
3,000 rpm	245 to 539 kPa (2.5 to 5.5 kgf/cm^2, 36 to 78 psi) or more



7. INSTALL OIL PRESSURE SWITCH

(a) Remove the oil pressure gauge.

(b) Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent

(c) Using a 24 mm deep socket wrench, install the oil pressure switch.

Torque: 29.4 N·m (300 kgf·cm, 22 ft·lbf)

NOTICE:

Do not start the engine for at least 1 hour after installation of the switch.

(d) Connect the oil pressure switch connector.

8. START ENGINE AND CHECK FOR ENGINE OIL LEAKS

OIL FILTER SUB–ASSY (N04C–TF)

170LB–01

REPLACEMENT

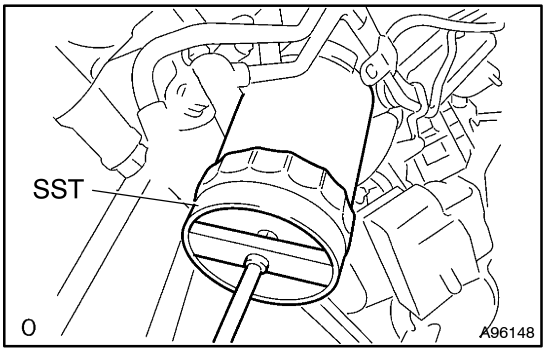
CAUTION:

- **Prolonged and repeated contact of mineral oil with the skin will deplete the skin's natural fats, leading to dryness, irritation and dermatitis. In addition, used engine oil contains harmful contaminants which may cause skin cancer.**
- **Wear protective clothing and gloves to minimize the length and frequency of contact between the skin and used oil. If contact does occur, wash your skin thoroughly with soap and water or waterless hand cleaner. Do not use gasoline, thinners or solvents to wash the skin.**
- **In order to preserve the environment, dispose of used oil and used oil filters only at designated disposal site.**

1. DRAIN ENGINE OIL

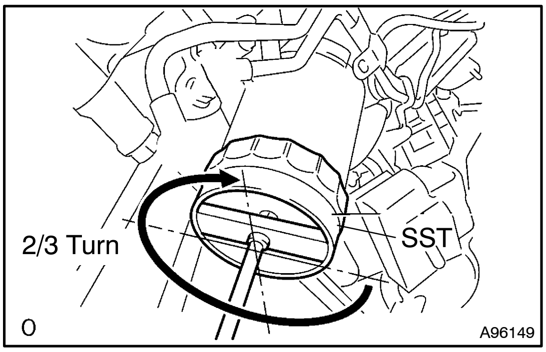
(a) Remove the oil filler cap.

(b) Remove the oil drain plug, and drain the oil into a container.



2. REMOVE OIL FILTER SUB–ASSY

(a) Using SST, remove the oil filter.
SST 09228–78010



3. INSTALL OIL FILTER SUB–ASSY

(a) Check and fresh the oil filter installation surface.

(b) Apply clean engine oil to the gasket of a new oil filter.

(c) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.

(d) Using SST, tighten the oil filter an additional 2/3 turn.
SST 09228–78010
Torque: 19.6 N·m (200 kgf·cm, 14 ft·lbf)

NOTICE:

- **Do not reuse the O–ring.**
- **Do not damage the O–ring.**

4. ADD ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket.
Torque: 34.5 N·m (350 kgf·cm, 25 ft·lbf)

(b) Fill with fresh engine oil.
Standard:

Item		Capacity
Drain and refill	w/ oil filter change	8.2 liters (8.6 US qts, 7.2 Imp. qts)
Drain and refill	w/o oil filter change	7.2 liters (7.6 US qts, 6.3 Imp. qts)

(c) Install the oil filler cap.

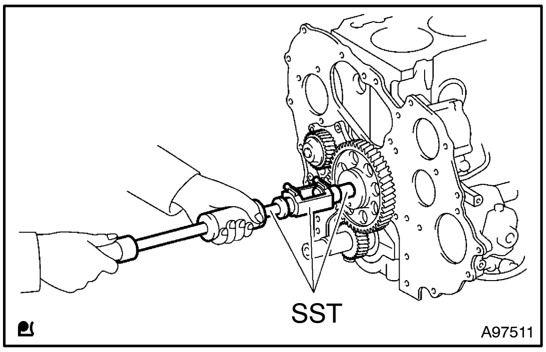
5. CHECK FOR ENGINE OIL LEAKS

OIL PUMP ASSY (N04C–TF)

170LC–01

REPLACEMENT

1. **DRAIN ENGINE OIL**
2. **REMOVE CAMSHAFT (See page 14–24)**



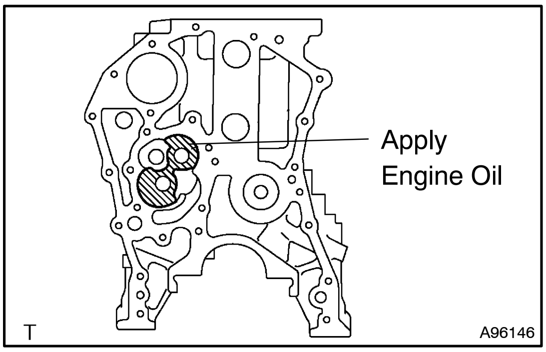
3. **REMOVE IDLE GEAR NO.1**

(a) Remove the bolt.

(b) Using SST, remove the gear shaft, gear and thrust plate.
SST 09910–00015 (09911–00011, 09912–00010, 09913–00010)

4. **REMOVE OIL PUMP ASSY**

(a) Remove the 7 bolts and pump.



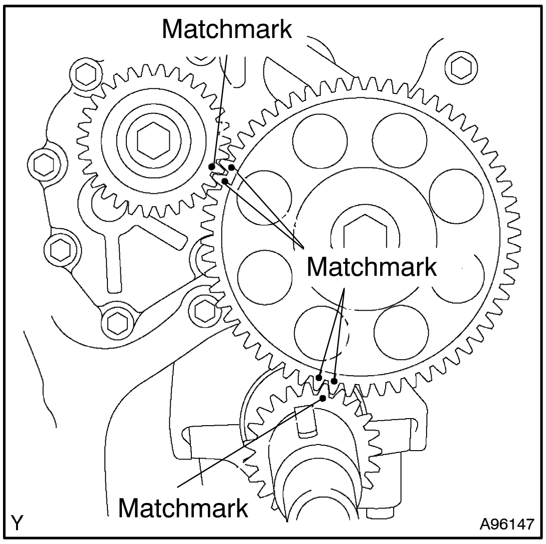
5. **INSTALL OIL PUMP ASSY**

(a) Apply engine oil to the pump case of the cylinder block and bearing.

NOTICE:
If engine oil is not applied, an oil suction malfunction will occur when starting the engine. The malfunction causes seizure and abnormal wear to the engine.

(b) Install a new gasket and pump with the 7 bolts.
Torque: 28.5 N·m (291 kgf·cm 21 ft·lbf)

(c) Check that the oil pump rotates smoothly by hand after the installation.



6. **INSTALL IDLE GEAR NO.1**

(a) Facing the oil hole of the idle gear shaft No. 1 downward, install the thrust plate, gear and idle gear shaft.

NOTICE:

If the oil hole is not facing downward, seizure and abnorml wear occurs.

(b) Align the matchmarks as shown in the illustration.

(c) Install the bolt to the idle gear shaft.

Torque: 137 N·m (1,397 kgf·cm 101 ft·lbf)

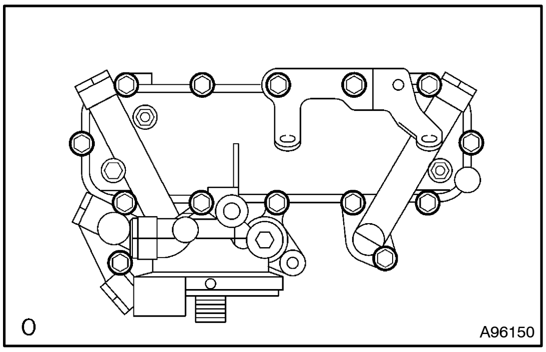
7. **INSTALL CAMSHAFT (See page 14–24)**
8. **ADD ENGINE OIL**
9. **CHECK FOR ENGINE OIL LEAKS**

OIL COOLER ASSY (N04C–TF)

170LD–01

REPLACEMENT

1. **DRAIN ENGINE OIL**
2. **REMOVE TURBOCHARGER SUB–ASSY (See page 13–6)**
3. **REMOVE OIL FILTER SUB–ASSY (See page 17–3)**
4. **REMOVE OIL PRESSURE SWITCH (See page 17–1)**



5. **REMOVE OIL W/BRACKET COOLER ASSY**

(a) Remove the 14 bolts and bracket.

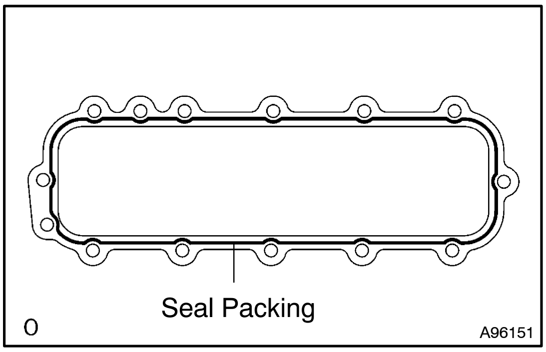
6. **REMOVE OIL COOLER ASSY**

(a) Remove the 4 nuts and cooler.

7. **INSTALL OIL COOLER ASSY**

(a) Install the cooler with the 4 nuts.

Torque: 28.5 N·m (286 kgf·cm, 21 ft·lbf)



8. **INSTALL OIL W/BRACKET COOLER ASSY**

(a) Remove any old seal packing from the contact surface.

(b) Apply a continuous bead of seal packing as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

- **Remove any oil from the contact surface.**
- **Apply seal packing to the inner side of the bolt holes.**
- **Install the oil pan within 3 minutes after applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installing the oil pan.**

(c) Install the bracket with the 14 bolts.

Torque: 28.5 N·m (286 kgf·cm, 21 ft·lbf)

9. **INSTALL OIL PRESSURE SWITCH (See page 17–1)**
10. **INSTALL OIL FILTER SUB–ASSY (See page 17–3)**
11. **INSTALL TURBOCHARGER SUB–ASSY (See page 13–6)**
12. **ADD ENGINE OIL (See page 17–3)**
13. **CHECK FOR ENGINE OIL LEAKS**

STARTING & CHARGING

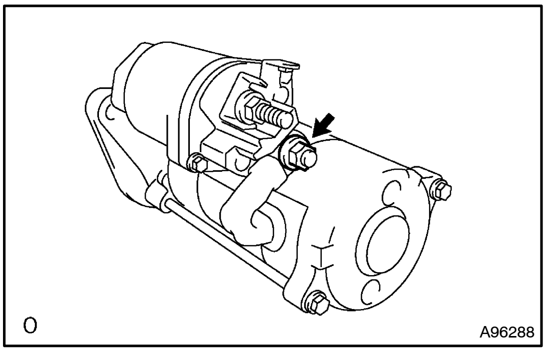
STARTING SYSTEM (N04C−TF)	19−1
INSPECTION	19−1
STARTER ASSY (N04C−TF)	19−3
REPLACEMENT	19−3
CHARGING SYSTEM (N04C−TF)	19−4
PRECAUTION	19−4
ON−VEHICLE INSPECTION	19−5
GENERATOR ASSY (N04C−TF)	19−7
REPLACEMENT	19−7

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1−YXZE05A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

STARTING SYSTEM (N04C–TF)

INSPECTION

190YL–01



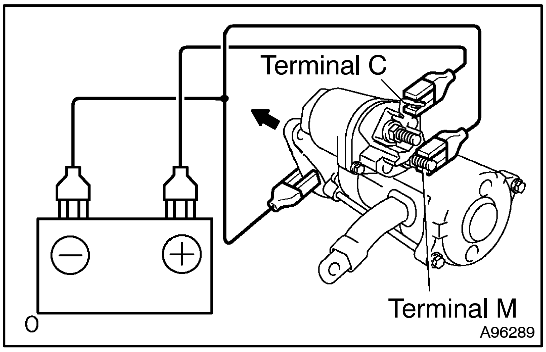
1. INSPECT STARTER ASSY

NOTICE:

These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

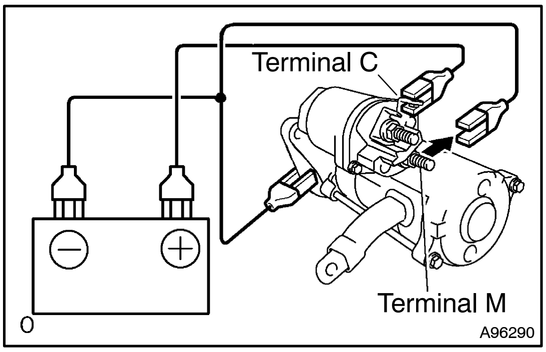
(a) Perform a pull–in test.

(1) Disconnect the lead wire from terminal M.



(2) Connect the battery to the magnetic switch as shown in the illustration on the left. Check that the clutch pinion gear extends.

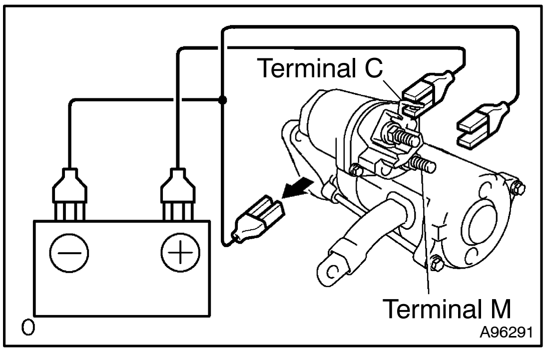
If the clutch pinion gear does not move, replace the magnetic switch assy.



(b) Perform a hold–in test.

(1) With the battery connected as above and the clutch pinion gear extended, disconnect the negative (–) lead from terminal M. Check that the pinion gear remains extended.

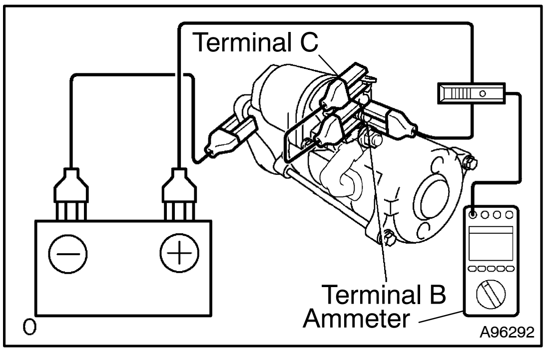
If the clutch pinion gear returns inward, replace the magnetic switch assy.



(c) Check that the clutch pinion gear returns.

(1) Disconnect the negative (–) leads from the switch body. Check that the clutch pinion gear returns inward.

If the clutch pinion gear does not return, replace the magnetic switch assy.



(d) Perform a no–load performance test.

(1) Connect the lead wire to terminal M. Make sure that the lead is not grounded.

Torque: 13.5 N·m (138 kgf·cm, 10 ft·lbf)

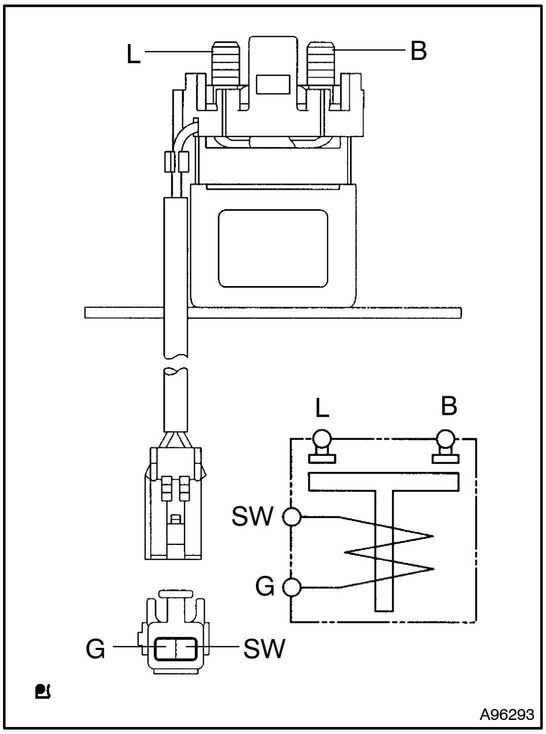
(2) Clamp the starter in a vise.

(3) Connect the battery and an ammeter to the starter as shown in the illustration.

(4) Check that the starter rotates smoothly and steadily with the clutch pinion gear extended. Check that the ammeter reads the specified current.

Standard: Below 120 A

If the current is not as specified, replace the starter assy.



2. INSPECT RELAY (Marking: STARTER)

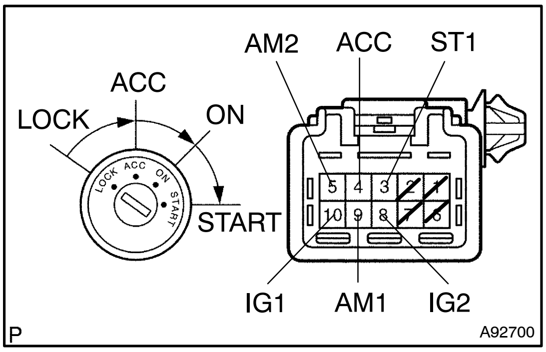
(a) Remove the STARTER relay from the R/B No. 2.

(b) Measure the resistance of the STARTER relay.

Standard:

Tester Connection	Specified Condition
L – B	10 kΩ or higher
L – B	Below 1 Ω (when battery voltage is applied to terminals SW and G)

If the result is not as specified, replace the relay.



3. INSPECT IGNITION OR STARTER SWITCH ASSY

(a) Measure the resistance of the switch.

Standard:

Tester Connection	Switch Condition	Specified Condition
–	LOCK	10 kΩ or higher
9 (AM1) – 4 (ACC)	ACC	Below 1 Ω
9 (AM1) – 4 (ACC) 9 (AM1) – 10 (IG1) 5 (AM2) – 8 (IG2)	ON	Below 1 Ω
9 (AM1) – 3 (ST1) 9 (AM1) – 10 (IG1) 5 (AM2) – 8 (IG2)	START	Below 1 Ω

If the result is not as specified, replace the switch assy (see Pub. No. S1–YXZE05A, page 50–8).

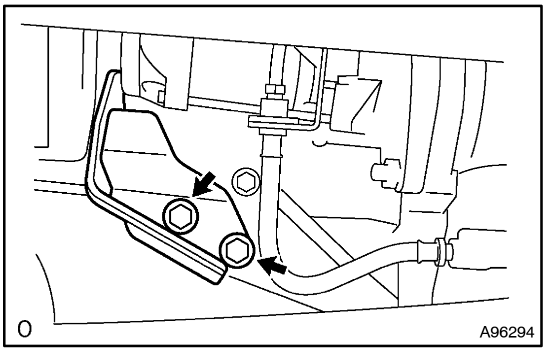
STARTER ASSY (N04C–TF)

190YM–01

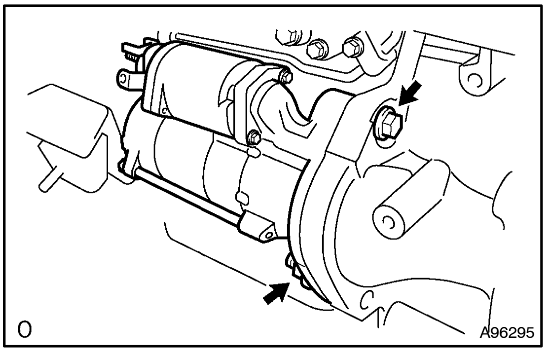
REPLACEMENT

NOTICE:
Before replacing the starter, check the following again:
- **Connector connection**
- **Accessory installation**

1. DISCONNECT BATTERY NEGATIVE TERMINAL



2. REMOVE STIFFENER PLATE LH
(a) Remove the 2 bolts and stiffener plate.



3. REMOVE STARTER ASSY
(a) Disconnect the starter connector.
(b) Open the terminal cap, remove the bolt and disconnect the starter wire from terminal C.
(c) Open the terminal cap, remove the nut and disconnect the starter wire from terminal B.
(d) Remove the bolt, nut and starter.

4. INSTALL STARTER ASSY
(a) Install the starter with the bolt and nut.
Torque: 154 N·m (1,570 kgf·cm, 114 ft·lbf)
(b) Connect the starter wire to terminal B with the nut.
Torque: 13.5 N·m (138 kgf·cm, 10 ft·lbf)
(c) Cover the nut with the cap.
(d) Connect the starter wire to terminal C with the bolt.
Torque: 2.5 N·m (25 kgf·cm, 22 in.·lbf)
(e) Cover the bolt with the cap.
(f) Connect the starter connector.

5. INSTALL STIFFENER PLATE LH
(a) Install the stiffener plate with the 2 bolts.
Torque: 97 N·m (989 kgf·cm, 72 ft·lbf)

6. CONNECT BATTERY NEGATIVE TERMINAL

CHARGING SYSTEM (N04C–TF)

190YN–01

PRECAUTION

CAUTION:

- **Check that the battery cables are connected to the correct terminals.**
- **Disconnect the battery cables before the battery is quickly charged.**
- **Do not perform tests with a high–voltage insulation resistance tester.**
- **Never disconnect the battery while the engine is running.**
- **Check that the charging cable is tightened on terminal B of the generator and the fuse box.**
- **Do not check whether the generator generates or not by connecting terminal F to another terminal.**

190YO–01

ON–VEHICLE INSPECTION

1. CHECK BATTERY ELECTROLYTE LEVEL

(a) Check the electrolyte quantity of each cell.

Maintenance–free battery:

If the electrolyte quantity is below the recommended amount, replace the battery.

Except maintenance–free battery:

If the electrolyte quantity is below the recommended amount, add distilled water.

2. Except maintenance–free battery:
CHECK BATTERY SPECIFIC GRAVITY

(a) Check the specific gravity of each cell.
Standard: 1.25 to 1.29 at 20°C (68°F)

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

3. Maintenance–free battery:
CHECK BATTERY VOLTAGE

(a) After the vehicle has run for 20 minutes, stop the engine.
(b) Turn the ignition switch ON, and turn on the headlight, blower fan and defogger for 1 minute.
(c) Turn the ignition switch OFF.
(d) Measure the battery voltage.
Standard: 24 to 25 V at 20°C (68°F)

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

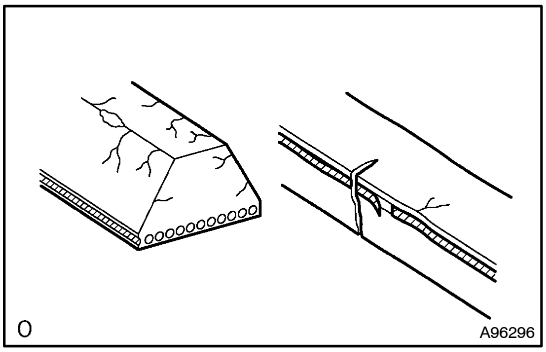
4. CHECK BATTERY TERMINAL, FUSIBLE LINK AND FUSE

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

If the terminals are corroded, clean the terminals.

(b) Check the resistance of the fusible link and fuse.
Standard: Below 1 Ω

If the result is not as specified, replace the fusible link and/or fuse.



5. INSPECT V BELT

(a) Check the belt for wear, cracks and other signs of damage.

If any defect is found, replace the belt.

HINT:

Replace the belt if the following defects are found:

- The belt has worn out and the wire is exposed.
- Cracks reach the wire in more than one place.
- The belt has chunks missing from the ribs.

(b) Check that the belt fits properly in the ribbed grooves.

HINT:

With your hand, confirm that the belt has not slipped out of the groove on the bottom of the pulley.

6. VISUALLY CHECK GENERATOR WIRING

(a) Check that the wiring is in good condition.

Replace the wiring if necessary.

7. LISTEN FOR ABNORMAL NOISES FROM GENERATOR

(a) Check that there is no abnormal noise from the generator while the engine is running.

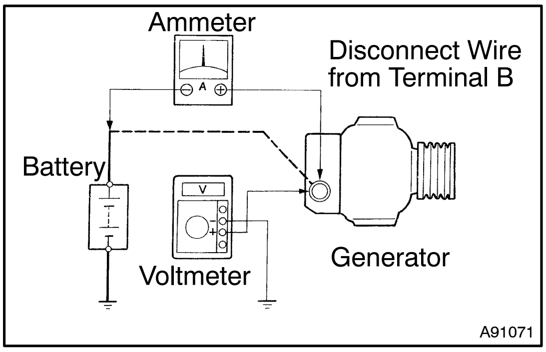
If abnormal noise is present, first check where the noise is originating from. If necessary, replace the bearings and generator.

8. **INSPECT CHARGE WARNING LAMP CIRCUIT**

(a) Turn the ignition switch ON. Check that the charge warning lamp turns ON.

(b) Start the engine and check that the lamp turns OFF.

If the lamp does not operate as specified, troubleshoot the charge warning lamp circuit.



9. **INSPECT CHARGING CIRCUIT WITHOUT LOAD**

HINT:

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

(a) If a tester is not available, connect an ammeter and voltmeter to the charging circuit as follows.

(1) Disconnect the wire from terminal B of the generator and connect it to the negative (–) lead of the ammeter.

(2) Connect the ammeter's positive (+) lead to terminal B of the generator.

(3) Connect the voltmeter's positive (+) lead to terminal B of the generator.

(4) Ground the voltmeter's negative (–) lead.

(b) Check the charging circuit.

(1) Keep the engine speed at 2,000 rpm, and check the reading on the ammeter and voltmeter.

Standard amperage: 10 A or less

Standard voltage: 25 to 26 V

If the result is not as specified, replace the generator.

10. **INSPECT CHARGING CIRCUIT WITH LOAD**

(a) With the engine running at 2,000 rpm, turn ON the high–beam headlamps and turn the heater blower switch to the HI position.

(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 generator.

HINT:

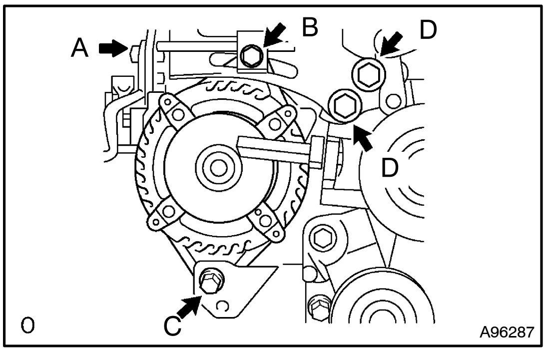
If the battery is fully charged, the indication will sometimes be less than the standard amperage.

GENERATOR ASSY (N04C–TF)

190YP–01

REPLACEMENT

1. **DISCONNECT BATTERY NEGATIVE TERMINAL**
2. **DRAIN ENGINE COOLANT (See page 16–3)**
3. **REMOVE ENGINE SIDE COVER SUB–ASSY RH (See page 14–14)**
4. **REMOVE RADIATOR HOSE INLET (See page 16–10)**
5. **REMOVE AIR HOSE NO.1 (See page 14–14)**



6. **REMOVE GENERATOR ASSY**

(a) Loosen the bolts labeled A and B.
(b) Loosen the bolt labeled C to remove the V belt from the generator.
(c) Remove the bolts labeled B, D and the generator bracket.
(d) Disconnect the generator connector.
(e) Open the terminal cap, remove the nut and disconnect the generator wire.
(f) Remove the bolt labeled C and generator assy.

7. **INSTALL GENERATOR ASSY**

(a) Temporarily install the generator with the bolt labeled C.
(b) Install the generator bracket with the bolt labeled D.
Torque: 62 N·m (632 kgf·cm, 46 ft·lbf) for bolt D
(c) Temporarily install the bolt labeled B.
(d) Install the V belt to the generator and adjust the V belt tension by tightening the bolt labeled A (see page 14–4).
(e) Tighten the bolts labeled B and C.
Torque:
28.5 N·m (291 kgf·cm, 21 ft·lbf) for bolt B
55 N·m (560 kgf·cm, 40 ft·lbf) for bolt C
(f) Connect the generator wire to terminal B with the nut.
Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)

8. **INSPECT V BELT (See page 14–1)**
9. **INSTALL AIR HOSE NO.1 (See page 14–14)**
10. **INSTALL RADIATOR HOSE INLET (See page 16–10)**
11. **ADD ENGINE COOLANT (See page 16–3)**
12. **CONNECT BATTERY NEGATIVE TERMINAL**
13. **CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)**
14. **INSTALL ENGINE SIDE COVER SUB–ASSY RH (See page 14–14)**

TIRE & WHEEL

TIRE AND WHEEL 28–1
INSPECTION 28–1

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

TIRE AND WHEEL

28054–01

INSPECTION

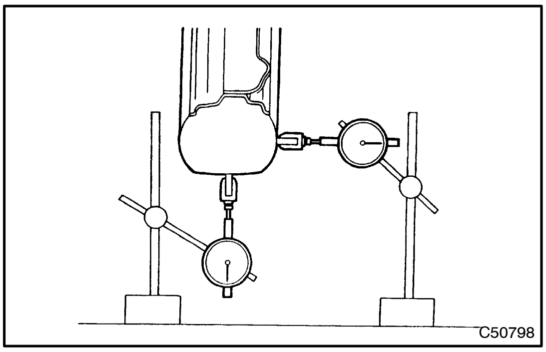
1. INSPECT TIRES

(a) Visually check the tires for wear.

(b) Check the tires' inflation pressure when they are cold, according to the table below.

Cold tire inflation pressure:

Cab Type	Models	Tire Size		Inflation Pressure kPa (kgf/cm^2, psi)	
		Front	Rear	Front	Rear
Standard cab	XZU305R–TQMMWQ3 XZU305R–HQMMWQ3	195/75R15	195/75R15	600 (6.0, 87)	600 (6.0, 87)
Standard cab	XZU305R–TKMMWQ3 XZU305R–HKMMWQ3	185/85R16	185/85R16	600 (6.0, 87)	600 (6.0, 87)
Standard cab	XZU345R–TKMMWQ3 XZU345R–HKMMWQ3	185/85R16	185/85R16	600 (6.0, 87)	600 (6.0, 87)



(c) Using a dial indicator, check the tires' runout.

Tire runout: 3.0 mm (0.039 in.) or less

DIFFERENTIAL

DIFFERENTIAL SYSTEM (SH12) .... 29−1
PRECAUTION .... 29−1
PROBLEM SYMPTOMS TABLE .... 29−2
DIFFERENTIAL OIL (SH12) .... 29−3
REPLACEMENT .... 29−3
REAR DIFFERENTIAL CARRIER OIL SEAL (SH12) .... 29−4
COMPONENTS .... 29−4
REPLACEMENT .... 29−5
DIFFERENTIAL CARRIER ASSY REAR (SH12) .... 29−8
COMPONENTS .... 29−8
OVERHAUL .... 29−11

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1−YXZE05A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

DIFFERENTIAL SYSTEM (SH12)

PRECAUTION

2907L–02

1. **Before overhaul, clean the outside of the differential assembly to prevent sand or mud from entering inside the differential carrier during overhaul.**
2. **Always arrange the disassembled parts in order and protect them from dust.**
3. **Before installation, thoroughly clean and dry each part and then apply hypoid gear oil to it. Do not use alkaline cleaner for aluminum or rubber parts and ring gear set bolts. Also, do not clean the rubber parts, such as O–rings and oil seals with white gasoline.**
4. **Coat all the sliding surfaces and rotating parts with hypoid gear oil.**
5. **When holding a component part with a vice, be sure to place an aluminum sheet under the part. Do not put it directly on the vice.**
6. **Be careful not to damage the contact surfaces of the case. Such damage may cause oil leakage.**
7. **Before applying sealant, remove the deposits of the oil sealant and clean the part to be sealed using white gasoline.**
8. **Do not supply oil immediately after installing the sealed parts. Leave it for at least an hour.**
9. **Damage on the surface being contact with an oil seal, O–ring and gasket may cause oil leakage. Special attention should be paid.**
10. **When press–fitting an oil seal, be careful not to damage the oil seal lip and outside periphery.**
11. **When replacing a bearing, replace the inner and outer races as a set.**

290AD–01

PROBLEM SYMPTOMS TABLE

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

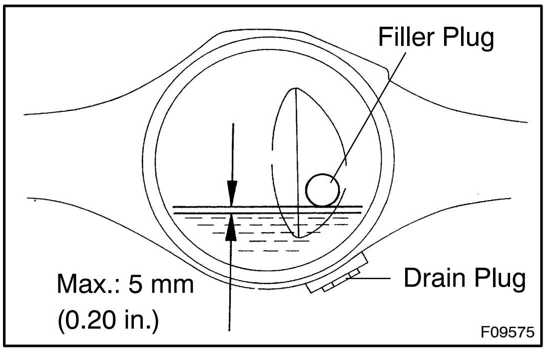
Symptom	Suspect Area	See page
Oil leak from rear differential	1. Oil level (Too high or wrong grade) 2. Rear differential front oil seal (Worn or damaged) 3. Companion flange (Loose or damaged)	29–3 29–5 29–5
Oil leak from drive pinion shaft	1. Oil level (Too high or wrong grade) 2. Rear differential front oil seal (Worn or damaged) 3. Companion flange (Loose or damaged)	29–3 29–5 29–5

DIFFERENTIAL OIL (SH12)

2907M–02

REPLACEMENT

1. DRAIN DIFFERENTIAL OIL



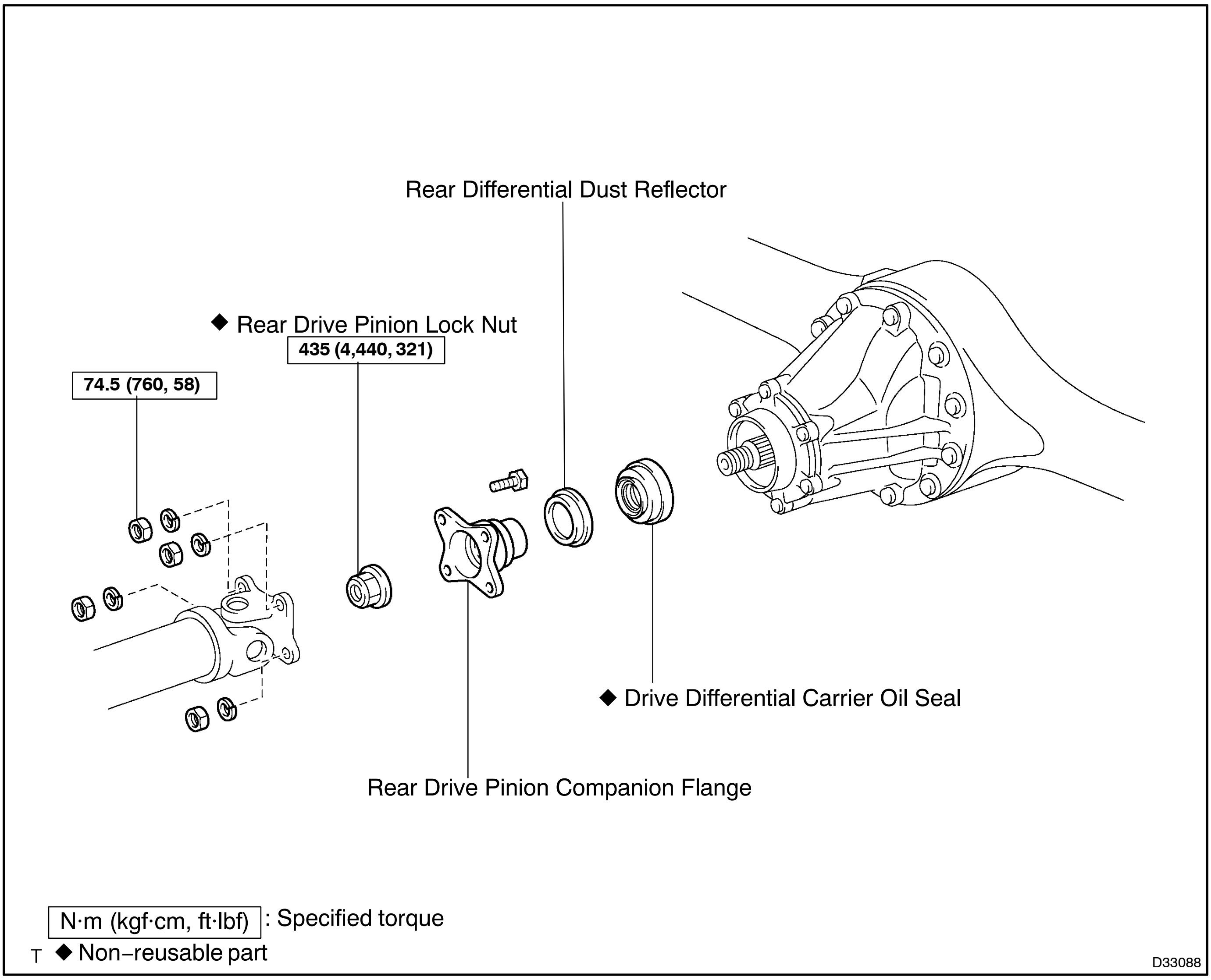
2. ADD DIFFERENTIAL OIL

Oil type: Hypoid gear oil API GL–5
Recommended oil viscosity: SAE 90
Capacity: 5.2 liters (5.5 US qts, 4.8 Imp. qts)
Torque for drain and filler plugs:
50 N·m (510 kgf·cm, 37 ft·lbf)

REAR DIFFERENTIAL CARRIER OIL SEAL (SH12)

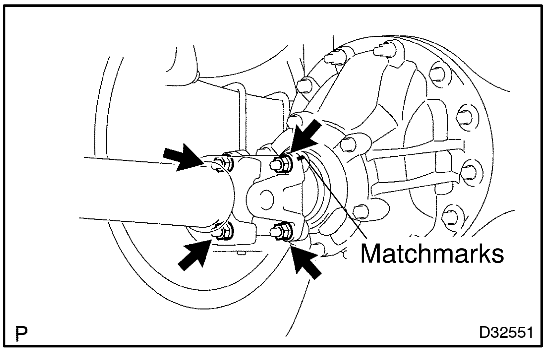
COMPONENTS

290A9–01



REPLACEMENT

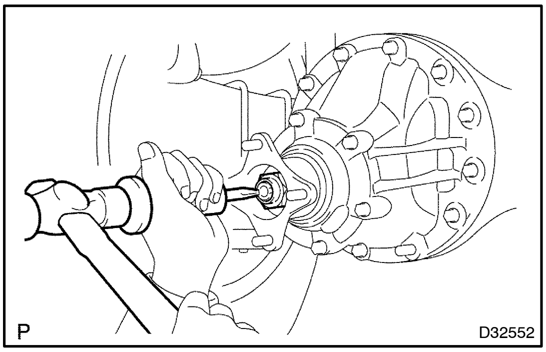
1. DRAIN DIFFERENTIAL OIL (See page 29–3)



2. DISCONNECT PROPELLER SHAFT ASSY

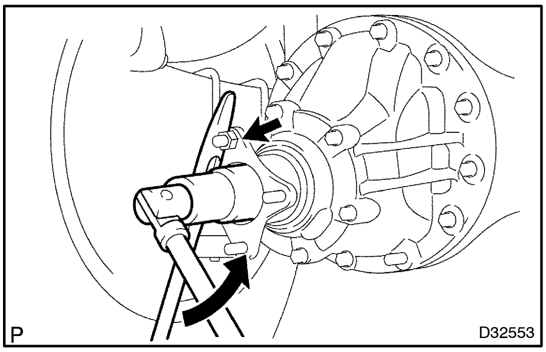
(a) Place matchmarks on the flanges.

(b) Remove the 4 nuts and 4 washers, and disconnect the rear propeller shaft.



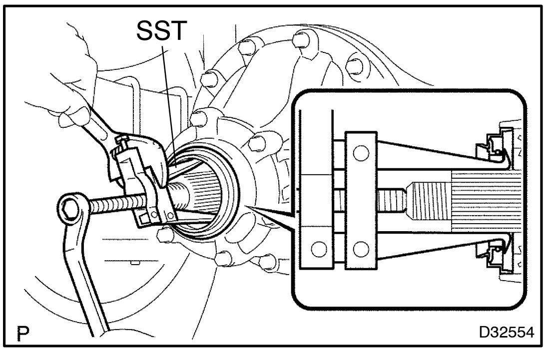
3. REMOVE REAR DRIVE PINION COMPANION FLANGE SUB–ASSY REAR

(a) Using a chisel and hammer, loosen the staked part of the nut.



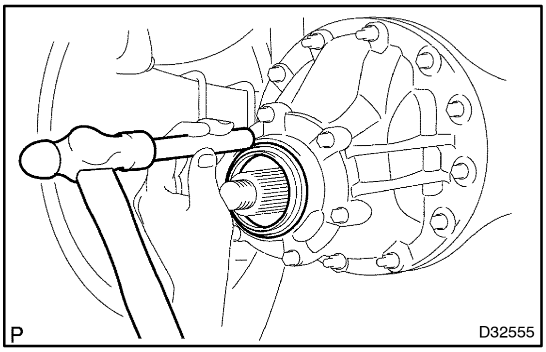
(b) Hold the flange in place with the tire lever and remove the nuts using the socket wrench.

(c) Remove the drive pinion companion flange.



4. REMOVE REAR DIFFERENTIAL CARRIER OIL SEAL

(a) Using SST, remove the oil seal.
SST 09308–10010

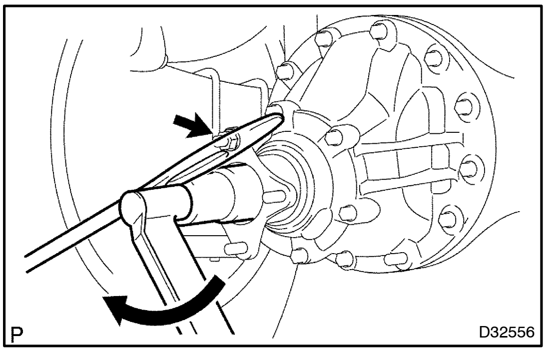


5. INSTALL REAR DIFFERENTIAL CARRIER OIL SEAL

(a) Apply MP grease to the lip of a new oil seal.

(b) Using a brass bar and hammer, tap in the oil seal.

Oil seal drive in depth: 0 mm (0 in.)



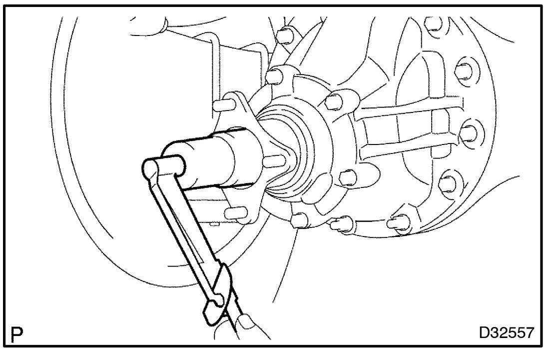
6. INSTALL REAR DRIVE PINION COMPANION FLANGE SUB–ASSY REAR

(a) Install the companion flange on the drive pinion.

(b) Apply a light coat of gear oil on the threads of a new companion flange nut.

(c) Using a tire lever, hold the flange and tighten the nut.

Torque: 435 N·m (4,440 kgf·cm, 320 ft·lbf)

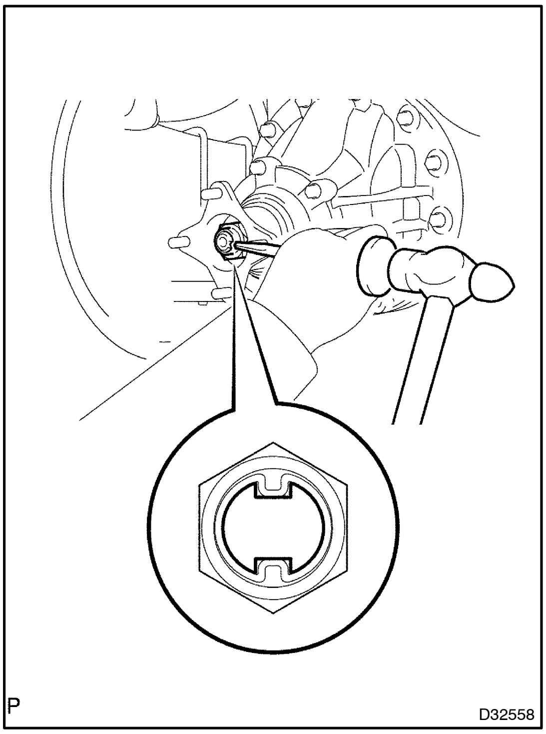


7. INSPECT TOTAL PRELOAD

(a) Using a torque wrench, measure the maximum torque within the backlash between the drive pinion and ring gear when the companion flange begins to rotate.

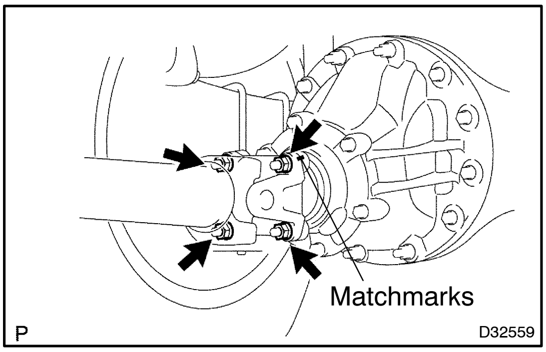
Preload:

1.48 to 2.45 N·m (15 to 25 kgf·cm, 13 to 22 in.·lbf)



8. INSTALL COMPANION FLANGE ROCK NUT

(a) Using a chisel and hammer, stake the nut to the bolt as shown in the illustration.



9. INSTALL PROPELLER SHAFT ASSY

(a) Align the matchmarks and connect the propeller shaft to the companion flange with the 4 bolts, 4 washers and 4 nuts.

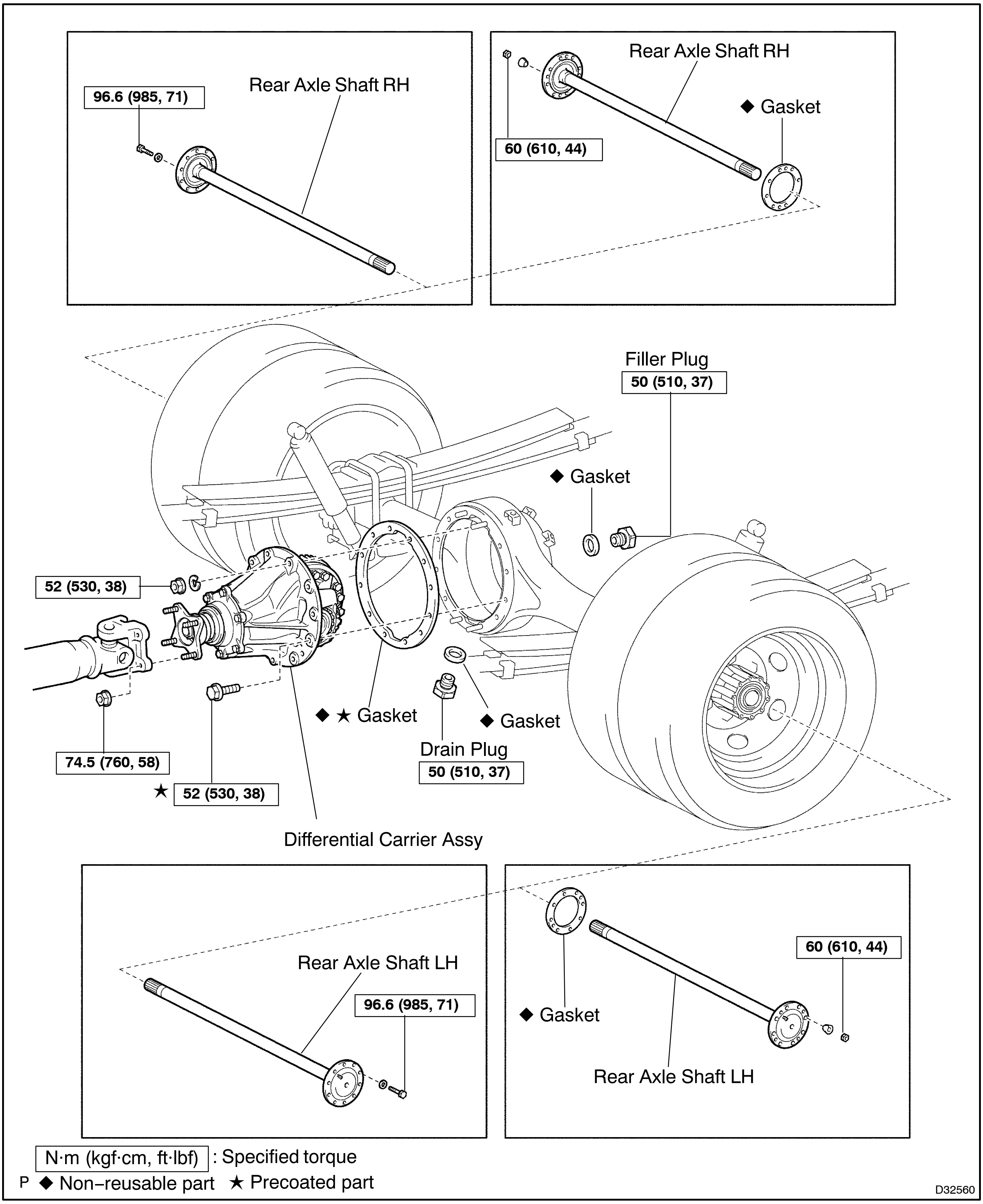
(b) Tighten the nuts (see pub No. S1−YXZE05A, page 30−4 or 30−11).

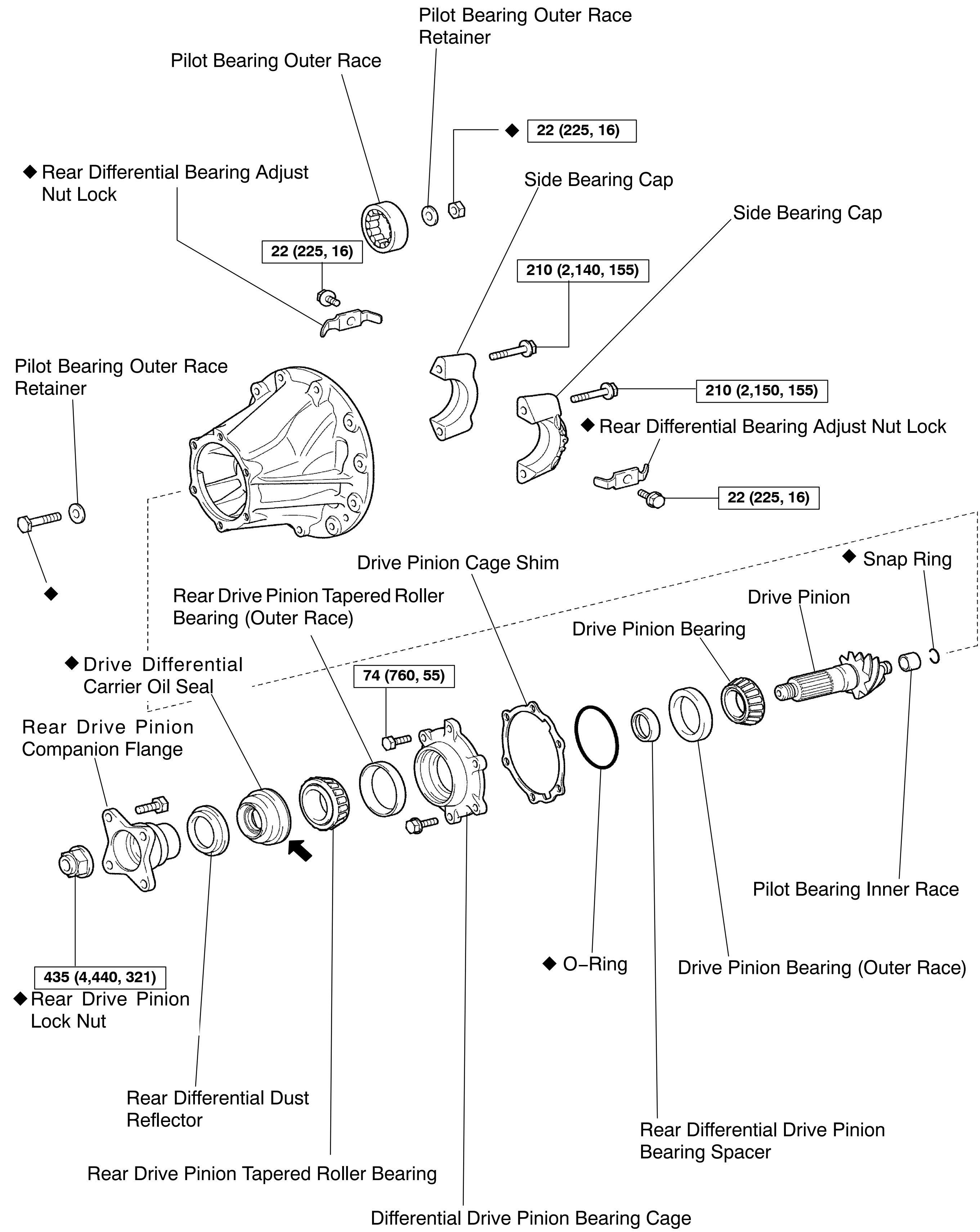
10. ADD DIFFERENTIAL OIL (See page 29−3)

DIFFERENTIAL CARRIER ASSY REAR (SH12)

COMPONENTS

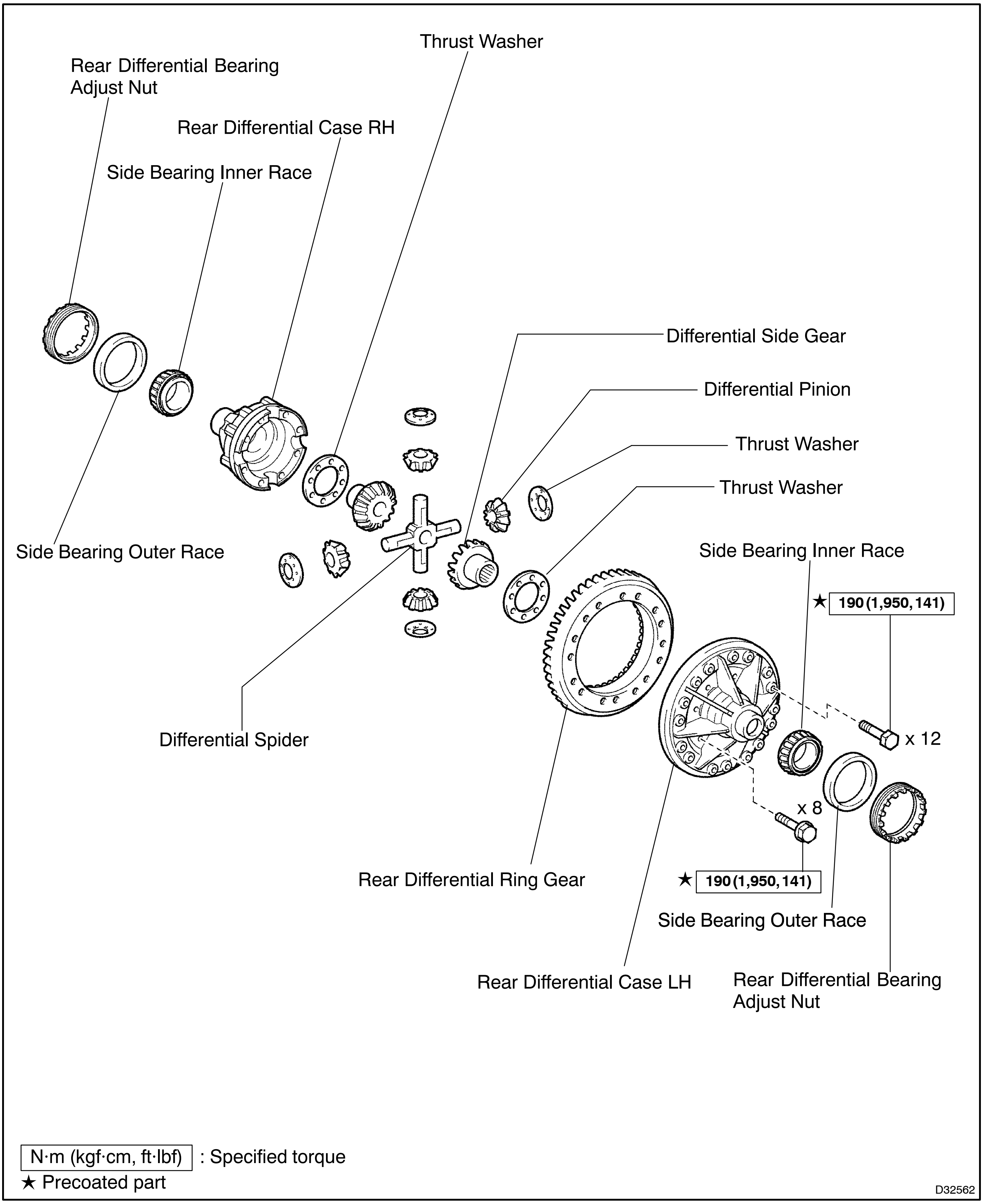
290AA–01





N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
MP Grease

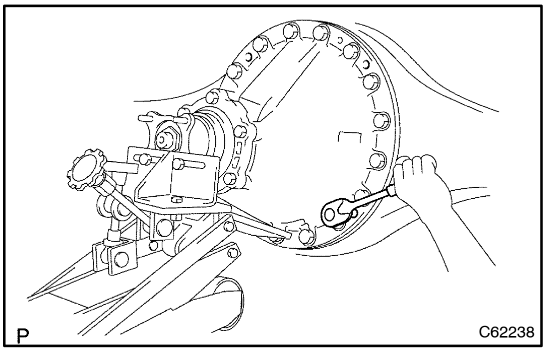
D32561


Thrust Washer
Rear Differential Bearing Adjust Nut
Rear Differential Case RH
Side Bearing Inner Race
Differential Side Gear
Differential Pinion
Thrust Washer
Thrust Washer
Side Bearing Outer Race
Side Bearing Inner Race
★ 190 (1,950, 141)
x 12
Differential Spider
x 8
Rear Differential Ring Gear
★ 190 (1,950, 141)
Side Bearing Outer Race
Rear Differential Case LH
Rear Differential Bearing Adjust Nut
N·m (kgf·cm, ft·lbf) : Specified torque
★ Precoated part
D32562

290AB–01

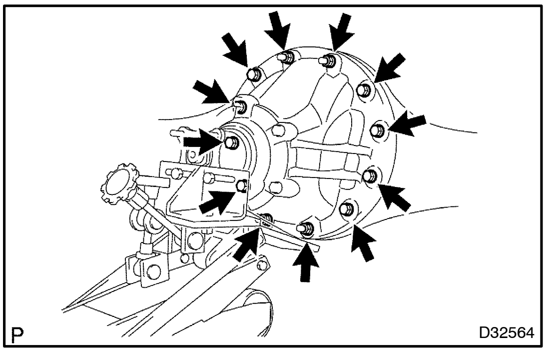
OVERHAUL

1. **DRAIN DIFFERENTIAL OIL (See page 29–3)**
2. **REMOVE REAR AXLE SHAFT (See pub No. S1–YXZE05A, page 30–72 or 30–75)**
3. **REMOVE PROPELLER SHAFT ASSY (See pub No. S1–YXZE05A, page 30–4 or 30–11)**



4. **REMOVE REAR DIFFERENTIAL CARRIER ASSY**

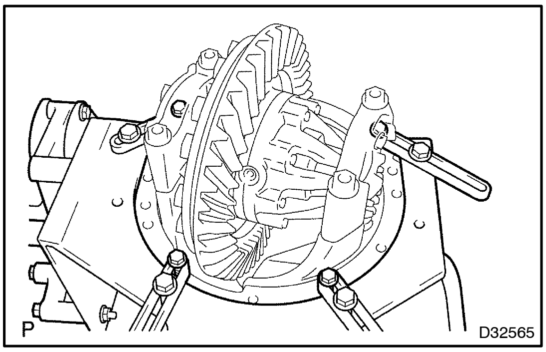
(a) Using a jack, support the differential carrier.



(b) Remove the 8 bolts, 4 nuts and differential carrier.

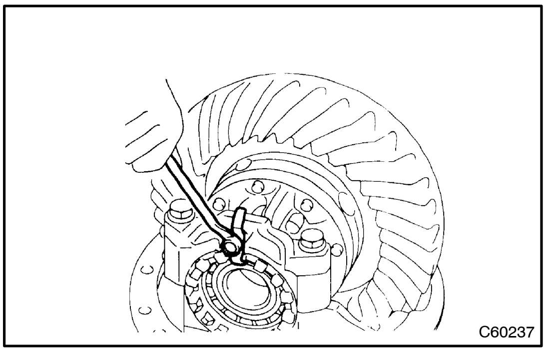
NOTICE:

Be careful not to damage the installation surface.

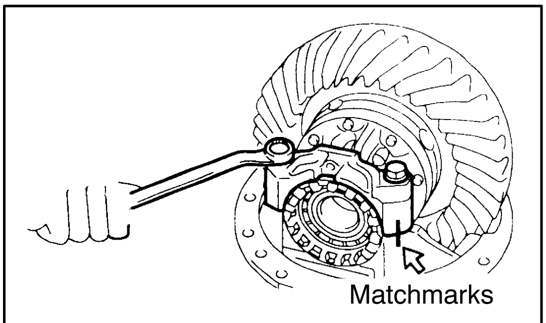


5. **REMOVE REAR DIFFERENTIAL CASE SUB–ASSY**

(a) Fix the differential carrier.



(b) Remove the 2 adjusting nut locks.

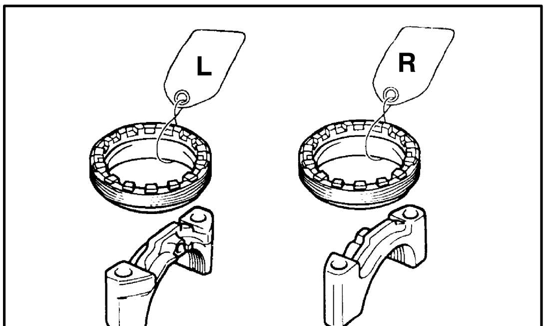


C60238

(c) Place matchmarks on the bearing cap and differential carrier.

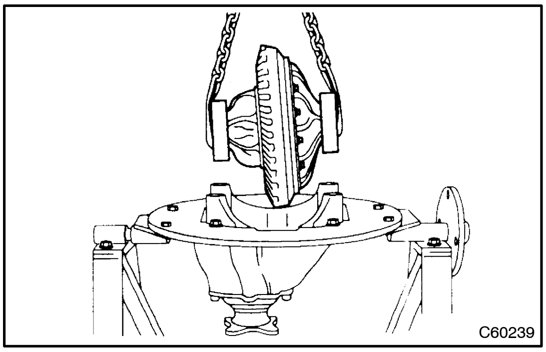
(d) Remove the 4 bolts, 2 bearing caps and 2 adjusting nuts.

(e) Remove the differential case together with the bearing outer races from the carrier.



D30839

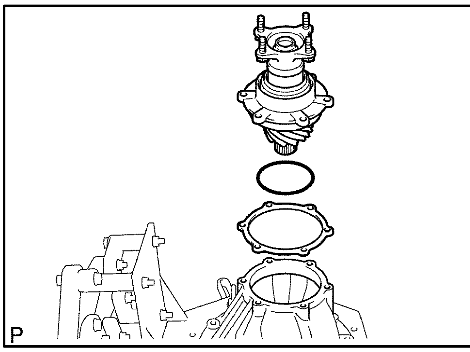
HINT:
Tag the removed parts to show the location for installation.


C60239

(f) Using a chain block, remove the differential gear from the differential carrier.

(g) Remove the side bearing outer race.

HINT:
Tag the removed parts to show the location for installation.

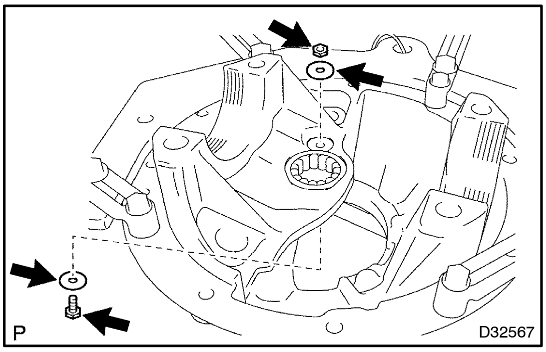

P D32566

6. REMOVE DRIVE PINION SUB–ASSY

(a) Remove the 6 bolts.

(b) Remove the drive pinion, shims and O–ring from the differential carrier.

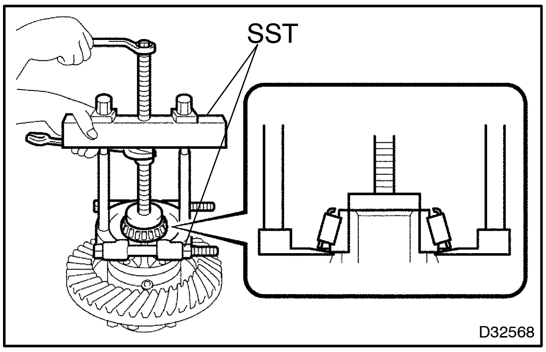
HINT:
For easy removal, remove the outer races, using a brass bar and hammer.


P D32567

7. REMOVE PILOT BEARING OUTER RACE

(a) Remove the bolt, nut and 2 bearing retainers.

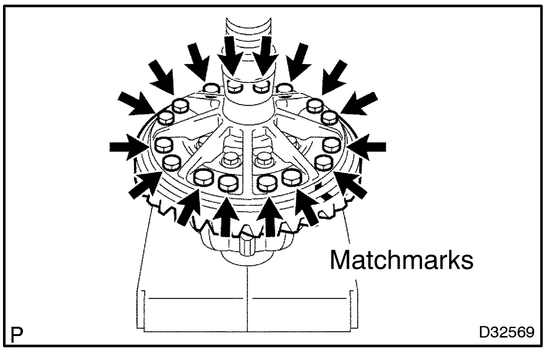
(b) Remove the outer race from the differential carrier.



8. REMOVE SIDE BEARING INNER RACE

(a) Using SST, remove the 2 inner races from the differential case.
SST 09950–60020, (09951–00680), 09950–40011, (09957–04010), 09950–00020, 09950–00030

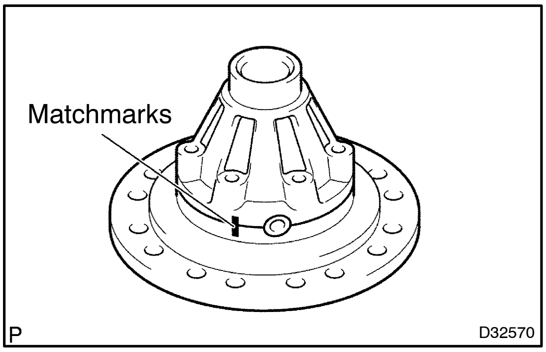
If reusing the bearings, arrange them so that the right bearing and left bearing can be distinguished.



9. REMOVE RING GEAR

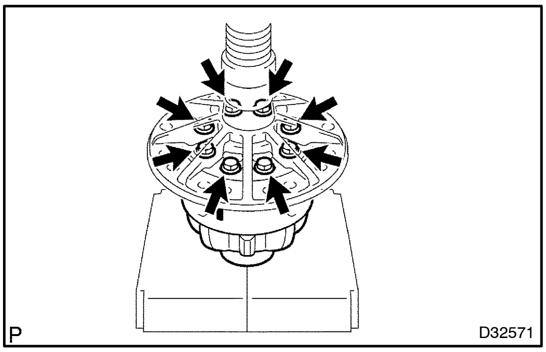
(a) Place matchmarks on the ring gear and differential case.
(b) Using a press, fix the differential carrier.
(c) Remove the 16 bolts.
(d) Using a plastic hammer, remove the ring gear to separate it from the differential case.

NOTICE:
Be careful not to drop the ring gear.

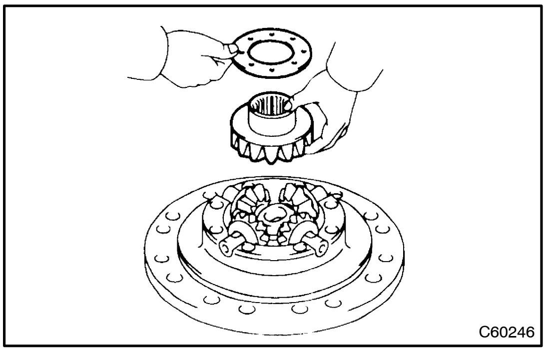


10. REMOVE DIFFERENTIAL CASE

(a) Place matchmarks on the LH and RH cases.

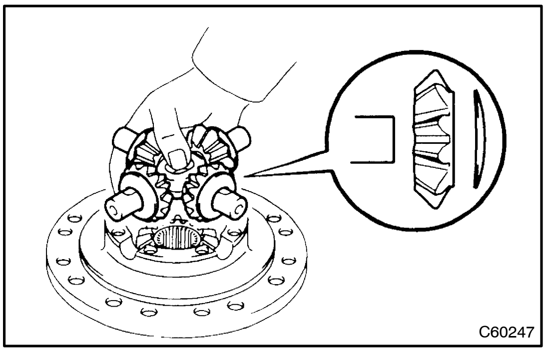


(b) Remove the 8 bolts.
(c) Using a plastic hammer, separate the LH and RH cases.



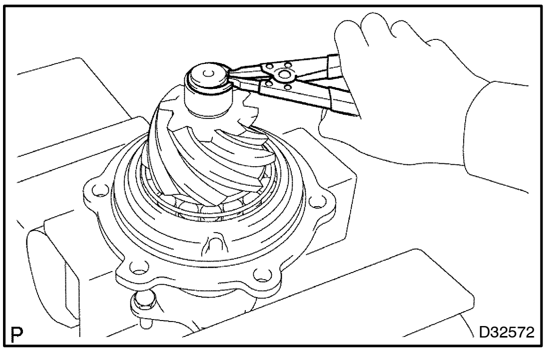
11. REMOVE REAR DIFFERENTIAL SPIDER

(a) Remove the side gear thrust washer and side gear.



(b) Remove the 4 pinion gear thrust washers, 4 pinion gears and spider.

(c) Remove the 4 side gear thrust washers and side gear.



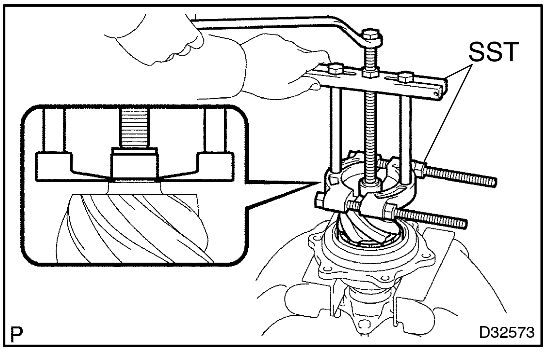
12. REMOVE PILOT BEARING INNER RACE

(a) Using a snap ring expander, remove the snap ring.

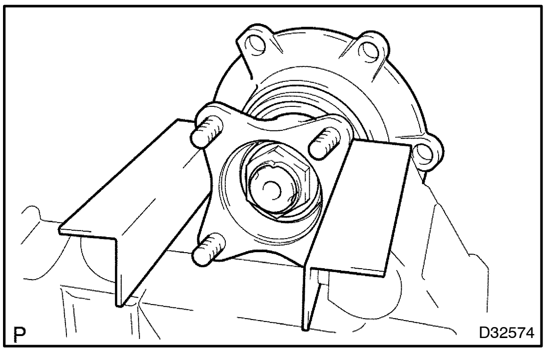
(b) Using a grinder, make a groove to the inner race.

NOTICE:

Use a cloth or similar object as a cover, at the time of snap ring installation, to prevent the snap ring from flying off.

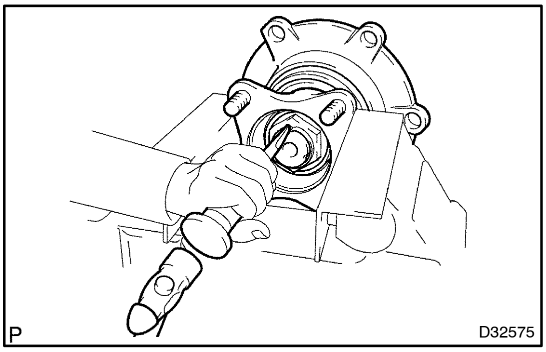


(c) Using SST, remove the inner race from the drive pinion.
SST 09950–00030, 09950–00020

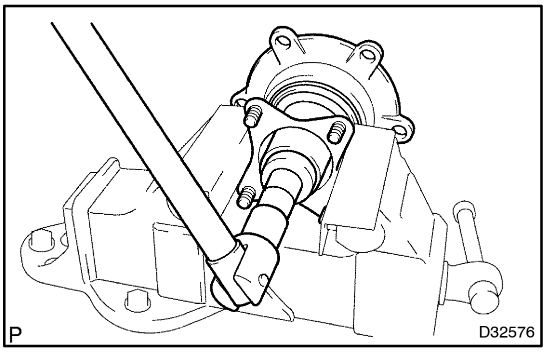


13. REMOVE REAR DRIVE PINION COMPANION FLANGE

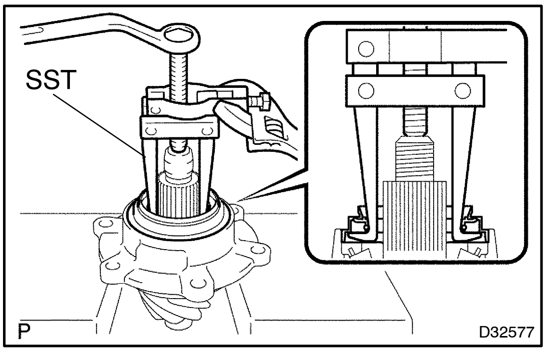
(a) Using a vise, hold the companion flange.



(b) Using a chisel and hammer, unstake the lock nut.

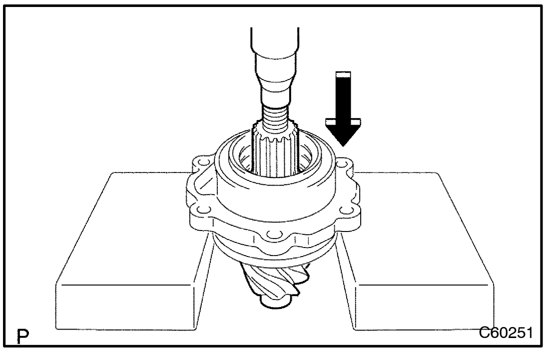


(c) Remove the lock nut and companion flange.



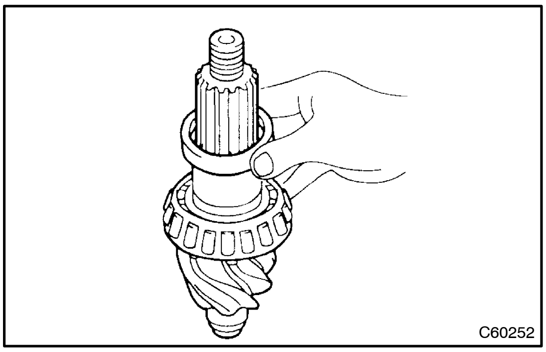
14. REMOVE REAR DIFFERENTIAL CARRIER OIL SEAL

(a) Using SST, remove the oil seal.
SST 09308–10010

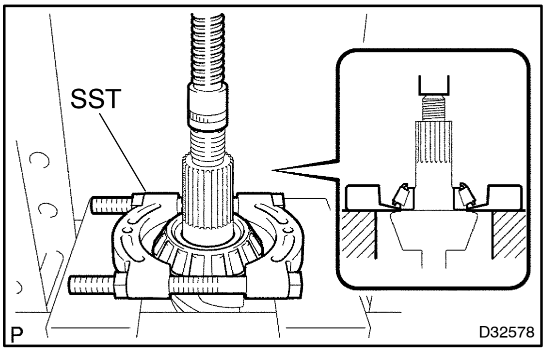


15. REMOVE DIFFERENTIAL DRIVE PINION

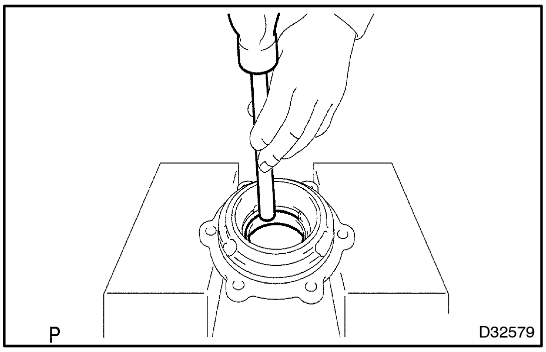
(a) Using a press, press out the drive pinion from the drive pinion cage.



(b) Remove the drive pinion bearing spacer.



(c) Using SST and a press, press out the rear bearing inner race.
SST 09950–00020



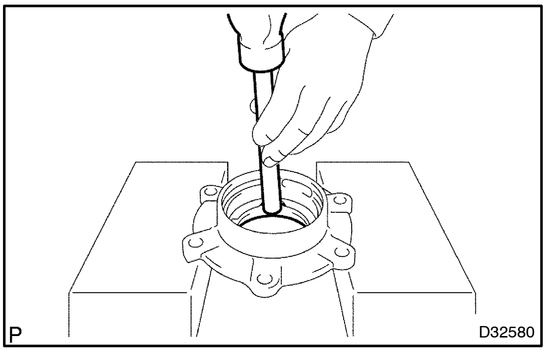
16. REMOVE FRONT BEARING OUTER RACE

(a) Using a brass bar and hammer, tap out the bearing oil seal.

(b) Using a brass bar and hammer, tap out the bearing outer race.

NOTICE:

Do not damage the inner surface of the cage.

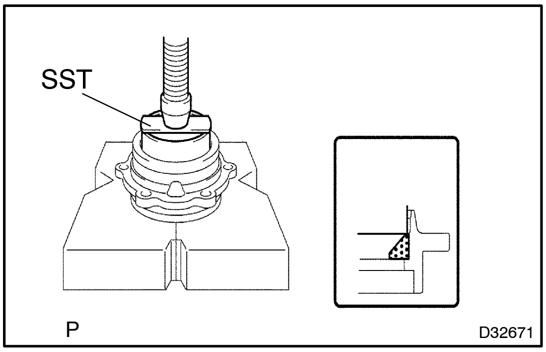


17. REMOVE REAR BEARING OUTER RACE

(a) Using a brass bar and hammer, tap out the bearing outer race.

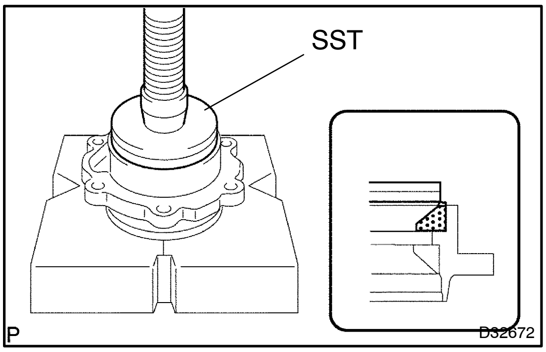
NOTICE:

Do not damage the inner surface of the cage.



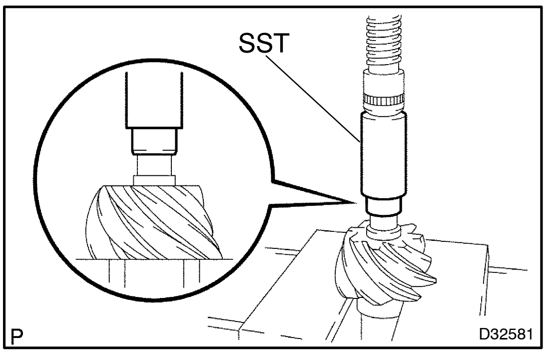
18. INSTALL FRONT BEARING OUTER RACE

(a) Using SST and a press, press in the front bearing outer race onto the differential cage.
SST 09518–36020



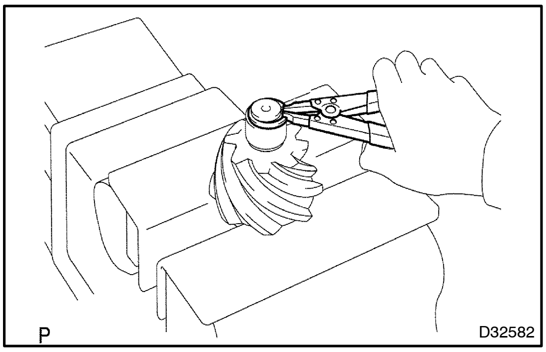
19. INSTALL REAR BEARING OUTER RACE

(a) Using SST and a press, press in the rear bearing outer race onto the differential cage.
SST 09223–78010



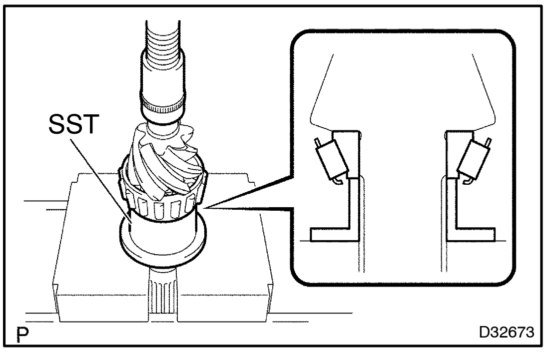
20. INSTALL PILOT BEARING INNER RACE

(a) Using SST and a press, press in the inner race onto the shaft of the drive pinion.
SST 09316–60011 (09316–00011, 09316–00071)



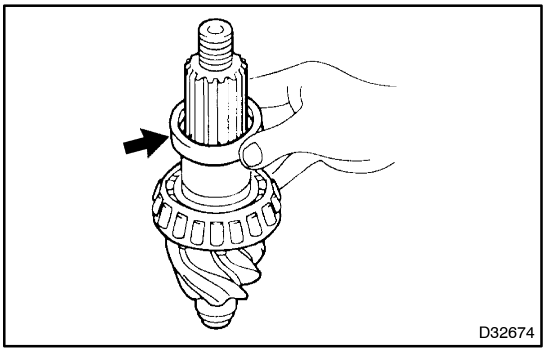
(b) Using a snap ring expander, install a new snap ring in the groove on the drive pinion tip.

NOTICE:
Use a cloth or similar object as a cover, at the time of snap ring installation, to prevent the snap ring from flying off.

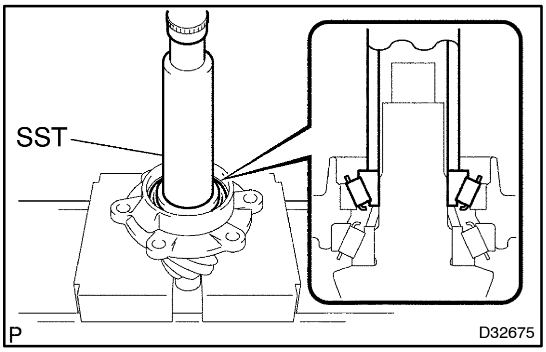


21. INSTALL REAR BEARING INNER RACE

(a) Using SST and a press, press in the inner race onto the drive pinion.
SST 09315–00022

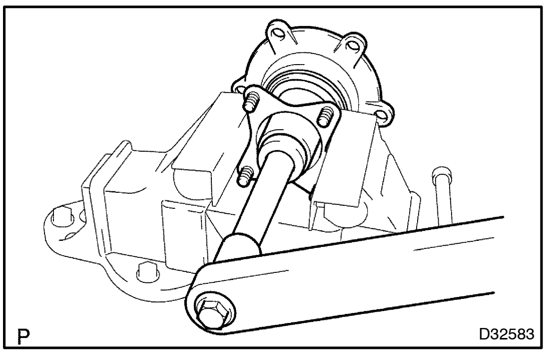


(b) Install the differential drive pinion bearing spacer.



22. INSTALL DIFFERENTIAL DRIVE PINION BEARING CAGE

(a) Using SST and a press, press in the drive pinion cage and front bearing inner race onto the drive pinion.
SST 09316–60011

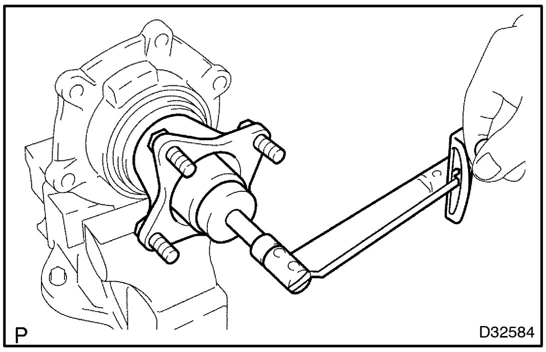


23. ADJUST DIFFERENTIAL DRIVE PINION PRELOAD

(a) Install the flange yoke and a new lock nut on the drive pinion, and fix the drive pinion assembly in a vise.

(b) Using a deep socket wrench (36 mm), tighten the lock nut.
Torque: 435 N·m (4,440 kgf·cm, 321 ft·lbf)

NOTICE:
Do not install an oil seal before preload measurement.



(c) Using a torque wrench, measure the preload at the lock nut part.

Preload:

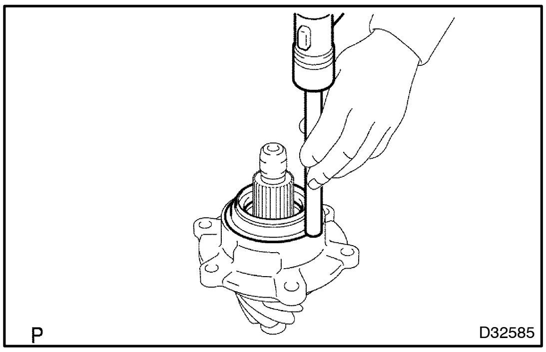
New bearing	1.47 to 1.96 N·m (15 to 20 kgf·cm, 13 to 17 in.·lbf)
Reused bearing	0.98 to 1.47 N·m (10 to 15 kgf·cm, 9 to 13 in.·lbf)

NOTICE:
When either bearing is new, use the preload for a new bearing.

(d) When the measured value exceeds the specified preload, select a spacer by increasing or decreasing the value and adjust the preload.

Spacer thickness:

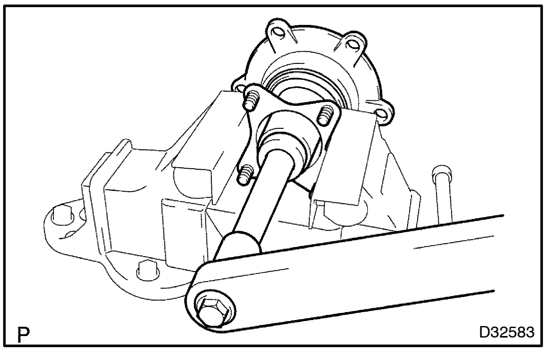
14.400 mm (0.5669 in.)	14.650 mm (0.5768 in.)
14.425 mm (0.5679 in.)	14.675 mm (0.5778 in.)
14.450 mm (0.5689 in.)	14.700 mm (0.5787 in.)
14.475 mm (0.5699 in.)	14.725 mm (0.5797 in.)
14.500 mm (0.5709 in.)	14.750 mm (0.5807 in.)
14.525 mm (0.5719 in.)	14.775 mm (0.5817 in.)
14.550 mm (0.5728 in.)	14.800 mm (0.5827 in.)
14.575 mm (0.5738 in.)	14.825 mm (0.5837 in.)
14.600 mm (0.5748 in.)	14.850 mm (0.5846 in.)
14.625 mm (0.5758 in.)	14.875 mm (0.5856 in.)



24. INSTALL REAR DIFFERENTIAL CARRIER OIL SEAL

(a) After preload adjustment, remove the companion flange and use a plastic hammer to tap in a new oil seal into the differential carrier cage.

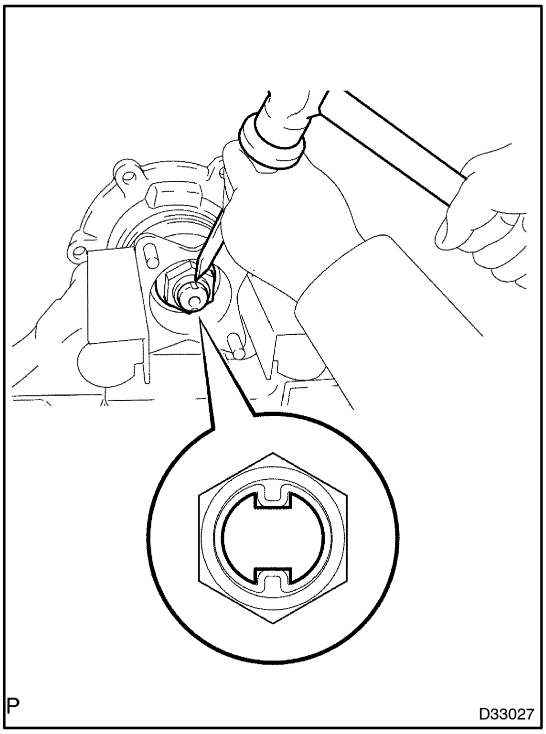
NOTICE:
Hit the oil seal uniformly to drive it in.



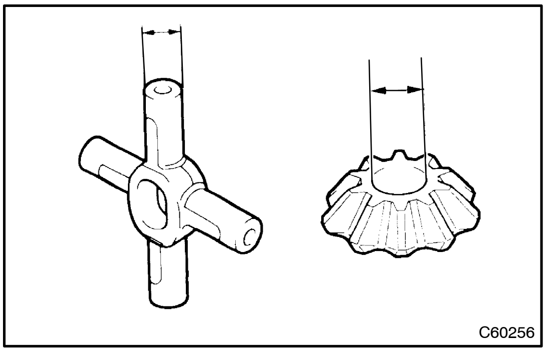
25. INSTALL REAR DRIVE PINION COMPANION FLANGE

(a) Install the companion flange with the lock nut.

Torque: 435 N·m (4,450 kgf·cm, 322 ft·lbf)



(b) Using a chisel and hammer, caulk the lock nut positively at the shaft groove (2 places).



26. INSPECT SPIDER BEARING

(a) Using a micrometer, measure the outer diameter of the spider.

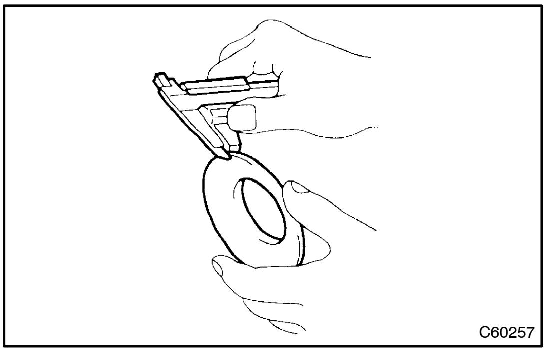
(b) Using a caliper gauge, measure the inner diameter of the pinion.

(c) Measure the clearance by subtracting the outer diameter of the spider from the inner diameter of the pinion.

Clearance:

Standard	0.140 to 0.261 mm (0.0055 to 0.0103 in.)
Maximum	0.4 mm (0.016 in.)

If the clearance is greater than the maximum, replace the spider bearing.



27. INSPECT SIDE GEAR THRUST WASHER AND PINION THRUST WASHER

(a) Using a vernier caliper, measure the thickness of the side gear thrust washer and pinon gear thrust washer.

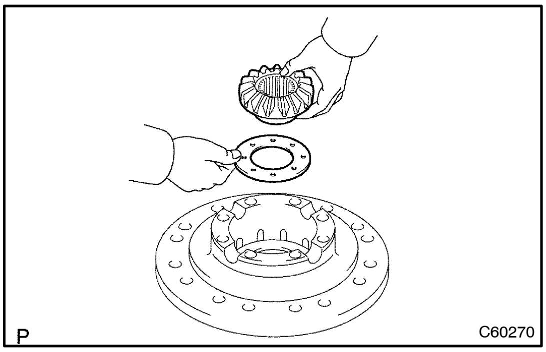
Thickness of side gear thrust washer:

Standard	1.9 to 2.1 mm (0.075 to 0.083 in.)
Minimum	1.7 mm (0.070 in.)

Thickness of pinion gear thrust washer:

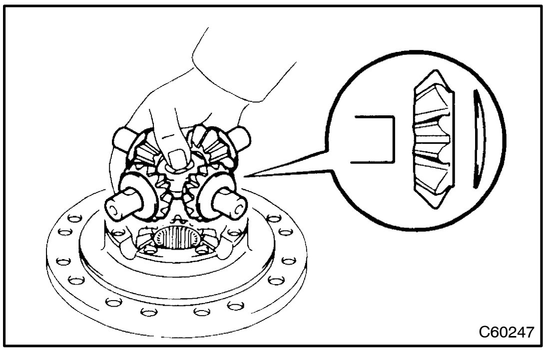
Standard	1.5 to 1.7 mm (0.059 to 0.070 in.)
Minimum	1.3 mm (0.051 in.)

If the value is less than the minimum, replace the side gear thrust washer or pinon gear thrust washer.



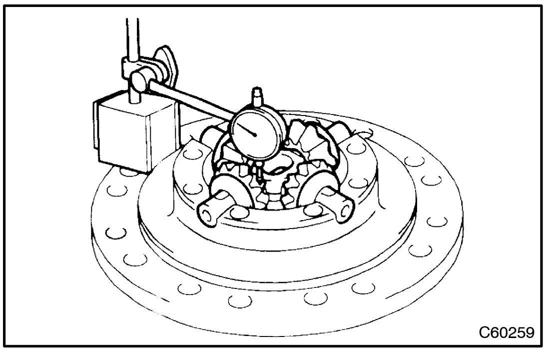
28. INSTALL REAR DIFFERENTIAL SPIDER

(a) Install the thrust washer on the slide gear.



(b) Install the 4 pinion gears and 4 thrust washers to the spider.

(c) Install the spider with the pinion gears to the LH case.



29. ADJUST DIFFERENTIAL SIDE GEAR BACKLASH

(a) Using a dial gauge, measure the side gear backlash.

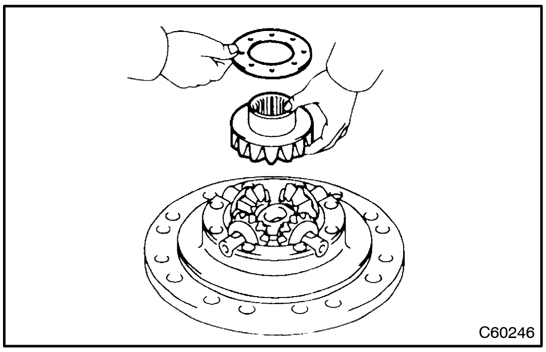
Backlash:

Standard	0.20 to 0.60 mm (0.0079 to 0.0236 in.)
Maximum	0.9 mm (0.035 in.)

If the backlash is greater than the maximum, replace the parts.

HINT:

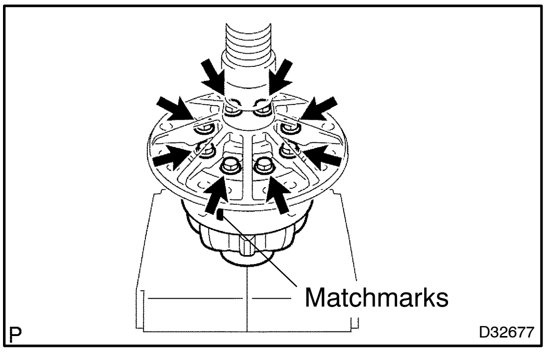
Measure the backlash at the RH case and LH case.



30. INSTALL REAR DIFFERENTIAL SIDE GEAR

(a) Install the side gear and thrust washer to the RH case.

(b) Apply gear oil to each part.



31. INSTALL DIFFERENTIAL CASE

(a) Align the matchmarks on the differential cases LH and RH.

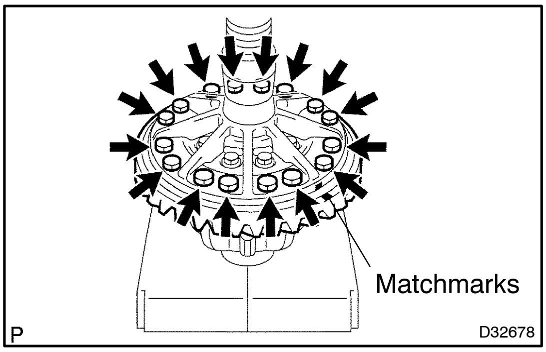
(b) Using a press, fix the differential.

(c) Apply sealant to the threads of the 8 bolts and install them.

Sealant:

Part No. 08833–00100, THREE BOND 1360K or equivalent

Torque: 190 N·m (1,950 kgf·cm, 141 ft·lbf)



32. INSTALL DIFFERENTIAL RING GEAR

(a) Align the matchmarks on the ring gear and differential.

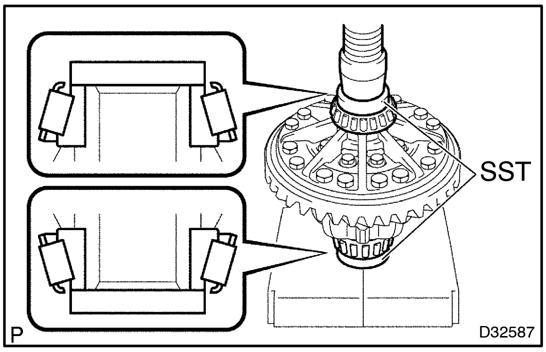
(b) Using a press, fix the differential.

(c) Apply sealant to the threads of the 16 bolts and install them.

Sealant:

Part No. 08833–00100, THREE BOND 1360K or equivalent

Torque: 190 N·m (1,950 kgf·cm, 141 ft·lbf)



33. INSTALL SIDE BEARING INNER RACE

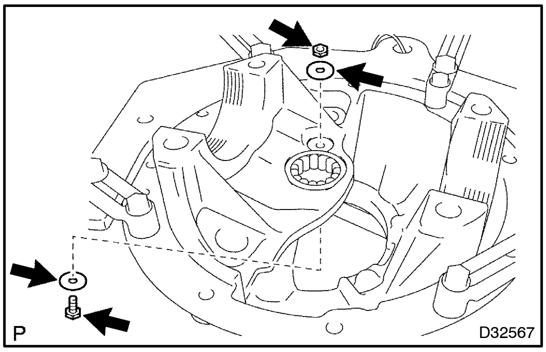
(a) Install the side spacer to the differential case LH.

(b) Using SST and a press, press in the 2 inner races onto the differential case.

SST 09223–15020, 09950–60010 (09951–00640, 09951–00650)

NOTICE:

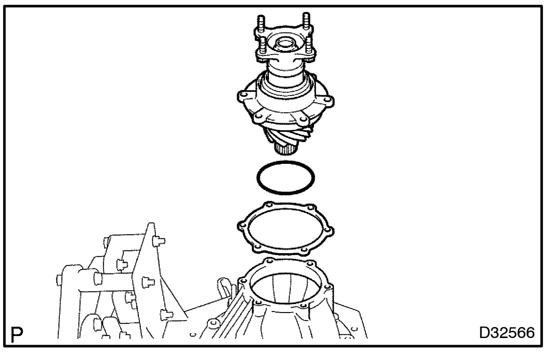
Check that the left and right inner races are not interchanged.



34. INSTALL PILOT BEARING OUTER RACE

(a) Install the bearing with the 2 retainers, a new bolt and nut.

Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)



35. INSTALL DRIVE PINION SUB–ASSY

(a) Apply bearing grease to a new O–ring.

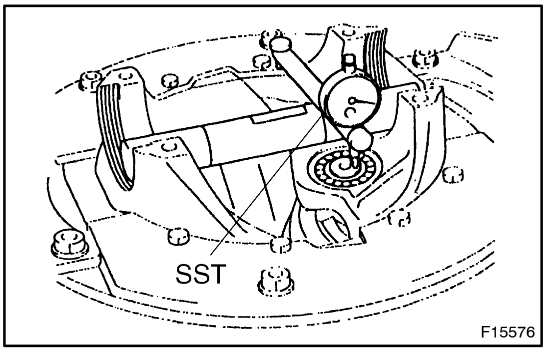
(b) Install the O–ring to the groove of the differential carrier cage.

NOTICE:

Be sure to use a new O–ring.

(c) Install the drive pinion and O–ring to the differential carrier with the 6 bolts and shims.

Torque: 74 N·m (755 kgf·cm, 55 ft·lbf)



(d) Measure the depth from the installation surface of the side bearing to the tip of the drive pinion (this depth is the conical distance).

Conical distance (Reference): 27.0 mm (1.063 in.)

SST 09640–1370

HINT:

- Make a note of the dimension of the error when manufactured which is stamped on the pinion tip before the installation of the drive pinion, then use it to calculate the conical distance.

- The conical distance is the basic dimension when the tooth contact of the drive pinion and the ring gear is adjusted. Setting them in this dimension makes the tooth contact best. Additionally, because of machine processing, dimension of the error when manufactured against the standard dimension is stamped on the tip of the pinion. The dimension that takes dimension of the error when manufactured and the standard dimension into account is the basic dimension.

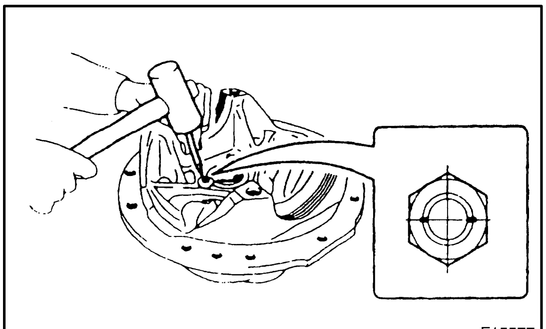
(e) Depending on the difference between the measured value and reference value (conical distance), adjust the thickness of the shim.

Shim thickness:

0.30 mm (0.0118 in.)	0.45 mm (0.0177 in.)
0.40 mm (0.0157 in.)	0.50 mm (0.0197 in.)

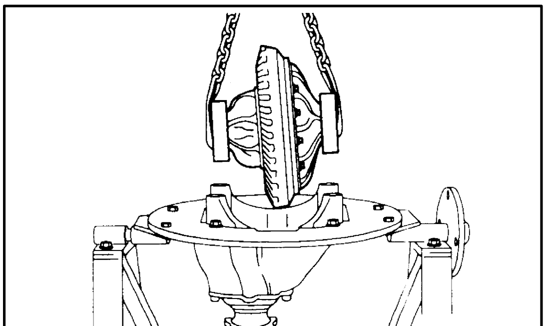
HINT:

- Basic value = Standard value + Dimension of the error when manufactured
- When dimension of the error when manufactured is stamped by –20, the actual dimension of the error when manufactured means –0.2 mm (–0.0079 in.).
  (Standard value + Dimension of the error when manufactured = Basic Dimension [21.5 mm (0.8465 in.) + (–0.2 mm (–0.0079 in.)) = 21.3 mm (0.8386 in.)])



F15577

(f) Using a punch, caulk the 2 portions of the pilot bearing lock nut.



C60239

36. INSTALL REAR DIFFERENTIAL CASE SUB–ASSY

(a) Place the bearing outer races on their respective bearings.

NOTICE:

Check that the left and right outer races are not interchanged.

(b) Using a chain block, install the differential case.

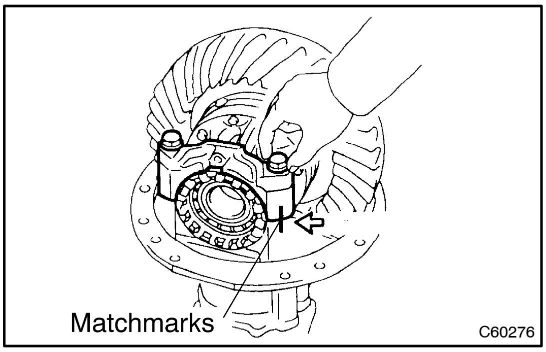
HINT:

Tilting the differential gear assy, install the differential carrier.

(c) Install the 2 adjusting nuts on the carrier and make sure the nuts are properly threaded.

HINT:

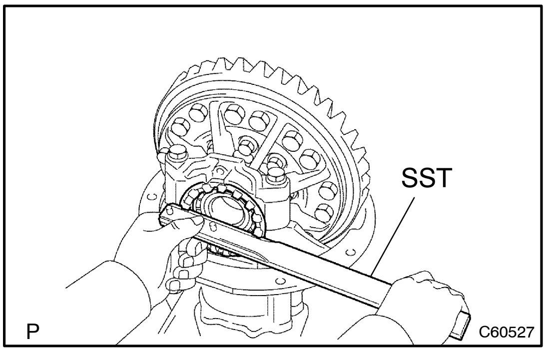
Making the 2 adjusting nuts horizontal to the side bearing, insert them from the top of the differential carrier.



(d) Align the matchmarks on the cap and carrier. Temporarily install the side bearing caps with the bolt.

HINT:

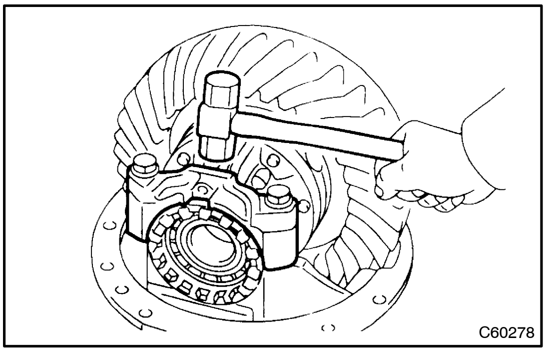
If the bearing cap does not tightly fit the carrier, the adjusting nuts may not be properly threaded. Reinstall the adjusting nuts if necessary.



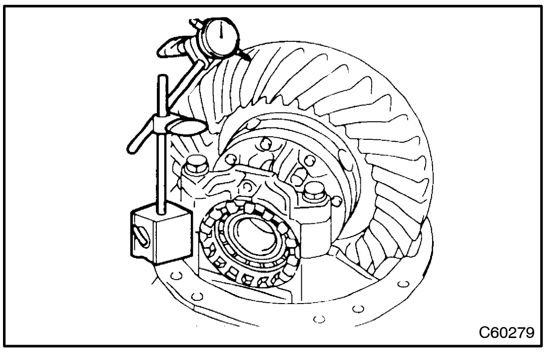
37. ADJUST DIFFERENTIAL SIDE BEARING PRELOAD

(a) Using SST, fully tighten the adjusting nut on the ring gear side. Then, loosen the nut by the 1/4 rotation.
SST 09504–00011

(b) Use the same procedures on the other side.



(c) Using a hammer, lightly tap the top of the side bearing cap so that the bearing fits.



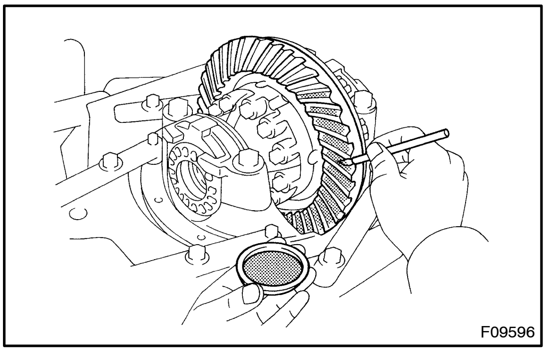
(d) Using a dial gauge, measure the backlash.
Backlash:

Reduction Ratio	Standard
5.375	0.18 to 0.23 mm (0.0072 to 0.0092 in.)
4.875, 5.125, 5.571, 6.167, 6.500	0.20 to 0.28 mm (0.0079 to 0.0110 in.)
5.833	0.25 to 0.33 mm (0.0098 to 0.0130 in.)

HINT:

Perform the measurements at 3 or more positions around the circumference of the ring gear, and adjust the side bearing preload as necessary.

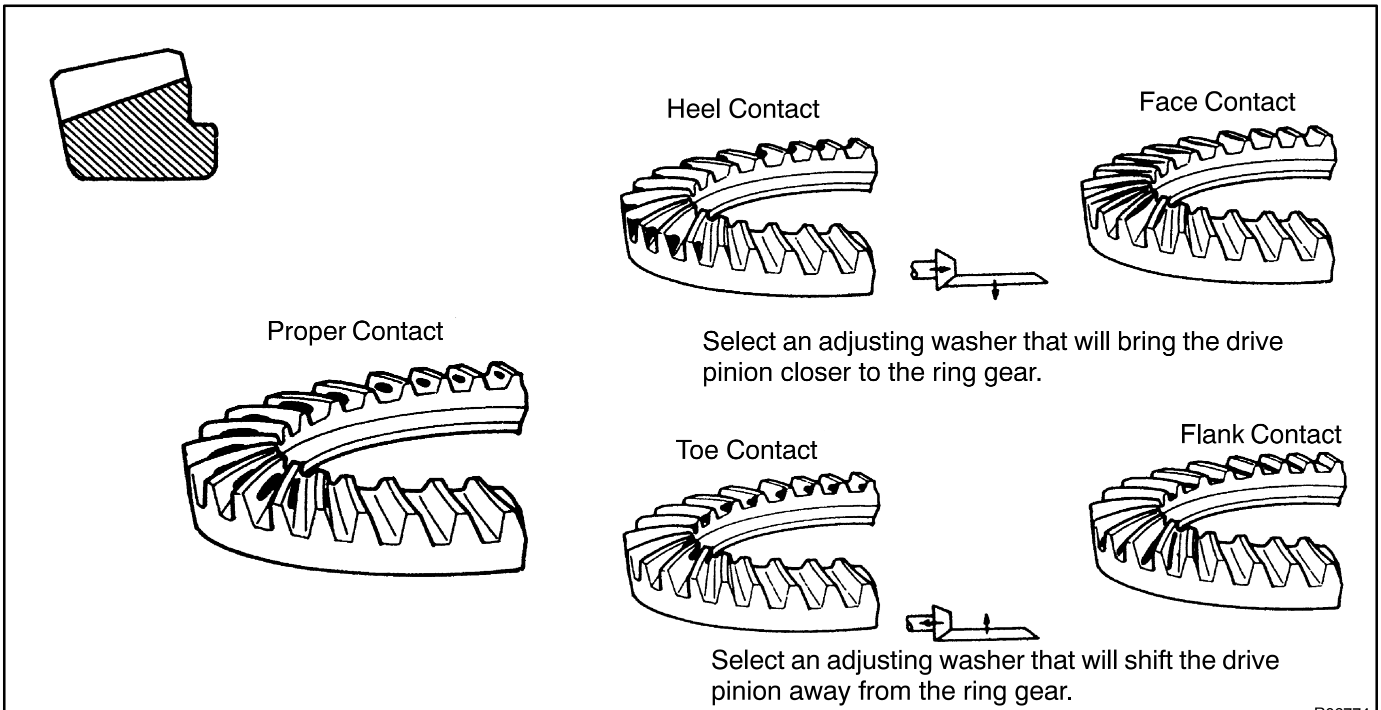
(e) The backlash should be adjusted by turning the left and right adjusting nuts by equal amounts. For example, loosen the nut on the left side one notch and torque the nut on the right side one notch.


F09596

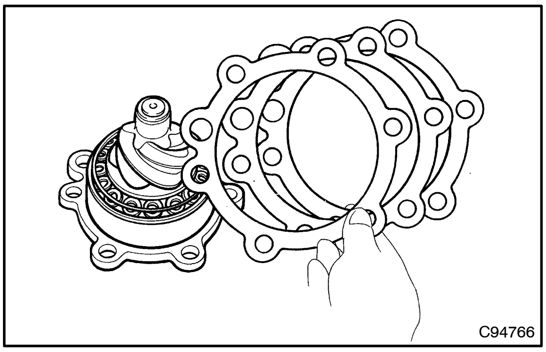
38. INSPECT TOOTH CONTACT BETWEEN RING GEAR AND DRIVE PINION

(a) Coat 3 or 4 teeth at 3 different positions on the ring gear with red lead.

(b) Turn the companion flange in both directions to inspect the ring gear for proper tooth contact.



R06774


C94766

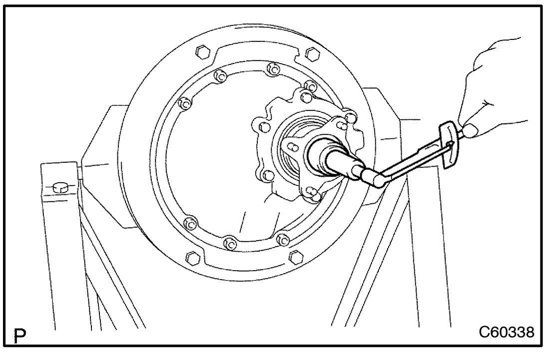
If the teeth are not properly contacting each other other, use the value below to select a proper shim for correction.

Shim thickness:

0.30 mm (0.0118 in.)	0.40 mm (0.0157 in.)
0.45 mm (0.0177 in.)	0.50 mm (0.0197 in.)

HINT:

Use one or more shims for adjustment.



39. MEASURE TOTAL PRELOAD

(a) Using a torque wrench, measure the total preload.

HINT:

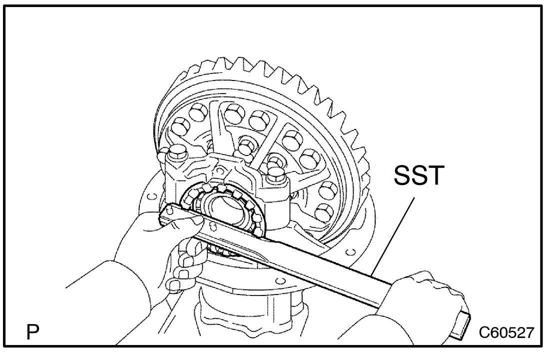
Total preload = Drive pinion preload + Side bearing preload.

Side bearing preload (new bearing):

Reduction Ratio	Standard
4.875	0.31 to 0.40 N·m (3.1 to 4.1 kgf·cm, 2.7 to 3.5 in.·lbf)
5.125	0.29 to 0.38 N·m (3.0 to 3.9 kgf·cm, 2.6 to 3.3 in.·lbf)
5.375	0.28 to 0.36 N·m (2.8 to 3.7 kgf·cm, 2.5 to 3.2 in.·lbf)
5.571	0.27 to 0.35 N·m (2.7 to 3.5 kgf·cm, 2.4 to 3.1 in.·lbf)
5.833	0.26 to 0.33 N·m (2.6 to 3.4 kgf·cm, 2.3 to 2.9 in.·lbf)
6.167	0.24 to 0.31 N·m (2.5 to 3.2 kgf·cm, 2.2 to 2.8 in.·lbf)
6.500	0.23 to 0.30 N·m (2.4 to 3.0 kgf·cm, 2.1 to 2.6 in.·lbf)

Side bearing preload (reused bearing):

Reduction Ratio	Standard
4.875	0.21 to 0.30 N·m (2.1 to 3.0 kgf·cm, 1.8 to 2.6 in.·lbf)
5.125	0.20 to 0.28 N·m (2.0 to 2.9 kgf·cm, 1.7 to 2.5 in.·lbf)
5.375	0.19 to 0.27 N·m (1.9 to 2.7 kgf·cm, 1.7 to 2.4 in.·lbf)
5.571	0.18 to 0.26 N·m (1.8 to 2.6 kgf·cm, 1.6 to 2.3 in.·lbf)
5.833	0.17 to 0.25 N·m (1.8 to 2.5 kgf·cm, 1.5 to 2.2 in.·lbf)
6.167	0.16 to 0.23 N·m (1.7 to 2.4 kgf·cm, 1.5 to 2.1 in.·lbf)
6.500	0.16 to 0.22 N·m (1.6 to 2.3 kgf·cm, 1.4 to 2.0 in.·lbf)

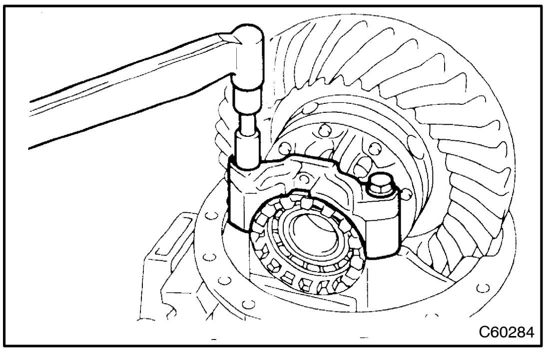


If the result is not as specified, then turn the left/right adjusting nuts using SST to adjust the preload.

SST 09504–00011

NOTICE:

When adjusting with the adjusting nuts, tighten one and another by an equal amount so that the adjustment of the backlash will not be out of order.

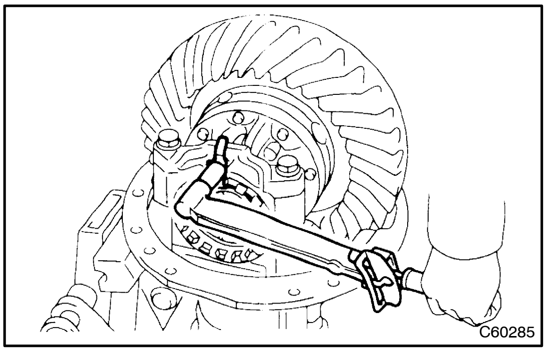


(b) Tighten the 2 bearing caps with the 4 bolts.

Torque: 210 N·m (2,150 kgf·cm, 156 ft·lbf)

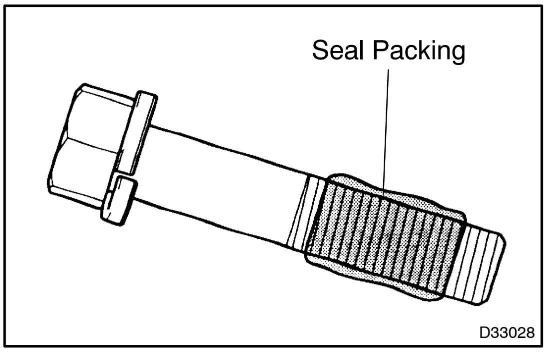
(c) Recheck the total preload.

(d) Recheck the ring gear backlash (see step 37).



40. INSTALL REAR DIFFERENTIAL BEARING ADJUSTING NUT LOCK

(a) Install 2 new nut locks on the bearing caps.
Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)



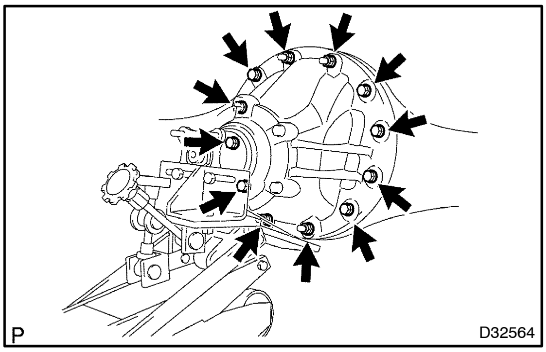
41. INSTALL REAR DIFFERENTIAL CARRIER ASSY

(a) Clean the contact surface of the differential case and rear axle housing.

(b) Apply seal packing to a new gasket, and install that to the rear axle housing.
Seal packing: Three bond 1215 or 1216

(c) Apply seal packing to the differential carrier bolts.
Seal packing: Three bond 1215 or 1216

NOTICE:
Install the bolts within 20 minutes after seal packing is applied.



(d) Using a jack, install the differential carrier into the axle housing with the 8 bolts and 4 nuts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

42. INSTALL PROPELLER SHAFT ASSY (See pub No. S1–YXZE05A, page 30–4 or 30–11)

43. INSTALL REAR AXLE SHAFT (See pub No. S1–YXZE05A, page 30–72 or 30–75)

44. ADD DIFFERENTIAL OIL (See page 29–3)

BRAKE

VACUUM PUMP ASSY 32–1
COMPONENTS 32–1
REPLACEMENT 32–2
ABS & TRACTION ACTUATOR ASSY 32–5
ON–VEHICLE INSPECTION 32–5
COMPONENTS 32–6
REPLACEMENT 32–7
LOAD SENSING VALVE ASSY 32–9
ON–VEHICLE INSPECTION 32–9

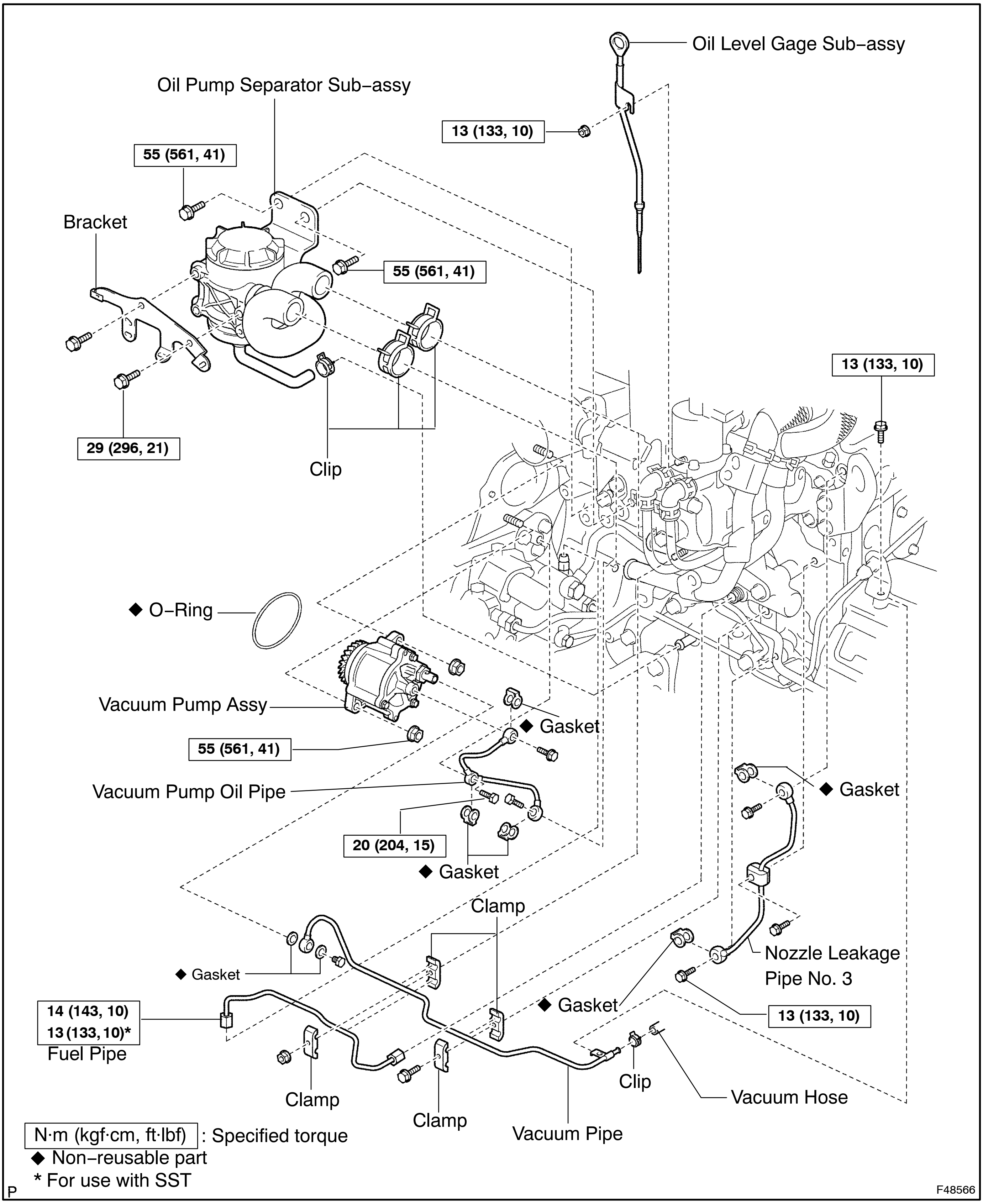
REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)

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

VACUUM PUMP ASSY

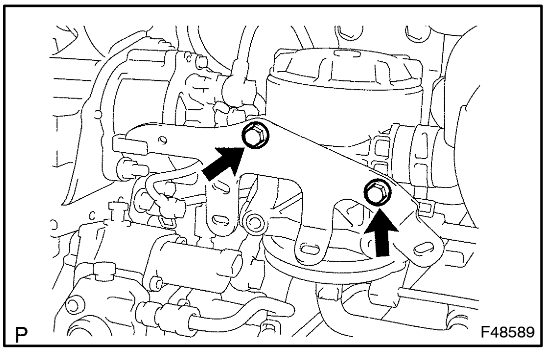
COMPONENTS

3218R–01



REPLACEMENT

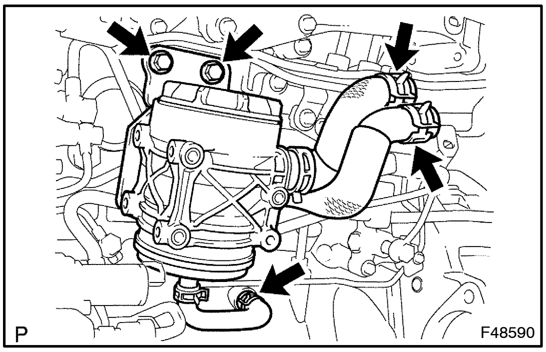
3218S–01



1. REMOVE OIL SEPARATOR SUB–ASSY

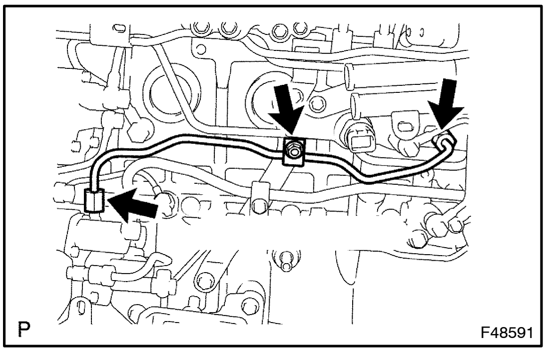
(a) Remove the wire harness clamp.

(b) Remove the 2 bolts and bracket.



(c) Disengage the 3 clips and disconnect the 3 hoses.

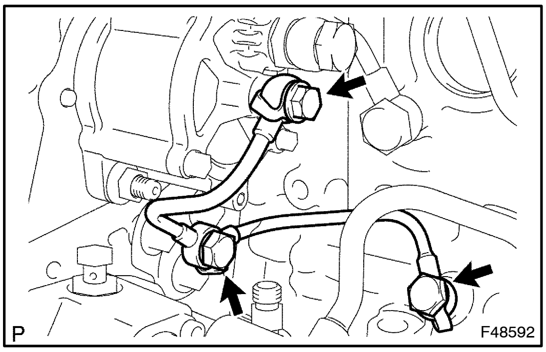
(d) Remove the 2 bolts and separator.



2. REMOVE FUEL PIPE

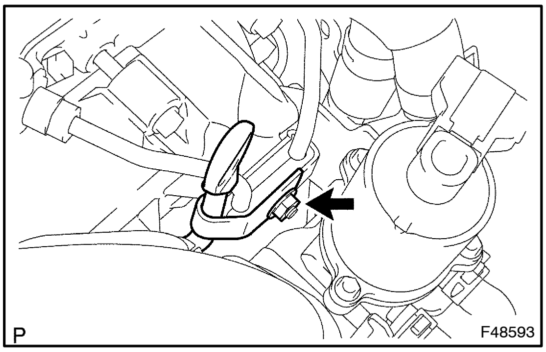
(a) Remove the nut and clamp.

(b) Using SST, disconnect the fuel pipe.
SST 09023–12900



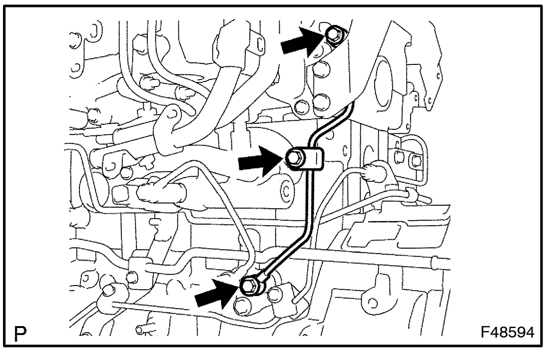
3. REMOVE VACUUM PUMP OIL PIPE

(a) Remove the 3 union bolts, oil pipe and 3 gaskets.



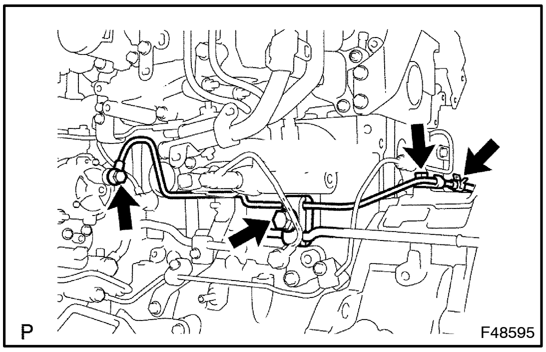
4. REMOVE OIL LEVEL GAGE SUB–ASSY

(a) Remove the nut and gage.



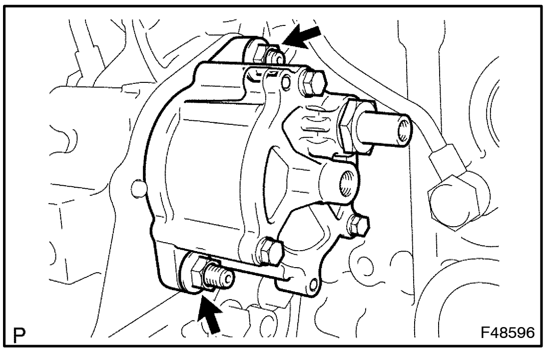
5. REMOVE NOZZLE LEAKAGE PIPE NO. 3

(a) Remove the bolt. 2 union bolts, 2 gaskets and leakage pipe.



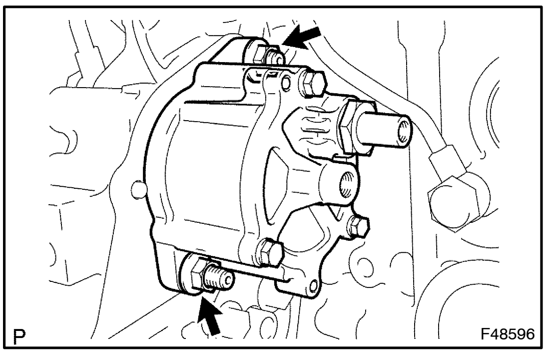
6. REMOVE VACUUM PIPE

(a) Remove the bolt and clamp.
(b) Disengage the clip and disconnect the vacuum hose from the vacuum pipe.
(c) Remove the bolt, union bolt and vacuum pipe.



7. REMOVE VACUUM PUMP ASSY

(a) Remove the 2 nuts, vacuum pump and O–ring.



8. INSTALL VACUUM PUMP ASSY

(a) Install a new O–ring and the vacuum pump with the 2 nuts.
Torque: 55 N·m (561 kgf·cm, 41 ft·lbf)

NOTICE:
Do not damage the O–ring.

9. INSTALL VACUUM PIPE

(a) Install the pipe with 2 new gaskets and the union bolt.

Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)

10. INSTALL NOZZLE LEAKAGE PIPE NO. 3

(a) Install the leakage pipe No. 3 with 2 new gaskets and the 2 union bolts.

Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)

11. INSTALL OIL LEVEL GAGE SUB–ASSY

(a) Install the gage with the nut.

Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)

NOTICE:

Do not damage the O–ring.

12. INSTALL VACUUM PUMP OIL PIPE

(a) Install the pipe with 3 new gaskets and the 3 union bolts.

Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)

13. INSTALL FUEL PIPE

(a) Using a SST, connect the pipe.

Torque:

13 N·m (133 kgf·cm, 10 ft·lbf) for use with SST

14 N·m (143 kgf·cm, 10 ft·lbf)

14. INSTALL OIL SEPARATOR SUB–ASSY

(a) Install the oil separator with the 2 bolts.

Torque: 55 N·m (561 kgf·cm, 41 ft·lbf)

(b) Install the bracket with the 2 bolts.

Torque: 29 N·m (296 kgf·cm, 21 ft·lbf)

ABS & TRACTION ACTUATOR ASSY

3218U–01

ON–VEHICLE INSPECTION

1. BRAKE ACTUATOR INSPECTION

(a) Prepare for the inspection.

(1) Connect the hand–held tester (with 24 V VIM) to the DLC3 and start the engine.

NOTICE:

Be sure to use the 24 V VIM, because the hand–held tester will be damaged if you do not use the 24 V VIM.

(2) Follow the instructions on the tester display and enter ACTIVE TEST mode.

(b) Inspect the actuator motor operation.

NOTICE:

Do not leave the motor relay running for more than 5 seconds. Make sure to wait for 20 seconds between each relay operation.

(1) Turn ON the motor relay. Check that the actuator motor emits noise.

(2) Turn OFF the motor relay.

(3) Depress and hold the brake pedal for 15 seconds. Without releasing the pedal, increase the pressure on the pedal. Check that the pedal cannot be depressed any further.

(4) While still depressing and holding the brake pedal, turn ON the motor relay. Check that the pedal does not vibrate.

(5) Turn OFF the motor relay and release the pedal.

(c) Inspect the solenoid valve operation for the front–right wheel.

NOTICE:

- **Do not leave the motor relay or solenoid valves running for more than 5 seconds. Make sure to wait for 20 seconds between each relay or solenoid valve operation.**
- **Each solenoid valve's ACTIVE TEST lasts approximately 2 seconds and ends (turns off) automatically.**
- **When only operating the pressure reducing valve, do not depress the brake pedal.**
- **Do not turn on any solenoid valves that do not appear in the instructions.**

(1) Depress and hold the brake pedal.

(2) Turn ON the SFRH and SFRR solenoid valves simultaneously. Without releasing the pedal, increase pressure on the pedal. Check that the pedal cannot be depressed any further.

(3) Continue to depress and hold the brake pedal. Then, turn OFF the SFRH and SFRR solenoid valves simultaneously. Increase pressure on the pedal. Check that the pedal can be depressed further.

(4) Turn on the motor relay and check that the pedal returns to its reset state.

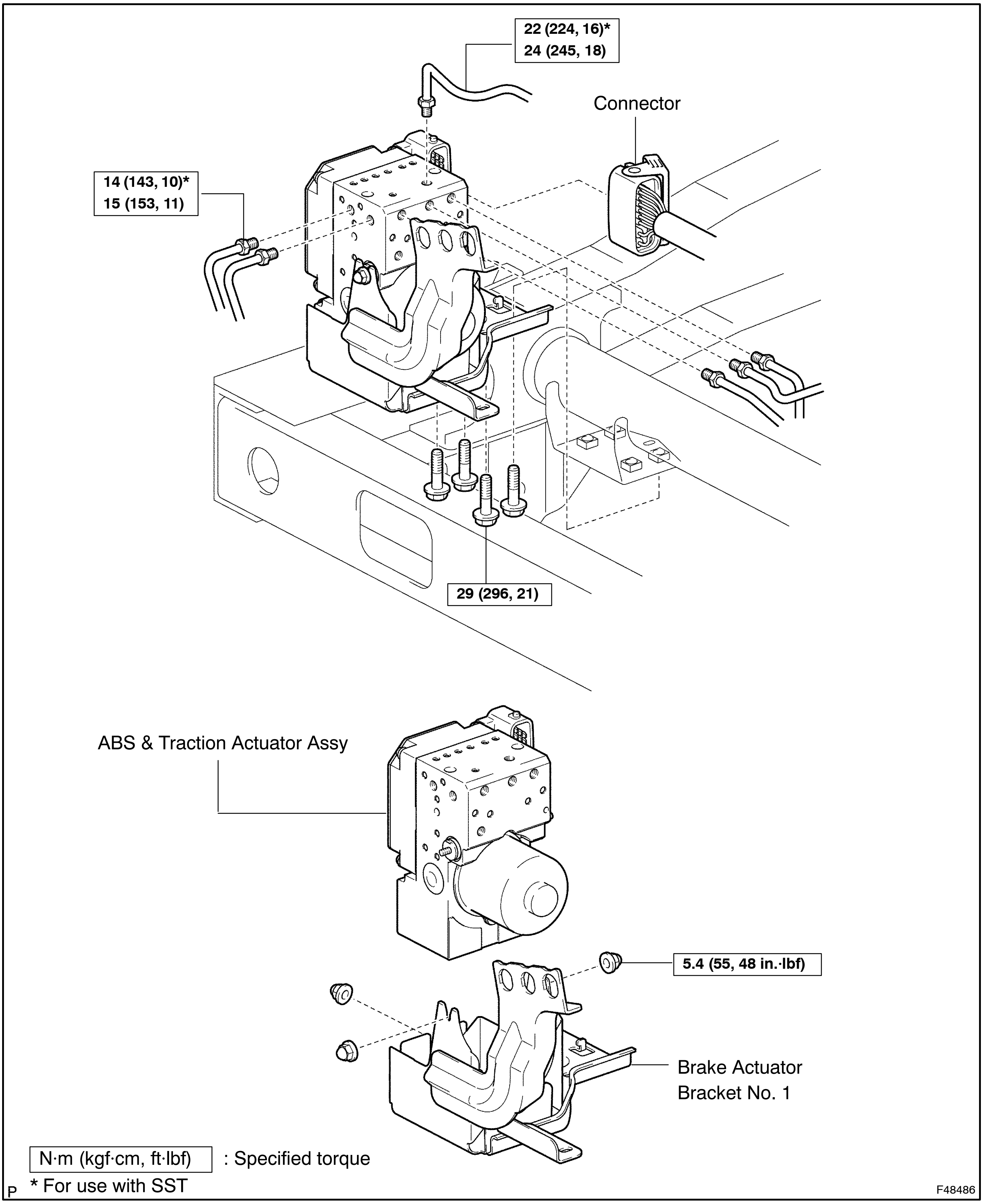
(5) Check the solenoid valves of the other wheels in the same way (step c (1) to (4)).

HINT:

The solenoid valves for the other wheel are: SFLH and SFLR for the front–left wheel, and SRH and SRR for the rear wheels.

3218V–01

COMPONENTS



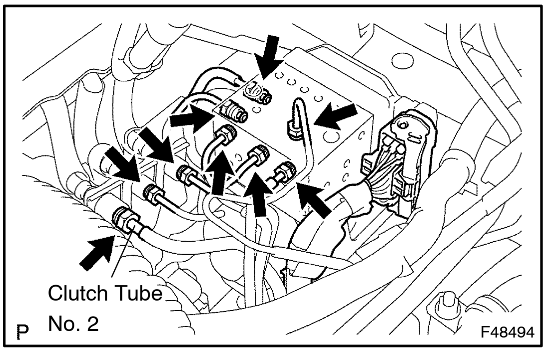
3218W–01

REPLACEMENT

1. **REMOVE BRAKE MASTER CYLINDER RESERVOIR FILLER CAP ASSY**
2. **REMOVE BRAKE MASTER CYLINDER RESERVOIR STRAINER**
3. **DRAIN BRAKE FLUID**

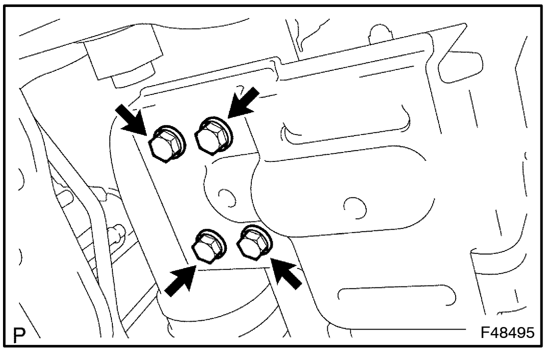
NOTICE:
Wash brake fluid off immediately if it adheres to any painted surface.

4. **DISCONNECT BATTERY NEGATIVE TERMINAL**



5. **REMOVE ABS & TRACTION ACTUATOR ASSY**

(a) Pull the lock lever upward.
(b) Disconnect the actuator connector.
(c) Using SST, disconnect the 8 brake lines.
SST 09023–00100
(d) Using SST, disconnect the clutch tube No. 2.
SST 09023–38200
(e) Remove the 3 clips and disconnect the 3 flexible hoses from the actuator bracket.



(f) Remove the 4 bolts and actuator.
(g) Remove the 3 nuts and actuator from the bracket.

6. **INSTALL ABS & TRACTION ACTUATOR ASSY**

(a) Install the actuator to the bracket with the 3 nuts.
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)
(b) Install the actuator with the 4 bolts.
Torque: 29 N·m (296 kgf·cm, 21 ft·lbf)
(c) Connect the 3 flexible hoses to the actuator bracket with the 3 new clips.
(d) Using SST, connect the clutch tube No. 2
SST 09023–38200
Torque:
22 N·m (224 kgf·cm, 16 ft·lbf) for use with SST
24 N·m (245 kgf·cm, 18 ft·lbf)
(e) Using SST, connect the 8 brake lines.
SST 09023–00100
Torque:
14 N·m (143 kgf·cm, 10 ft·lbf) for use with SST
15 N·m (153 kgf·cm, 11 ft·lbf)

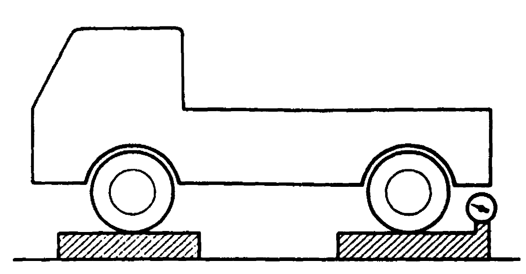
7. **BLEED BRAKE LINE**
8. **CHECK FLUID LEVEL IN RESERVOIR**
9. **CHECK BRAKE FLUID LEAKAGE**
10. **INSTALL BRAKE MASTER CYLINDER RESERVOIR STRAINER**

11. **INSTALL BRAKE MASTER CYLINDER RESERVOIR FILLER CAP ASSY**
12. **CONNECT BATTERY NEGATIVE TERMINAL**
13. **CHECK ACTUATOR WITH HAND–HELD TESTER (See page 32–5)**

LOAD SENSING VALVE ASSY

ON–VEHICLE INSPECTION

3218T–01



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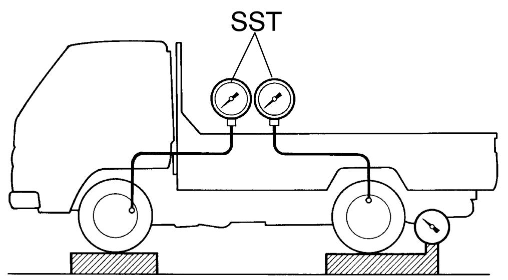
1. SET REAR AXLE LOAD

HINT:

If the vehicle unladen weight exceeds the specification, set it by following step 5.

Rear axle load (including vehicle weight):

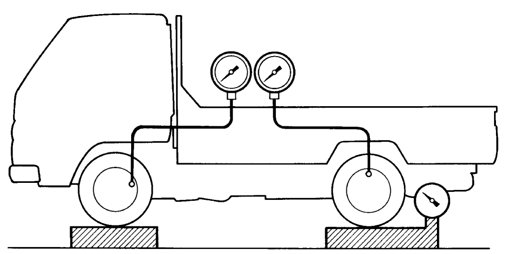
Model	Front axle load kg (lb)
XZU305R–TQMMWQ3	1,350 (2,976)
XZU305R–HQMMWQ3	1,350 (2,976)
XZU305R–TKMMWQ3	1,350 (2,976)
XZU305R–HKMMWQ3	1,350 (2,976)
XZU345R–TKMMWQ3	1,400 (3,086)
XZU345R–HKMMWQ3	1,400 (3,086)



C61079

2. INSTALL LSPV GAUGE (SST) AND BLEED AIR

SST 09709–29018



C61079

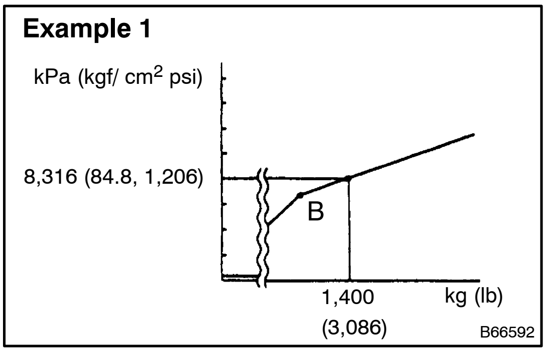
3. RAISE FRONT BRAKE PRESSURE 9,807 kPa (100 kgf/cm^2, 1,422 psi) AND CHECK REAR BRAKE PRESSURE

Rear brake fluid pressure:

5,600 ± 500 kPa (57 ± 5 kgf/cm^2, 810 ± 70 psi)

HINT:

Gradually depress on the brake pedal until the pressure reaches the specified valve. Do not overshoot the specified pressure. Read the value of rear pressure 2 seconds after adjusting to the specified fluid pressure.

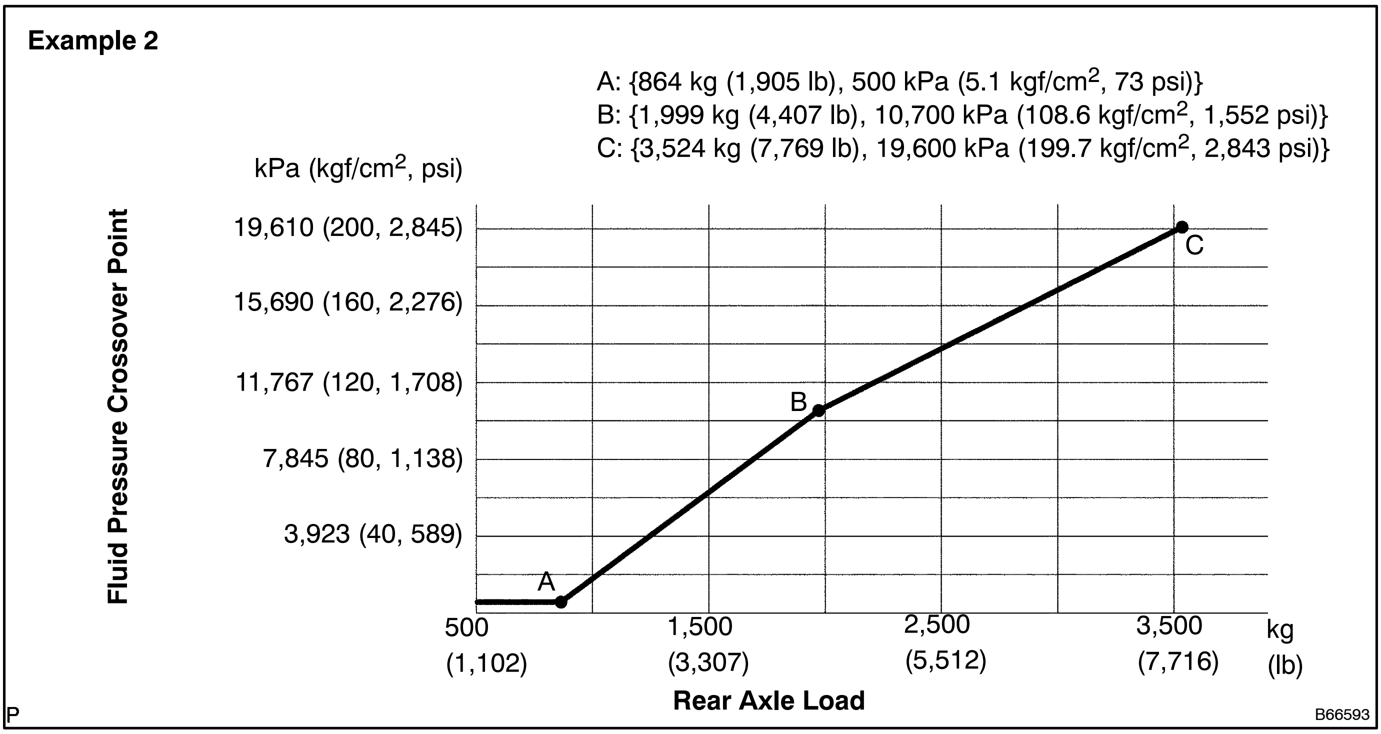


4. **IF VEHICLE UNLADEN WEIGHT EXCEEDS SPECIFICATION, SET IT BY FOLLOWING STEPS**

(a) Make a graph of rear axle load and brake fluid pressure as shown in example 1 or 2, using the applicable data of A B C point data table.

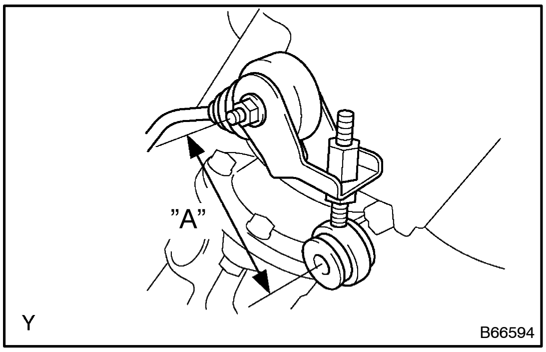
(b) Input the rear axle load on the applicable graph and find out the fluid pressure crossover point.
Example: When the rear axle load is 1,400 kg (3,086 lb), the fluid pressure crossover point is 8,316 kPa (84.8 kgf/cm^2, 1,206 psi).

(c) Calculate the rear brake pressure when the front brake pressure is 7,845 kPa (80 kgf/cm^2, 1,138 psi) using the following formula.
X: Fluid Pressure Crossover Point
X + (7,845 – X) x 0.37
Example:
X: 8,316 kPa (84.8 kgf/cm^2, 1,206 psi)
8,316 + (7,845 – 8,316) x 0.37 = 83.024
Rear brake pressure: 8,142 kPa (83.0 kgf/cm^2, 1,181 psi)
Service limit: ± 490 kPa (5 kgf/cm^2, 71 psi)



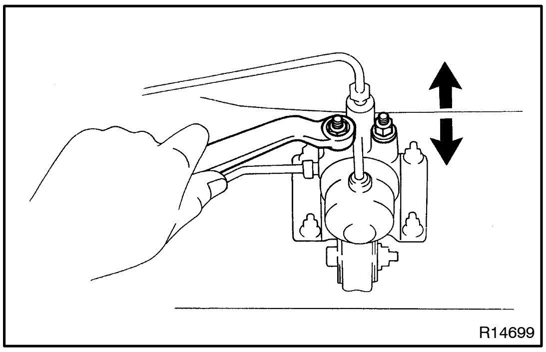
A, B, C point data table:

Model	A		B		C	
	kg (lb)	kPa (kg/ cm^2, psi)	kg (lb)	kPa (kg/ cm^2, psi)	kg (lb)	kPa (kg/ cm^2, psi)
XZU305R–TQMMWQ3	991 (2,185)	500 (5.1, 73)	2,179 (4,803)	8,300 (84.9, 1,204)	2,555 (5,633)	12,900 (132, 1,871)
XZU305R–HQMMWQ3	1,121 (2,471)	500 (5.1, 73)	2,152 (4,745)	7,300 (74.4, 1,059)	2,943 (6,488)	13,000 (132.4, 1,885)
XZU305R–TKMMWQ3	1,127 (2,485)	500 (5.1, 73)	2,406 (5,304)	8,700 (89, 1,262)	4,246 (9,361)	16,400 (167.1, 2,379)
XZU305R–HKMMWQ3	875 (1,929)	500 (5.1, 73)	1,908 (4,206)	7,100 (72.9, 1,030)	4,247 (9,363)	16,300 (166, 2,364)
XZU345R–TKMMWQ3	1,095 (2,414)	500 (5.1, 73)	2,012 (4,436)	8,400 (85.6, 1,218)	4,994 (11,010)	17,000 (173.3, 2,466)
XZU345R–HKMMWQ3	1,145 (2,524)	500 (5.1, 73)	2,012 (4,436)	8,000 (81.2, 1,160)	4,815 (10,615)	16,000 (163, 2,321)



5. IF NECESSARY, ADJUST FLUID PRESSURE

(a) Adjust the length of the No. 2 shackle.
Lower pressure – Lengthen "A"
High pressure – Shorten "A"
Initial value: 78 mm (3.07 in.)
Adjusting: 72 to 84 mm (2.83 to 3.31 in.)

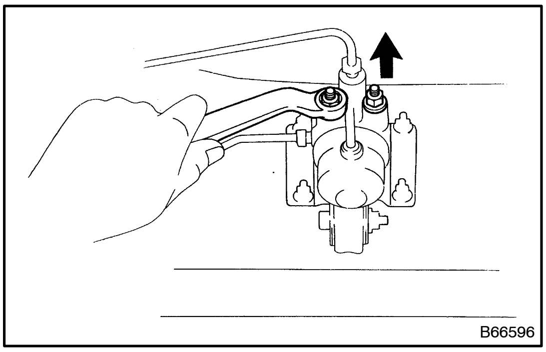


(b) If the pressure cannot be adjusted by the No. 2 shackle, raise or lower the valve body.
Lower pressure – Lower
High pressure – Raise

(c) Torque the nuts.
Torque: 12.5 N·m (130 kgf·cm, 9 ft·lbf)

(d) Adjust the length of the No. 2 shackle again.

If it cannot be adjusted, inspect the valve body.



6. IF NECESSARY, CHECK VALVE BODY

(a) Assemble the valve body in the uppermost position.

HINT:

When the brakes are applied, the piston moves down about 1 mm (0.039 in.). Even at this time, the piston should not make contact with or move the load sensing spring.

(b) In this position, check the brake pressure.

Brake pressure:

Front Brake Pressure kPa (kgf/cm^2, psi)	Rear Brake Pressure kPa (kgf/cm^2, psi)
490 (5, 71)	490 (5, 71)
2,452 (25, 356)	1,020 to 1,412 (10.4 to 14.4, 148 to 204)
5,884 (60, 853)	2,148 to 2,834 (21.9 to 28.9, 311 to 411)

If the measured value is not within the standard, replace the valve body.

7. REMOVE LSPV GAUGE (SST) AND BLEED BRAKE SYSTEM (See Pub. No. S1–YXZE05A, page 32– 4)

PARKING BRAKE

PARKING BRAKE SYSTEM 33–1
PROBLEM SYMPTOMS TABLE 33–1
PARKING BRAKE CABLE ASSY NO.2 33–2
COMPONENTS 33–2
REPLACEMENT 33–3
PARKING BRAKE CABLE ASSY NO.3 33–6
REPLACEMENT 33–6

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)

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

PARKING BRAKE SYSTEM

330HJ–01

PROBLEM SYMPTOMS TABLE

Use the table below to help determine the cause of the problem. The numbers indicate likely causes of the problem in descending order. Check each part in order. Repair or replace parts as necessary.

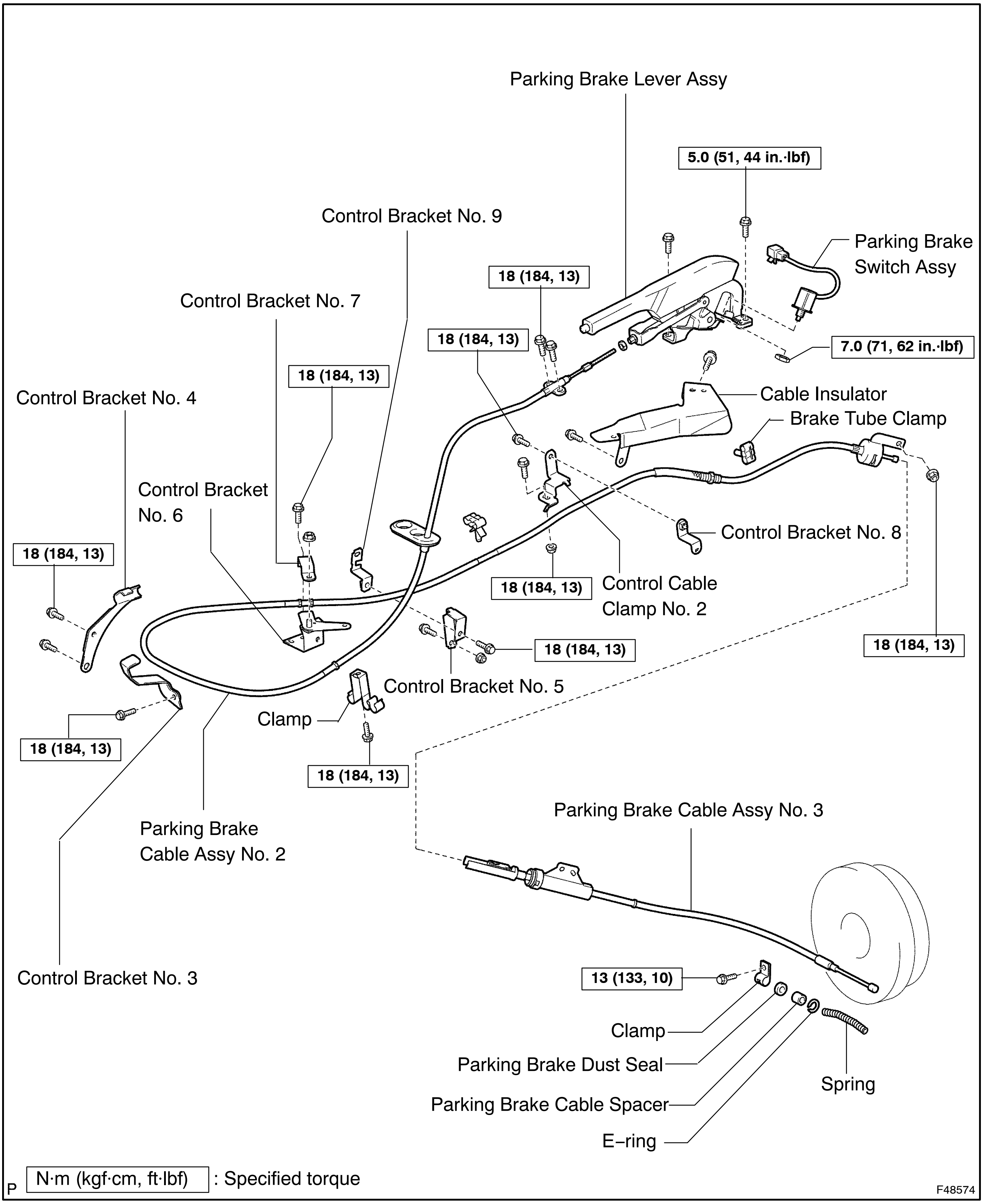
Symptom	Suspected Area	See Page
Brake drag	1. Parking brake lever travel (out of adjustment) 2. Parking brake wire (sticking) 3. Parking brake shoe clearance (out of adjustment) 4. Tension or return spring (damaged)	33–3* 33–3* 33–11* 33–11*

HINT:
*: See Pub. No. S1–YXZE05A, page 33–1.

PARKING BRAKE CABLE ASSY NO.2

COMPONENTS

330HK–01

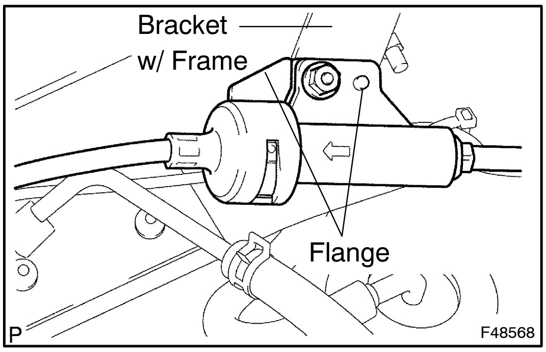


330HL–01

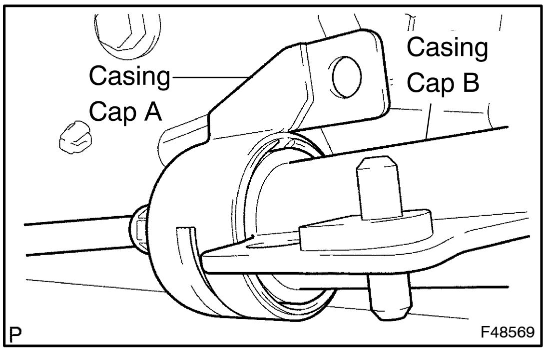
REPLACEMENT

1. **REMOVE SHIFT LEVER KNOB SUB–ASSY**
2. **REMOVE SHIFTING HOLE COVER SUB–ASSY**
3. **REMOVE PARKING BRAKE HOLE COVER**
4. **REMOVE SHIFT LEVER BOOT COVER**
5. **REMOVE PARKING BRAKE CABLE ASSY NO.2**

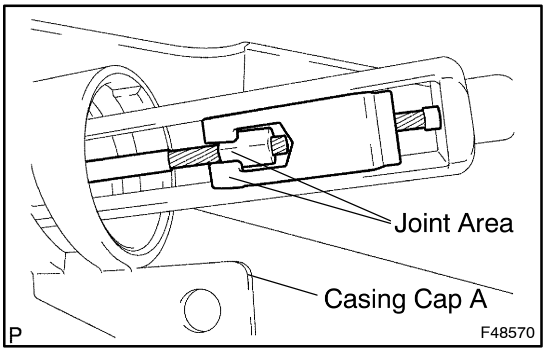
(a) Loosen the lock nut and disconnect the cable No. 2 from the parking lever.
(b) Remove the 2 bolts and cable No. 2 from the floor panel.
(c) Remove the scuff plate. Pull back the floor carpet until the control cable cover is visible.
(d) Remove the 4 bolts and cable cover.
(e) Remove the cable No. 2 from the vehicle through the out side.



(f) Remove the flanges from the bracket w/ frame by removing the nut.

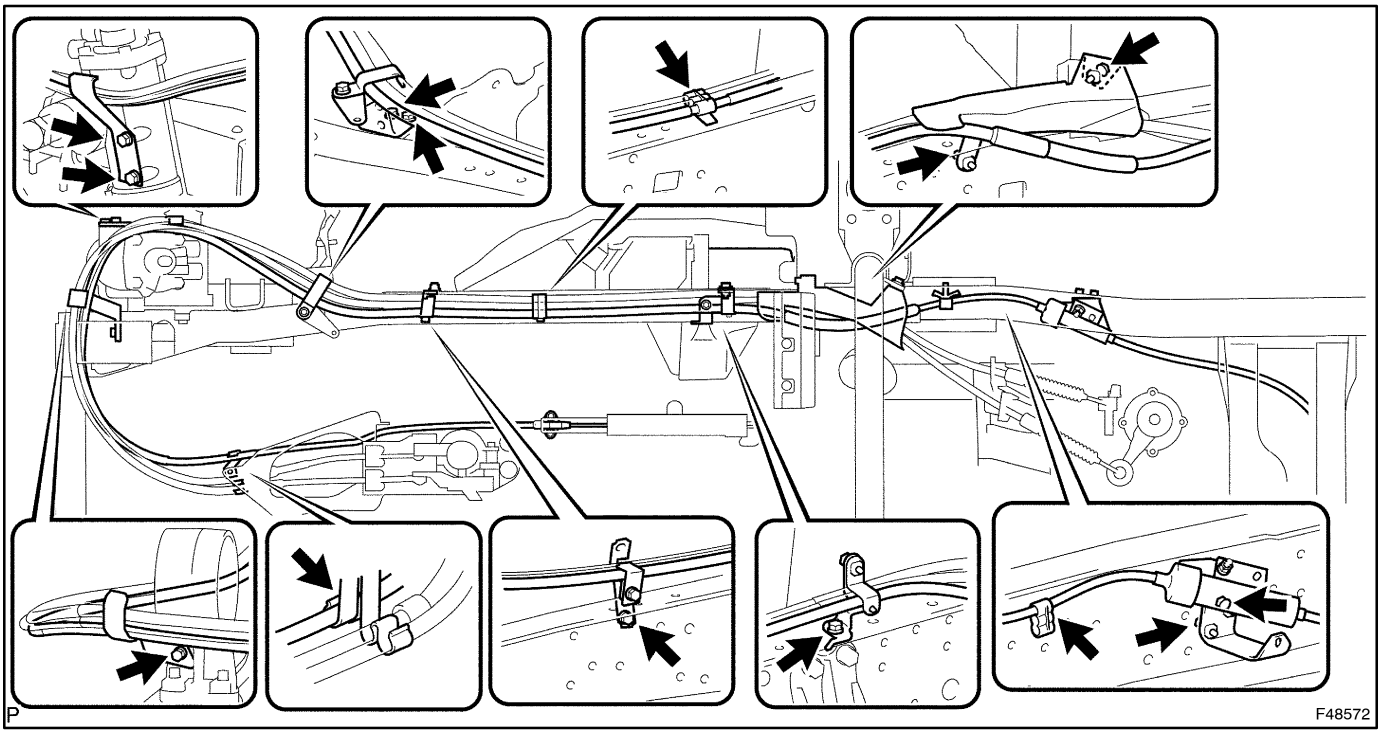


(g) Twist casing cap B 90°.
(h) Then separate casing caps A and B.

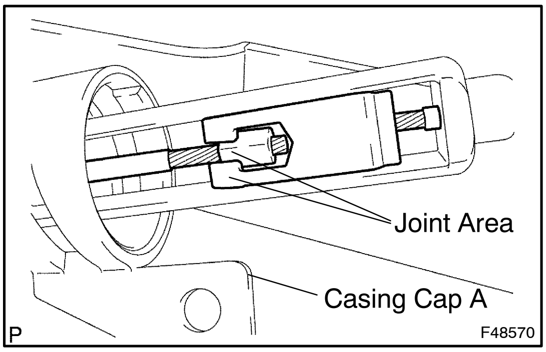


(i) Pull out the interior of the separated caps. From the joint area, remove the parking brake cable No. 2 from the parking brake cable No. 3.

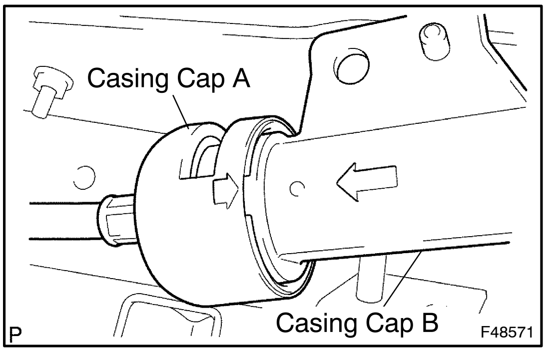
(j) Remove the parking brake cable No. 2 to each cable bracket with the bolt or nut, as shown in the illustration.



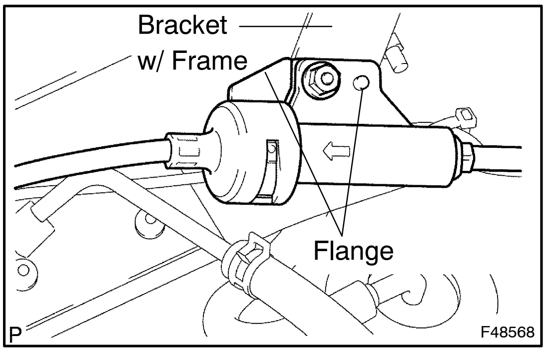
6. INSTALL PARKING BRAKE CABLE ASSY NO.2



(a) Connect the parking brake cable No. 2 to the parking brake cable No. 3.



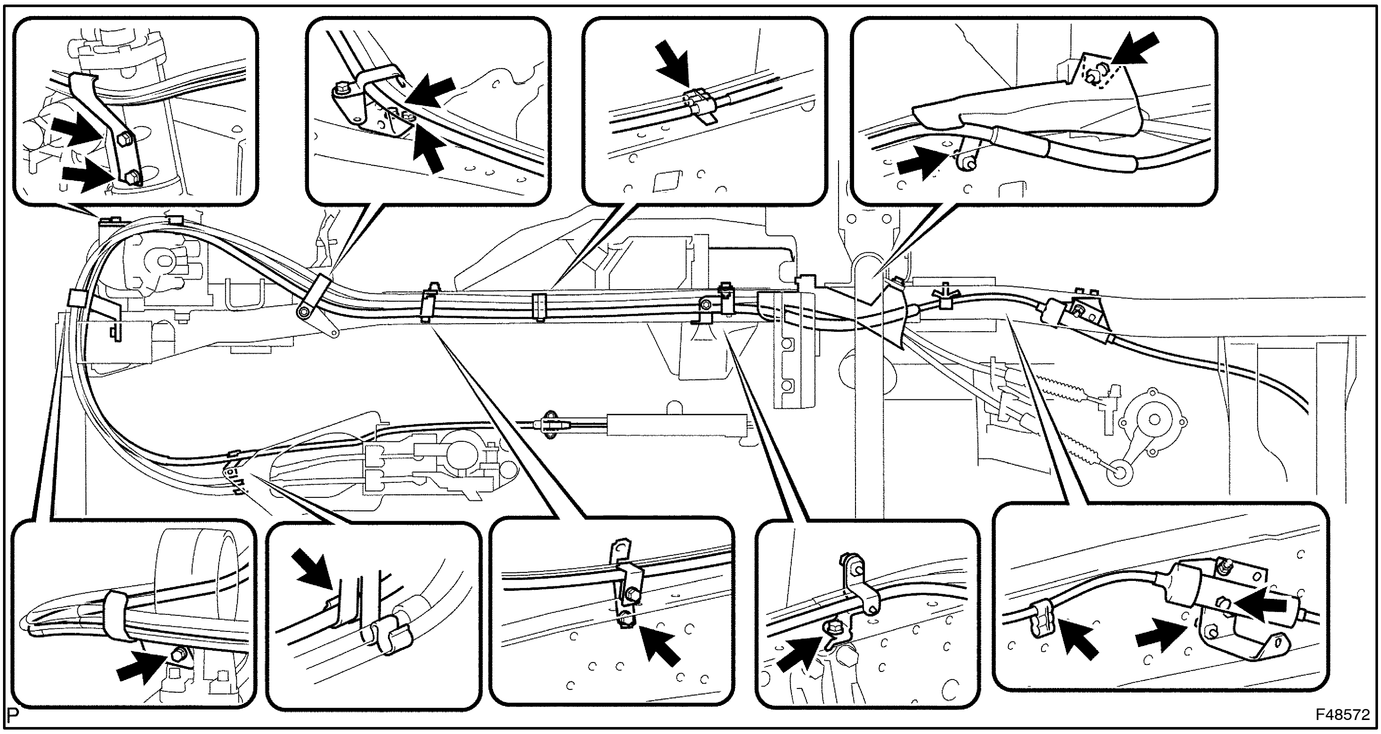
(b) Insert casing cap B into casing cap A. Align the protrusion on casing cap B with the slit of casing cap A using the arrows in the illustration as guides. Twist casing cap A and B until their flanges come together (approximately 90°).



(c) Insert the flange to the bracket w/ frame by installing the nut.

(d) Insert the parking brake cable No. 2 into the room interior. Mount the cable grommet into the floor panel.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

(e) Attach the parking brake cable No. 2 to each cable bracket with the bolt or nut, as shown in the illustration.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)



(f) Install the control cable cover with the 4 bolts. Return the floor carpet to its original position and install the scuff plate. Install the parking brake cable No. 2 to the floor panel with the 2 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

(g) Connect the parking brake cable No. 2 to the parking brake lever's adjusting nut. Temporarily tighten the lock nut.

7. ADJUST PARKING BRAKE SHOE CLEARANCE
8. INSTALL SHIFT LEVER BOOT COVER
9. INSTALL PARKING BRAKE HOLE COVER
10. INSTALL SHIFTING HOLE COVER SUB–ASSY
11. INSTALL SHIFT LEVER KNOB SUB–ASSY

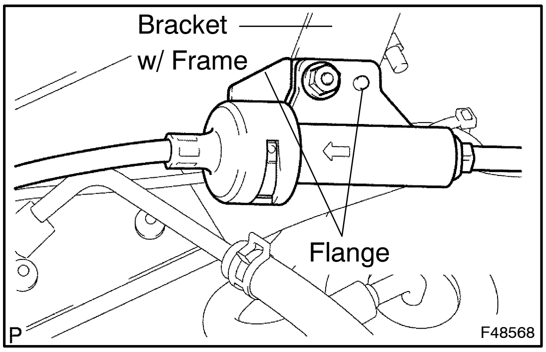
PARKING BRAKE CABLE ASSY NO.3

HINT:
COMPONENTS: See page 33–2.

330HM–01

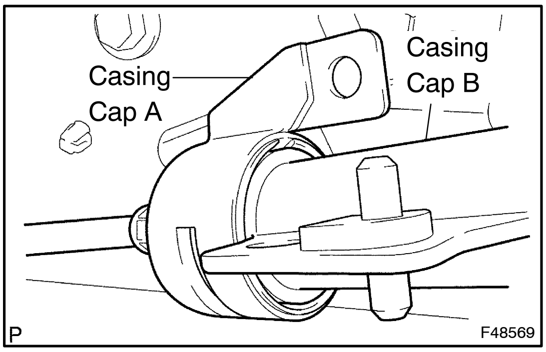
REPLACEMENT

1. **REMOVE PROPELLER SHAFT ASSY (2 JOINT TYPE)**
2. **REMOVE PROPELLER INTERMEDIATE SHAFT ASSY**
3. **REMOVE PARKING BRAKE DRUM SUB–ASSY**
4. **REMOVE PARKING BRAKE SHOE RETURN TENSION SPRING**
5. **REMOVE PARKING BRAKE SHOE ADJUSTER SUB–ASSY**
6. **REMOVE PARKING BRAKE SHOE ASSY RH OR CENTER NO.2**
7. **REMOVE PARKING BRAKE SHOE ASSY RH OR CENTER NO.1**



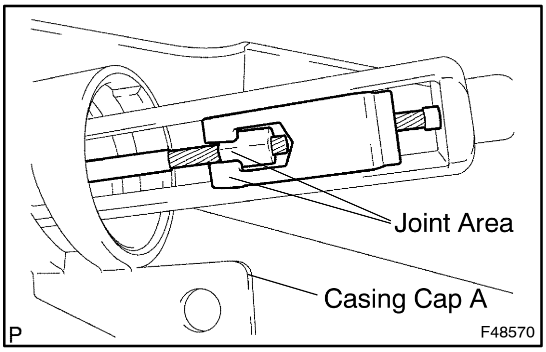
8. **REMOVE PARKING BRAKE CABLE ASSY NO.3**

(a) Remove the flanges from the bracket w/ frame by removing the nut.

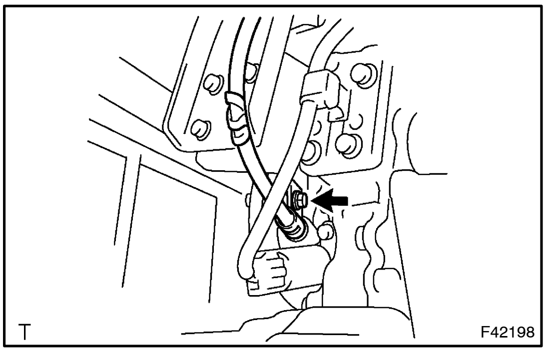


(b) Twist casing cap B 90°.

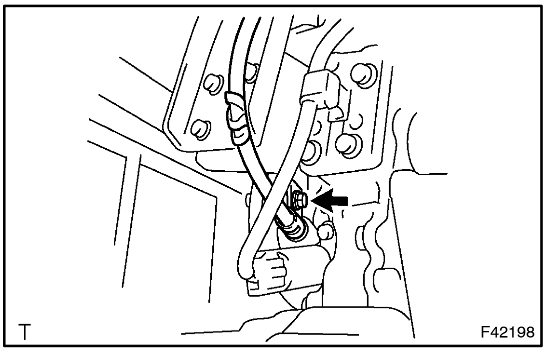
(c) Then separate casing caps A and B.



(d) Pull out the interior of the separated caps. From the joint area, remove the parking brake cable No. 2 from the parking brake cable No. 3.



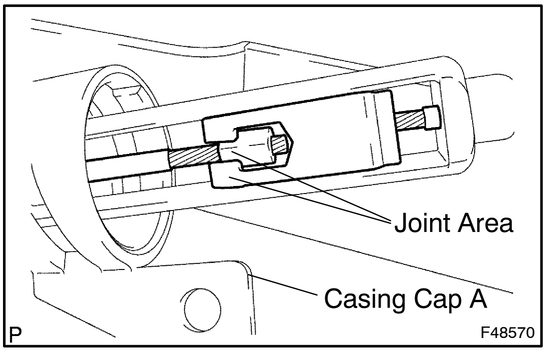
(e) Disconnect the parking brake cable No. 3.
  (1) Remove the bolt and clamp from the parking brake shoe back plate.
  (2) Disconnect the parking brake cable No. 3 from the parking brake shoe back plate.
  (3) Remove the inner wire spring, E–ring, collar and dust seal from the cable No. 3.



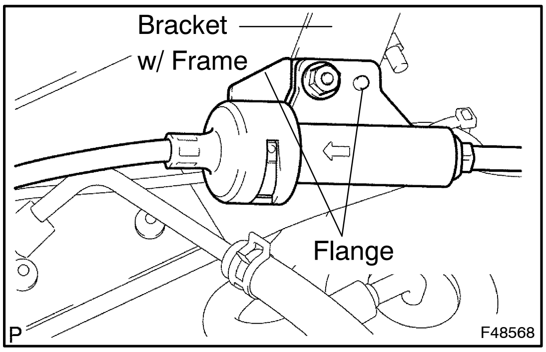
9. INSTALL PARKING BRAKE CABLE ASSY NO.3

(a) Connect the parking brake cable No. 3.
  (1) Install the inner wire spring, E–ring, collar and dust seal to the cable No. 3.
  (2) Connect the parking brake cable No. 3.
  (3) Install the bolt and clamp to the parking brake shoe backing plate.

Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)



(b) Connect the parking brake cable No. 2 to the parking brake cable No. 3.



(c) Insert the flange to the bracket w/ frame by installing the nut.

(d) Insert the parking brake cable No. 2 into the room interior. Mount the cable grommet into the floor panel.

Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

10. INSTALL PARKING BRAKE SHOE ASSY RH OR CENTER NO.1

11. INSTALL PARKING BRAKE SHOE ASSY RH OR CENTER NO.2

12. INSTALL PARKING BRAKE SHOE ADJUSTER SUB–ASSY

13. INSTALL PARKING BRAKE SHOE RETURN TENSION SPRING

14. CHECK PARKING BRAKE INSTALLATION

15. INSTALL PARKING BRAKE DRUM SUB–ASSY

16. ADJUST PARKING BRAKE SHOE CLEARANCE

17. INSTALL PROPELLER INTERMEDIATE SHAFT ASSY

18. INSTALL PROPELLER SHAFT ASSY (2 JOINT TYPE)

MANUAL TRANSMISSION/TRANSAXLE

MANUAL TRANSMISSION SYSTEM (M550) 41–1
PROBLEM SYMPTOMS TABLE 41–1
MANUAL TRANSMISSION OIL (M550) 41–2
REPLACEMENT 41–2
MANUAL TRANSMISSION UNIT ASSY (M550) 41–3
REPLACEMENT 41–3
TRANSMISSION REAR BEARING RETAINER OIL SEAL (M550) 41–7
REPLACEMENT 41–7
SHIFT AND SELECT TRANSMISSION CONTROL CABLE ASSY (M550) 41–8
REPLACEMENT 41–8
SPEEDOMETER DRIVEN (MTM) GEAR SUB–ASSY (M550) 41–15
REPLACEMENT 41–15

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

MANUAL TRANSMISSION SYSTEM (M550)

410D4–02

PROBLEM SYMPTOMS TABLE

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

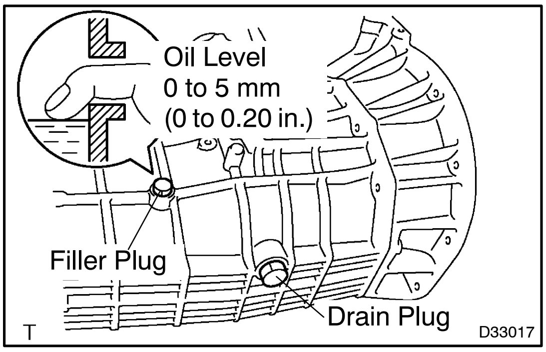
Symptom	Suspected Area	See Page
Noise	1. Oil (level low) 2. Oil (wrong) 3. Gear (worn or damaged) 4. Bearing (worn or damaged)	41–2 41–2 ★ ★
Oil leakage	1. Oil (level too high) 2. Gasket (damaged) 3. Oil seal (worn or damaged) 4. O–ring (worn or damaged)	41–2 ★ 41–7 ★
Shifting is hard or disabled	1. Synchronizer ring (worn or damaged) 2. Shift key spring (damaged)	★ ★
Jumps out of gear	1. Locking ball spring (damaged) 2. Shift fork (worn) 3. Gear (worn or damaged) 4. Bearing (worn or damaged)	★ ★ ★ ★

HINT: ★ See pub. No. S1–YXZE09A, page 41–1

MANUAL TRANSMISSION OIL (M550)

REPLACEMENT

410D5–02



1. REPLACE MANUAL TRANSMISSION OIL

(a) Loosen the filler plug.

(b) Remove the drain plug.

HINT:

Use a container to catch the transmission oil.

(c) Remove the filler plug.

(d) Reinstall the drain plug.

Torque: 37 N·m (377 kgf·cm, 27 ft·lbf)

(e) Pour fresh transmission oil, as shown in the illustration.

Oil grade: API GL–4 or GL–5
Viscosity: SAE 75W–90
Capacity:
2.8 liters (2.96 US. qts, 2.46 Imp. qts) for w/o PTO
3.1 liters (3.28 US. qts, 2.73 Imp. qts) for w/ PTO

(f) Reinstall the filler plug.

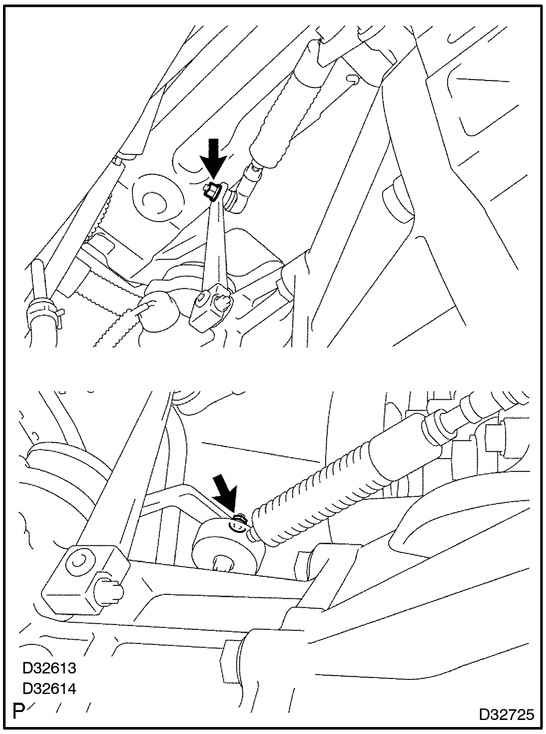
Torque: 37 N·m (377 kgf·cm, 27 ft·lbf)

MANUAL TRANSMISSION UNIT ASSY (M550)

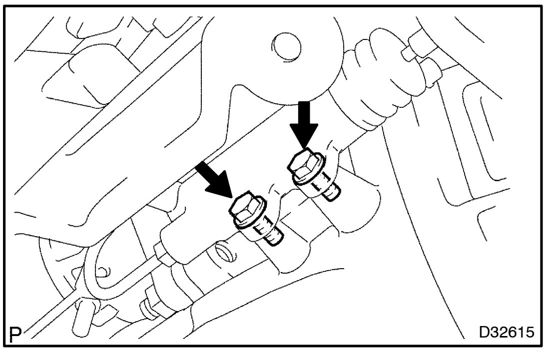
410GF–01

REPLACEMENT

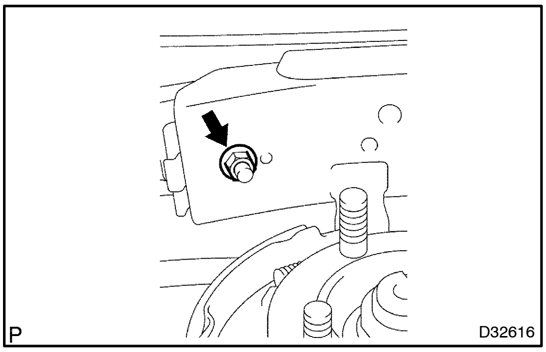
1. DISCONNECT BATTERY NEGATIVE TERMINAL
2. DRAIN MANUAL TRANSMISSION OIL (See page 41–2)
3. REMOVE ENGINE SIDE COVER SUB–ASSY LH
4. REMOVE ENGINE SIDE COVER SUB–ASSY RH
5. REMOVE EXHAUST PIPE ASSY CENTER (See page 15–2)
6. REMOVE EXHAUST PIPE ASSY FRONT (See page 15–2)
7. REMOVE PROPELLER SHAFT ASSY
   B–type propeller shaft (See pub No. RM1008E, page 30–6 or 30–22)
   LE–type propeller shaft (See pub No. RM1008E, page 30–14 or 30–29)
8. REMOVE PARKING BRAKE DRUM SUB–ASSY (See pub No. S1–YXZE05A, page 33–11)
9. DISCONNECT PARKING BRAKE PLATE SUB–ASSY (See pub No. S1–YXZE05A, page 33–11)



10. DISCONNECT SHIFT AND SELECT TRANSMISSION CONTROL CABLE ASSY
(a) Remove the 2 nuts.
(b) Remove the 2 clips and disconnect the 2 control cables.



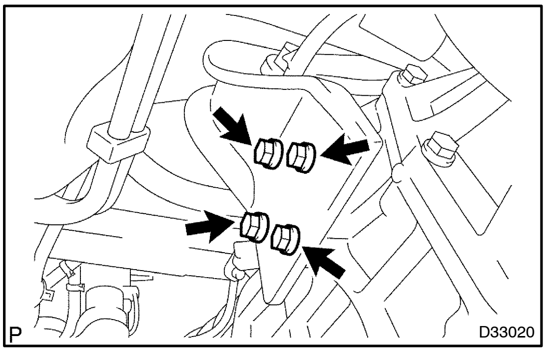
11. DISCONNECT CLUTCH RELEASE CYLINDER ASSY
(a) Remove the 2 bolts and disconnect the release cylinder.



12. REMOVE ENGINE MOUNTING BRACKET NO.3

(a) Using a transmission jack, support the transmission unit.

(b) Remove the nut.

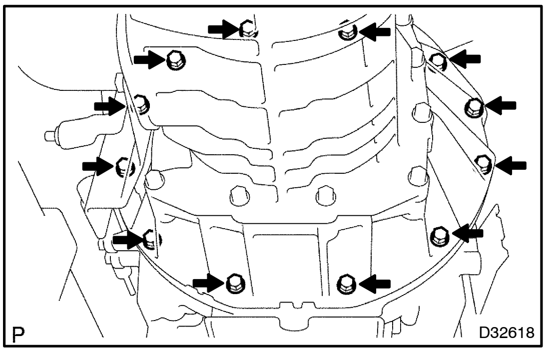


(c) Remove the 4 bolts and mounting bracket together with the insulator.

13. REMOVE ENGINE MOUNTING BRACKET NO.1

HINT:

Use the same procedure discribed for the No. 3.



14. REMOVE MANUAL TRANSMISSION UNIT ASSY

(a) Disconnect the connector and clamp.

(b) Remove the 12 bolts.

(c) Remove the transmission unit.

NOTICE:

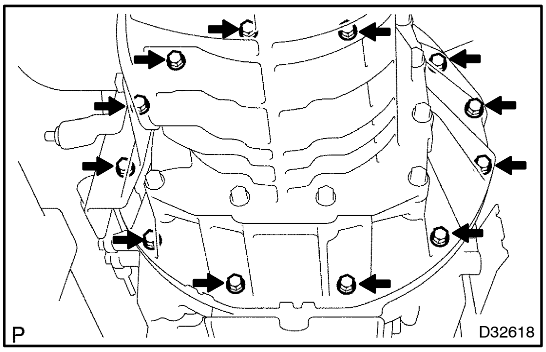
Do not severely shake the transmission, otherwise the input shaft will be damaged.

15. REMOVE CLUTCH RELEASE BEARING ASSY (See page 42–2)

16. REMOVE CLUTCH RELEASE FORK SUB–ASSY (See page 42–2)

17. INSTALL CLUTCH RELEASE FORK SUB–ASSY (See page 42–2)

18. INSTALL CLUTCH RELEASE BEARING ASSY (See page 42–2)



19. INSTALL MANUAL TRANSMISSION UNIT ASSY

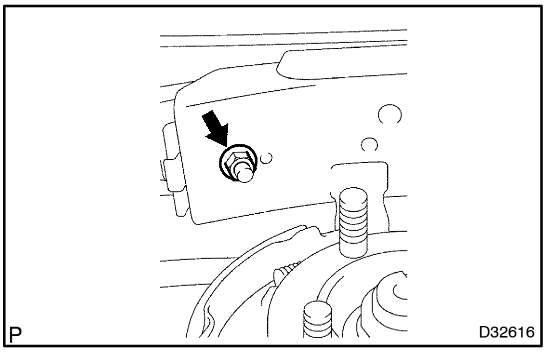
(a) Using a jack, lift up the transmission unit.

(b) Align the input shaft with the clutch disc and install the transmission unit to the engine.

(c) Install the 12 transmission mounting bolts.

Torque: 43 N·m (439 kgf·cm, 32 ft·lbf)

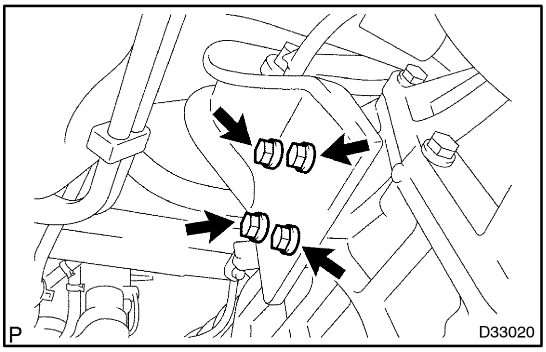
(d) Install each connector and clamp.



20. INSTALL ENGINE MOUNTING BRACKET NO.1

(a) Install the nut.

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



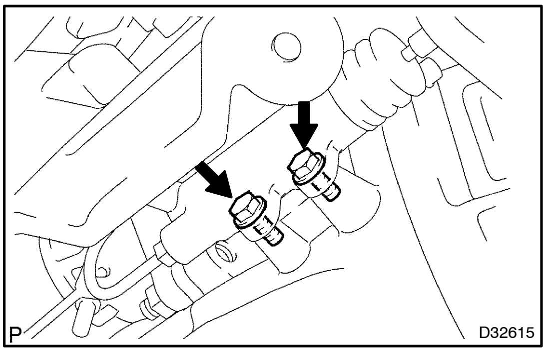
(b) Install the mounting bracket with the 4 bolts.

Torque: 57 N·m (581 kgf·cm, 42 ft·lbf)

21. INSTALL ENGINE MOUNTING BRACKET NO.3

HINT:

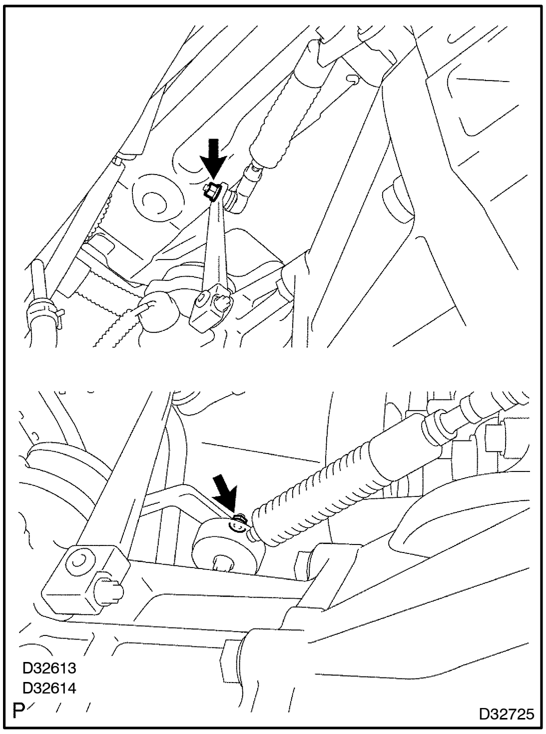
Use the same procedure described for the No. 1.



22. INSTALL CLUTCH RELEASE CYLINDER ASSY

(a) Install the release cylinder with the 2 bolts.

Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)



23. CONNECT SHIFT AND SELECT TRANSMISSION CONTROL CABLE ASSY

(a) Connect the 2 control cables to the levers with the 2 nuts.
Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)

(b) Install the 2 control cables to the bracket with 2 new clips.

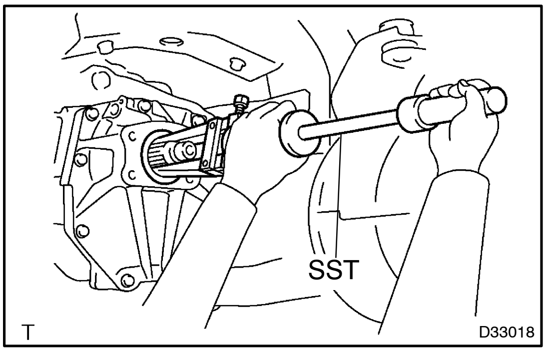
24. INSTALL PARKING BRAKE PLATE SUB–ASSY (See pub No. S1–YXZE05A, page 33–11)
25. INSTALL PARKING BRAKE DRUM SUB–ASSY (See pub No. S1–YXZE05A, page 33–11)
26. ADJUST PARKING BRAKE SHOE CLEARANCE (See pub No. S1–YXZE05A, page 33–2)
27. INSTALL PROPELLER SHAFT ASSY
B–type propeller shaft (See pub No. S1–YXZE05A, page 30–6 or 30–22)
LE–type propeller shaft (See pub No. S1–YXZE05A, page 30–14 or 30–29)
28. INSTALL EXHAUST PIPE ASSY FRONT (See page 15–2)
29. INSTALL EXHAUST PIPE ASSY CENTER (See page 15–2)
30. INSTALL ENGINE SIDE COVER SUB–ASSY LH
31. INSTALL ENGINE SIDE COVER SUB–ASSY RH
32. FILL UP MANUAL TRANSMISSION OIL (See page 41–2)
33. CONNECT BATTERY NEGATIVE TERMINAL

TRANSMISSION REAR BEARING RETAINER OIL SEAL (M550)

410D7–02

REPLACEMENT

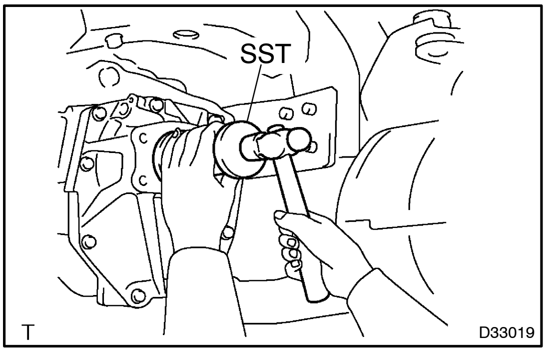
1. **REMOVE PROPELLER SHAFT ASSY**
   B–type propeller shaft (See pub No. S1–YXZE05A, page 30–6 or 30–22)
   LE–type propeller shaft (See pub No. S1–YXZE05A, page 30–14 or 30–29)
2. **REMOVE PARKING BRAKE DRUM SUB–ASSY (See pub No. S1–YXZE05A, page 33–11)**
3. **SEPARATE PARKING BRAKE PLATE SUB–ASSY (See pub No. S1–YXZE05A, page 33–11)**



4. **REMOVE TRANSMISSION REAR BEARING RETAINER OIL SEAL**

(a) Using SST, tap out the oil seal.
SST 09308–00010

NOTICE:
Take care not to damage the sealing seat of the rear cover.



5. **INSTALL TRANSMISSION REAR BEARING RETAINER OIL SEAL**

(a) Coat the lip of a new oil seal with MP grease.
(b) Using SST and a hammer, tap in the oil seal.
SST 09316–60011 (09316–00011, 09316–00041)

NOTICE:
- **Uniformly tap the oil seal.**
- **Do not damage or deform the oil seal.**

6. **INSTALL PARKING BRAKE PLATE SUB–ASSY (See pub No. S1–YXZE05A, page 33–11)**
7. **INSTALL PARKING BRAKE DRUM SUB–ASSY (See pub No. S1–YXZE05A, page 33–11)**
8. **ADJUST PARKING BRAKE SHOE CLEARANCE (See pub No. S1–YXZE05A, page 33–2)**
9. **INSTALL PROPELLER SHAFT ASSY**
   B–type propeller shaft (See pub No. S1–YXZE05A, page 30–6 or 30–22)
   LE–type propeller shaft (See pub No. S1–YXZE05A, page 30–14 or 30–29)
10. **CHECK MANUAL TRANSMISSION OIL (See page 41–2)**

SHIFT AND SELECT TRANSMISSION CONTROL CABLE ASSY (M550)

410GG–01

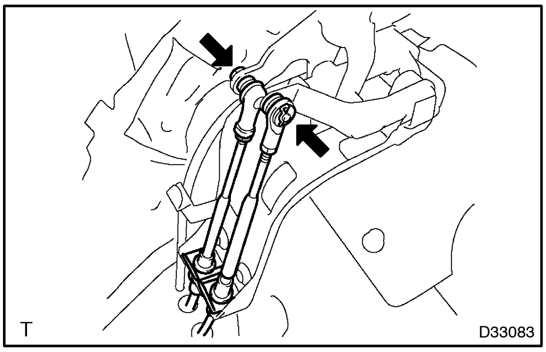
REPLACEMENT

1. **REMOVE SHIFT LEVER KNOB SUB–ASSY**
2. **REMOVE PARKING BRAKE HOLE COVER**

(a) Remove the 2 screws and parking brake hole cover.

3. **REMOVE SHIFTING HOLE COVER SUB–ASSY AND SHIFT LEVER BOOT COVER**

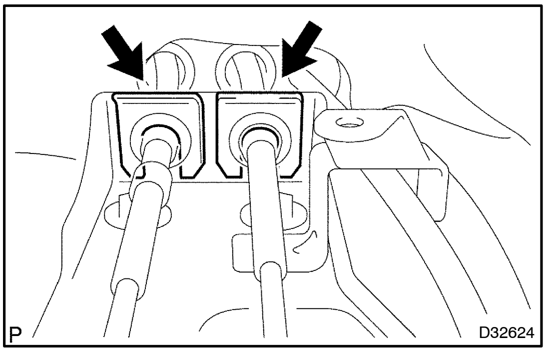
(a) Remove the 3 clips, shifting hole cover and shift lever boot cover.



4. **REMOVE SHIFT AND SELECT TRANSMISSION CONTROL CABLE ASSY**

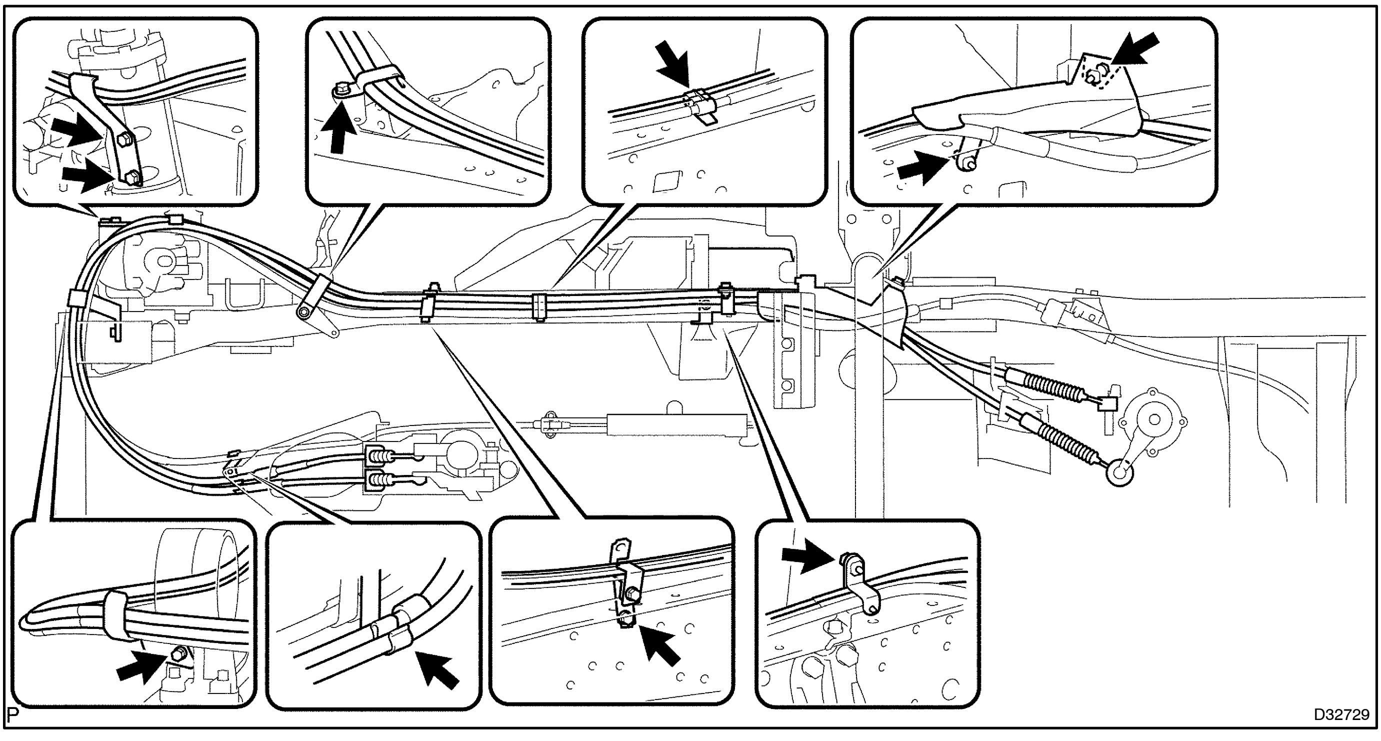
(a) Remove the nut and disconnect the shift cable from the floor shift.

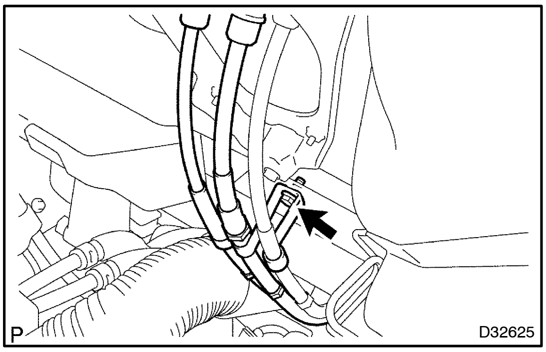
(b) Remove the clip and washer, and disconnect the select cable from the floor shift.



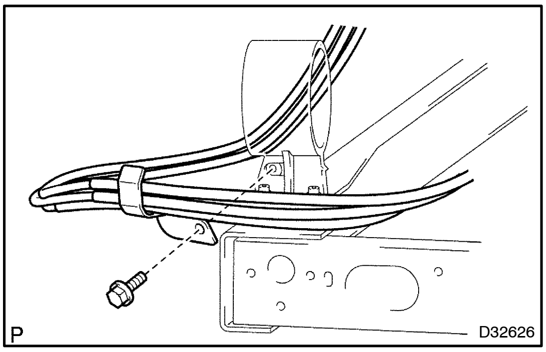
(c) Remove the 2 clips and pull up the shift and select cables together with the grommets.

(d) Remove the brackets and clamps, as shown in the illustration.

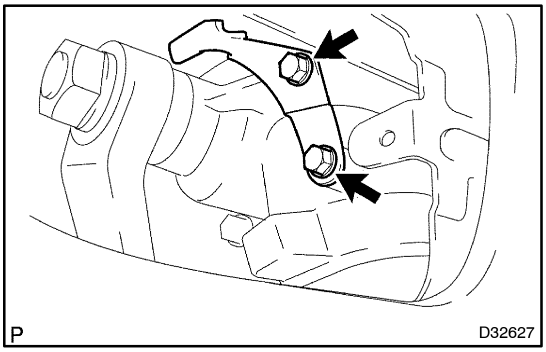




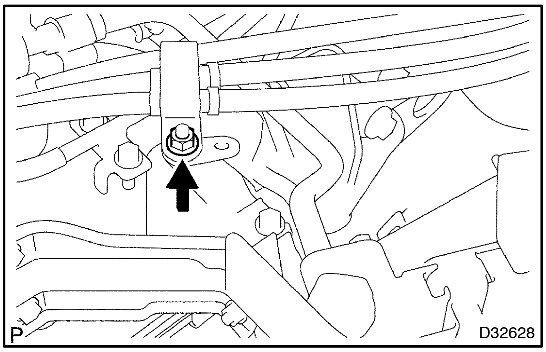
(1) Remove the bolt and bracket.



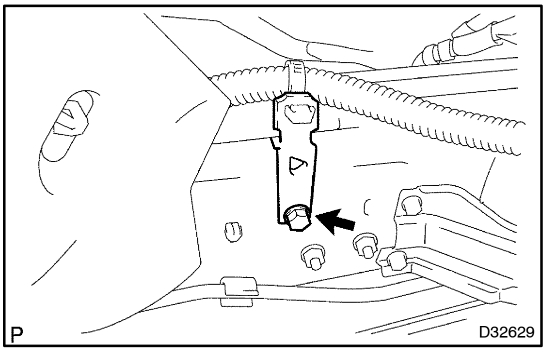
(2) Remove the bolt and clamp.



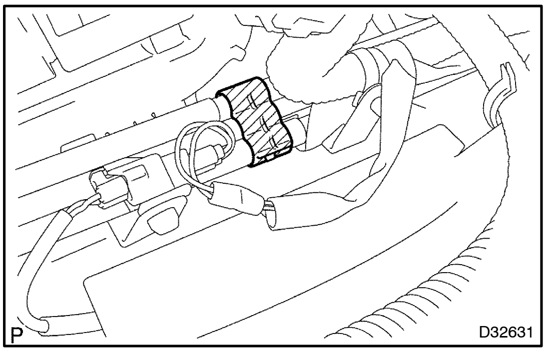
(3) Remove the 2 bolts and clamp.



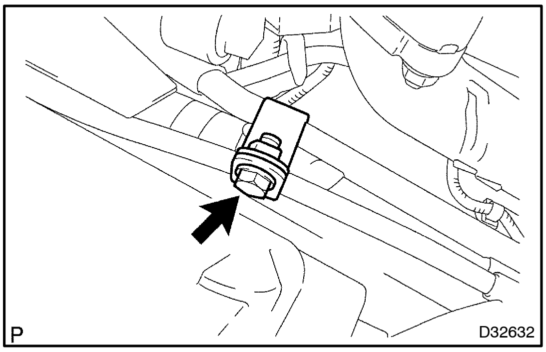
(4) Remove the nut and clamp.



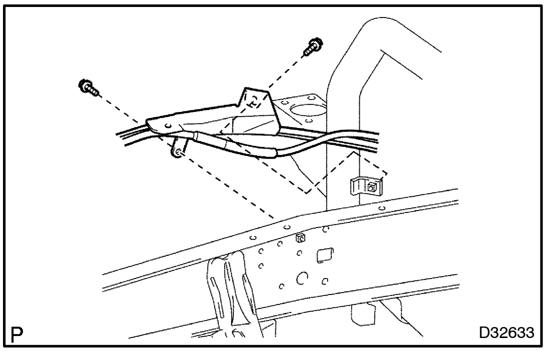
(5) Remove the bolt and clamp.



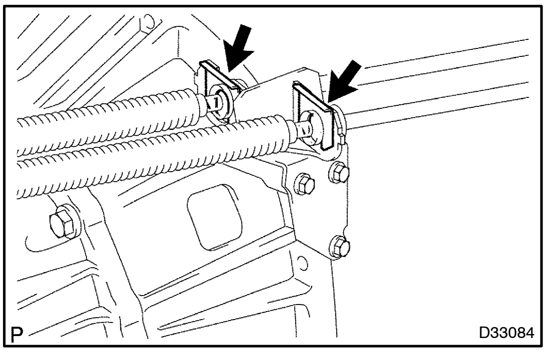
(6) Remove the clamp.



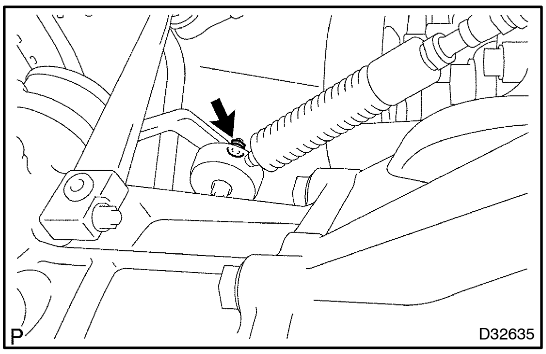
(7) Remove the bolt and clamp.



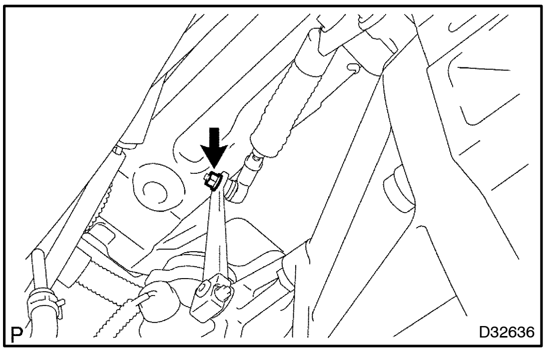
(8) Remove the 2 bolts and bracket.



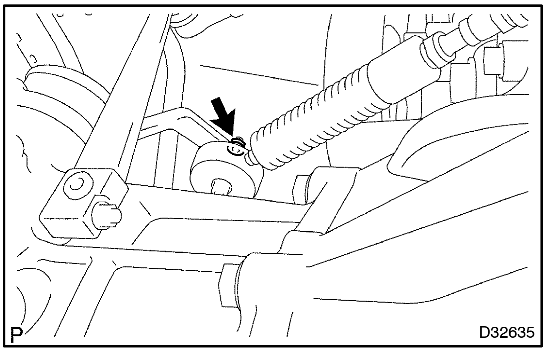
(e) Remove the 2 clips and disconnect the select cable and shift cable.



(f) Remove the nut and disconnect the shift cable from the control lever.

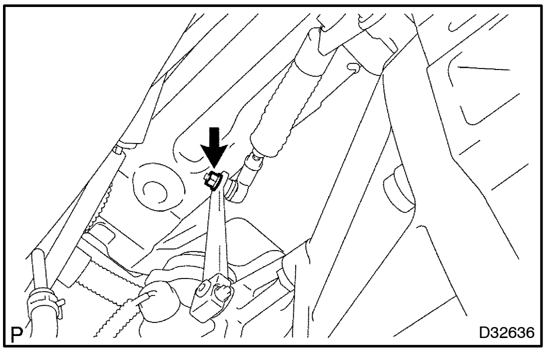


(g) Remove the nut and disconnect the select cable from the select lever.

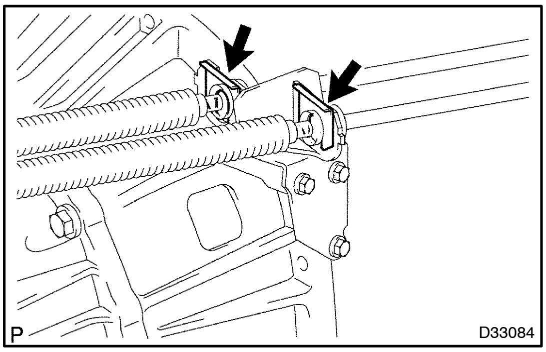


5. INSTALL SHIFT AND SELECT TRANSMISSION CONTROL CABLE ASSY

(a) Install the shift cable to the shift lever with the nut.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

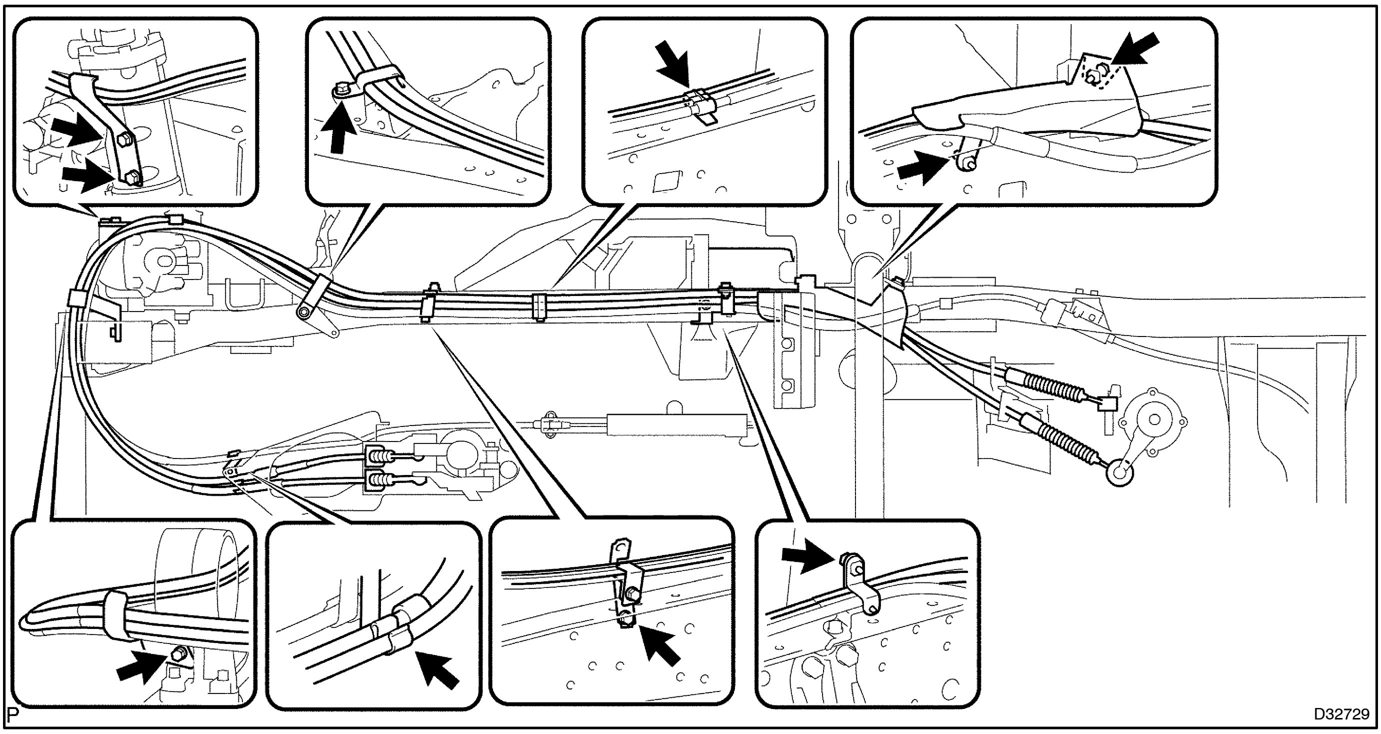


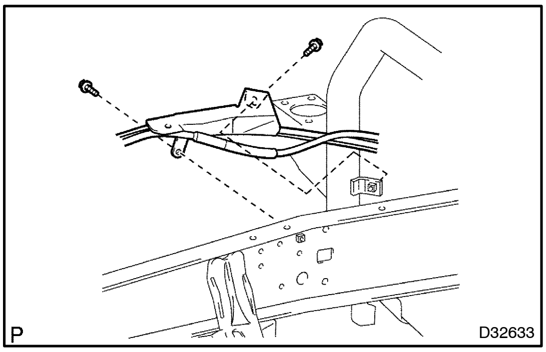
(b) Install the select cable to the select lever with the nut.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)



(c) Connect the shift cable and select cable to the bracket with 2 new clips.

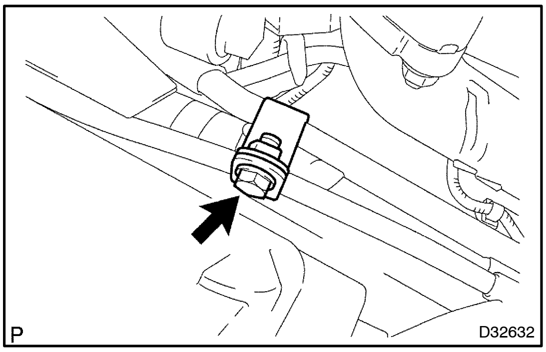
(d) Install the brackets and clamps, as shown in the illustration.





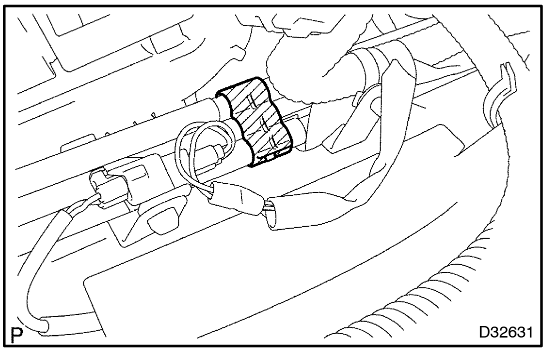
(1) Install the clamp with the 2 bolts.

Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

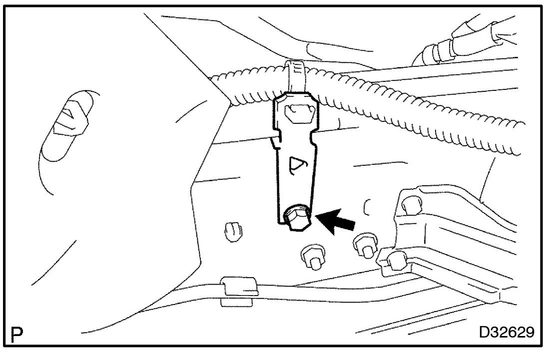


(2) Install the bolt and clamp.

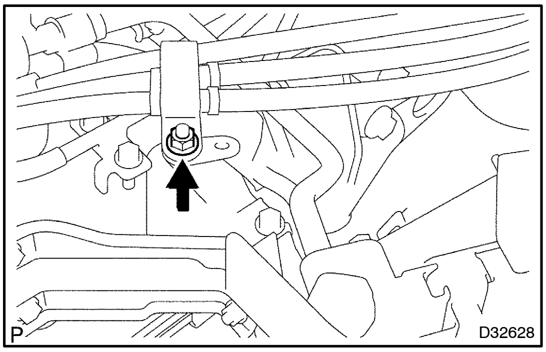
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)



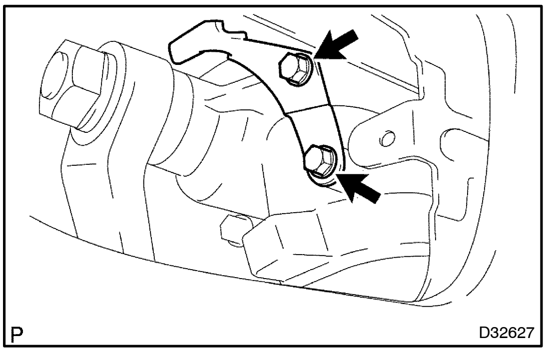
(3) Install the clamp.



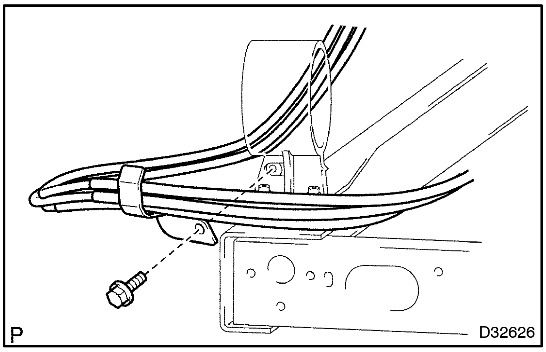
(4) Install the clamp with the bolt.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)



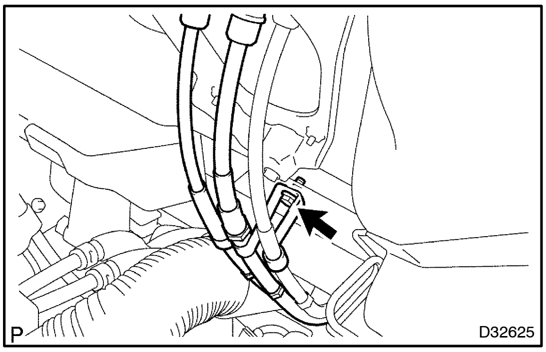
(5) Install the clamp with the nut.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)



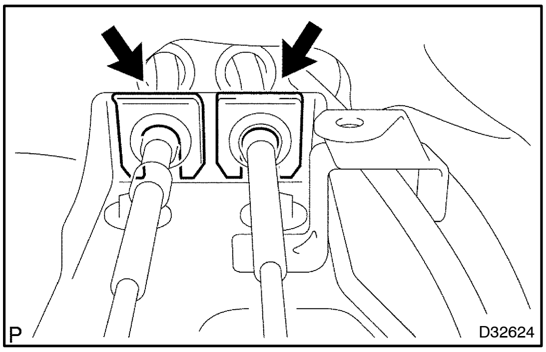
(6) Install the clamp with the 2 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)



(7) Install the clamp with the bolt.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

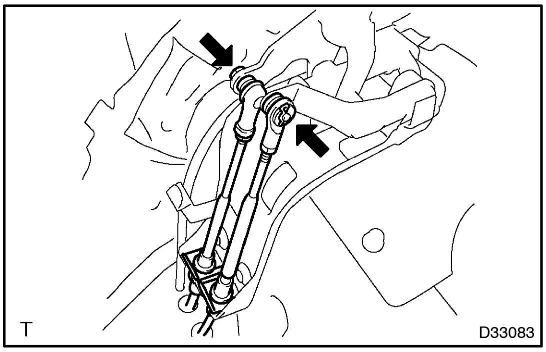


(8) Install the bracket with the bolt.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)



(e) Connect the shift cable, select cable and grommets with 2 new clips.

NOTICE:
Be sure to install the grommet.



(f) Connect the select cable to the floor shift with the washer and a new clip.

(g) Connect the shift cable to the floor shift with the nut.
Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)

6. INSPECT AND ADJUST SHIFT LEVER POSITION (See pub No. RM1008E, page 41–10)

7. INSTALL SHIFTING HOLE COVER SUB–ASSY AND SHIFT LEVER BOOT COVER

(a) Install the shifting hole cover and shift lever boot cover with the 3 clips.

8. INSTALL PARKING BRAKE HOLE COVER

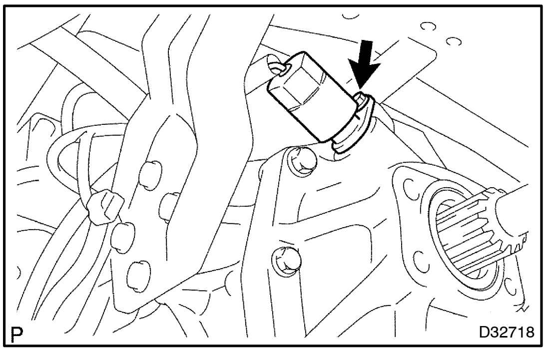
(a) Install the parking brake hole cover with the 2 screws.

9. INSTALL SHIFT LEVER KNOB SUB–ASSY

SPEEDOMETER DRIVEN (MTM) GEAR SUB–ASSY (M550)

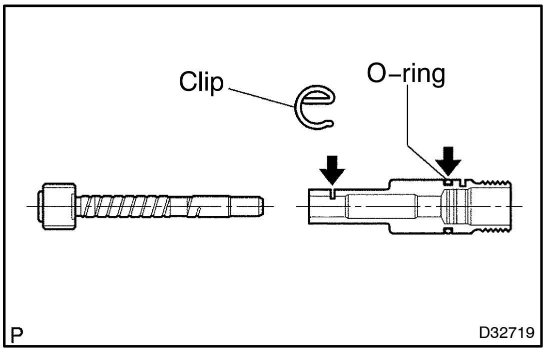
410GH–01

REPLACEMENT



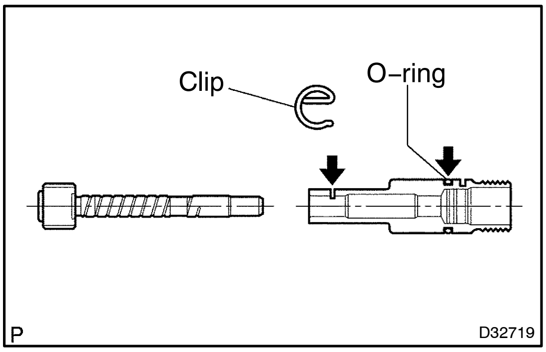
1. **REMOVE SPEEDOMETER DRIVEN (MTM) GEAR SUB–ASSY**

(a) Disconnect the connector.
(b) Remove the bolt, speedometer lock plate and speedometer driven gear



(c) Remove the clip from the speedometer sleeve.
(d) Remove the speedometer driven gear from the speedometer sleeve.
(e) Remove the O–ring from the speedometer sleeve.

NOTICE:
Confirm the teeth of the speedometer driven gear.

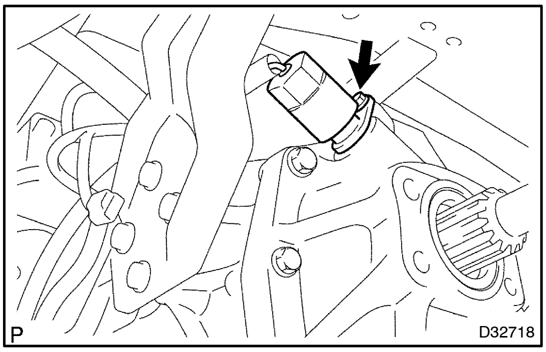


2. **INSTALL SPEEDOMETER DRIVEN (MTM) GEAR SUB–ASSY**

(a) Install a new O–ring to the speedometer sleeve.
(b) Choose a speedometer driven gear whose gear teeth are the same as the previously installed driven gear's teeth. Install the selected driven gear to the speedometer sleeve.

NOTICE:
Apply gear oil to the speedometer driven gear.

(c) Install a new clip to the speedometer sleeve.
(d) Apply gear oil to the O–ring, and install the speedometer driven gear with the speedometer lock plate and bolt.
Torque: 11 N·m (112 kgf·cm, 8 ft·lbf)
(e) Connect the connector.



CLUTCH

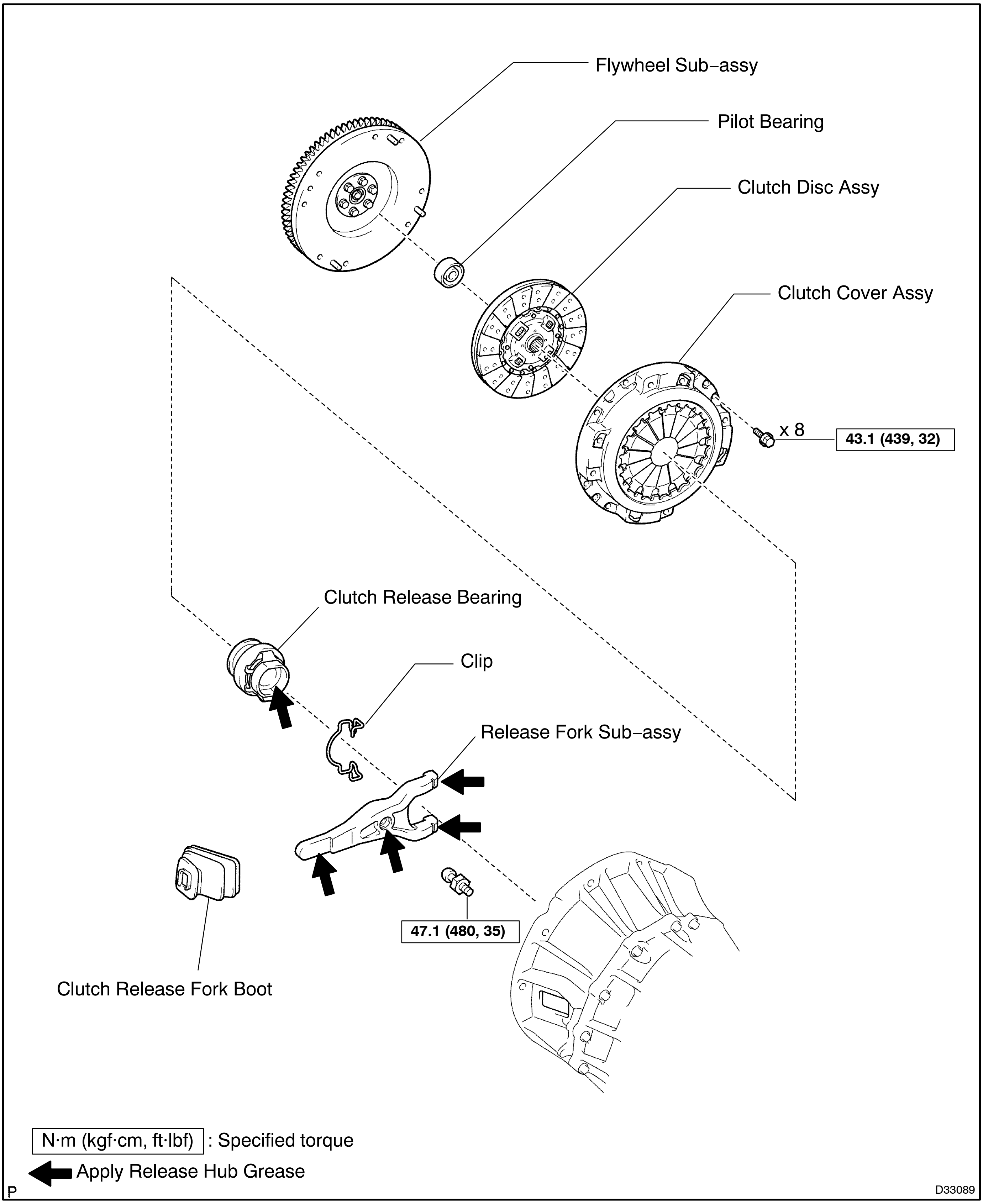
CLUTCH UNIT (N04C–TF) 42–1
COMPONENTS 42–1
OVERHAUL 42–2

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

CLUTCH UNIT (N04C–TF)

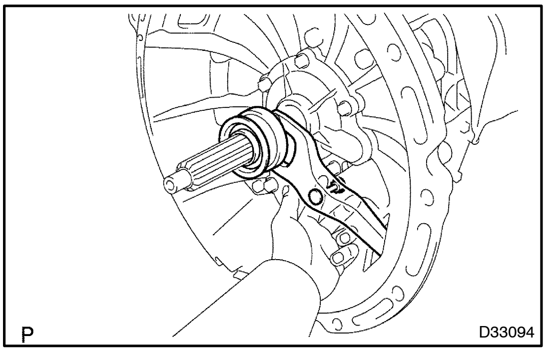
COMPONENTS

42066–02



OVERHAUL

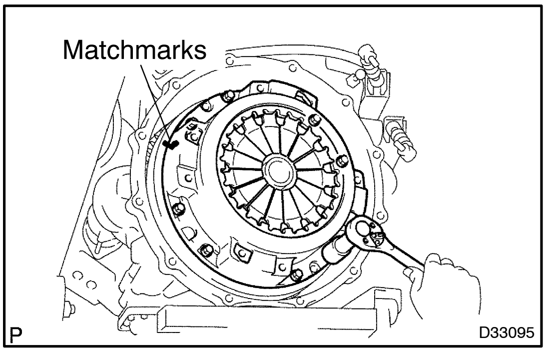
1. REMOVE MANUAL TRANSMISSION UNIT ASSY (See page 41–3)



2. REMOVE CLUTCH RELEASE BEARING ASSY

3. REMOVE CLUTCH RELEASE FORK BOOT

4. REMOVE CLUTCH RELEASE FORK SUB–ASSY



5. REMOVE CLUTCH COVER ASSY

(a) Place matchmarks on the clutch cover and flywheel.

(b) Loosen each set bolt one turn at a time until the spring tension is released.

(c) Remove the set bolts and pull off the clutch cover together with the clutch disc.

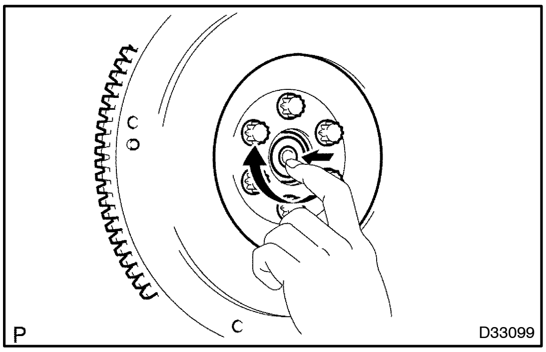
NOTICE:

Do not drop the clutch disc.

6. REMOVE CLUTCH DISC ASSY

NOTICE:

Keep the lining part of the clutch disc, the pressure plate and the surface of the flywheel away from oil and foreign objects.



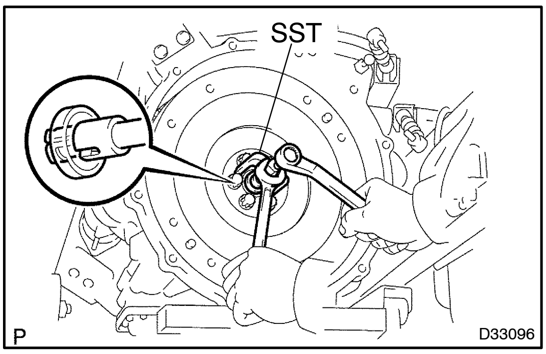
7. INSPECT PILOT BEARING

(a) Turn the bearing by hand while applying force in the rotation direction.

If the bearing cannot be turned smoothly, replace the pilot bearing.

HINT:

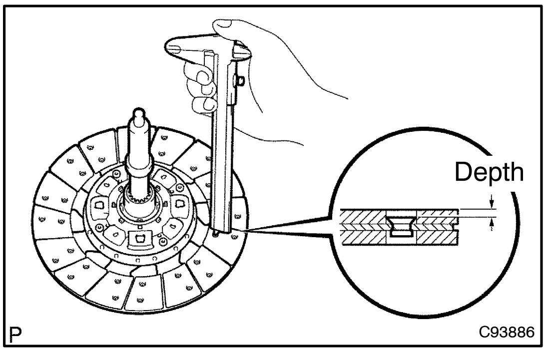
The bearing is permanently lubricated and requires no cleaning or lubrication.



8. REMOVE PILOT BEARING

(a) Using SST, remove the pilot bearing.

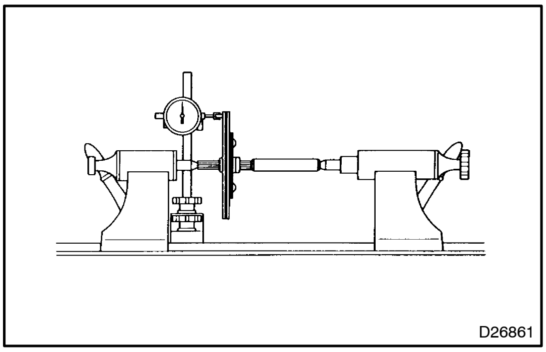
SST 09303–35011



9. INSPECT CLUTCH DISC ASSY

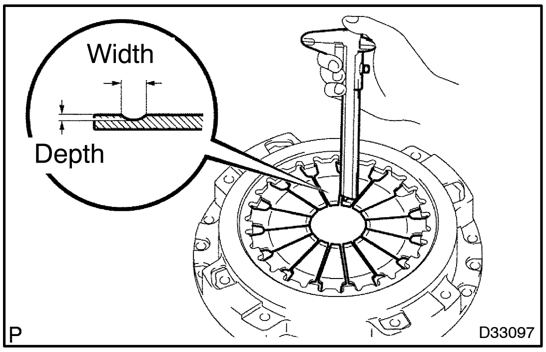
(a) Using a vernier caliper, measure the rivet head depth.
Minimum rivet head depth: 0.3 mm (0.012 in.)

If necessary, replace the clutch disc assy.



(b) Using a dial indicator, measure the disc runout.
Maximum runout: 1.0 mm (0.039 in.)

If necessary, replace the clutch disc assy.

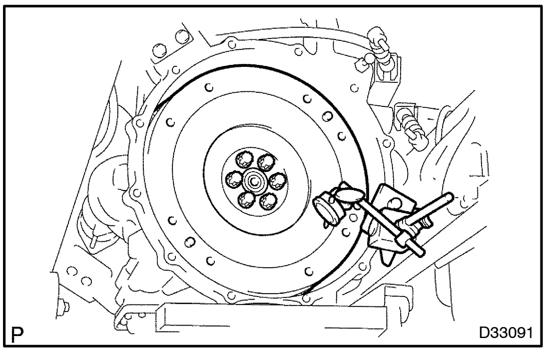


10. INSPECT CLUTCH COVER ASSY

(a) Using a vernier caliper, measure the worn depth and width of the diaphragm spring.
Standard:

Worn depth	0.6 mm (0.024 in.)
Worn width	5.0 mm (0.197 in.)

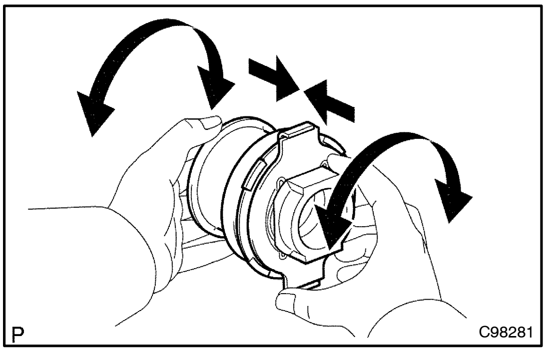
If necessary, replace clutch cover assy.



11. INSPECT FLYWHEEL SUB–ASSY

(a) Using a dial indicator, measure the flywheel runout.
Maximum runout: 0.1 mm (0.004 in.)

If necessary, replace the flywheel sub–assy.



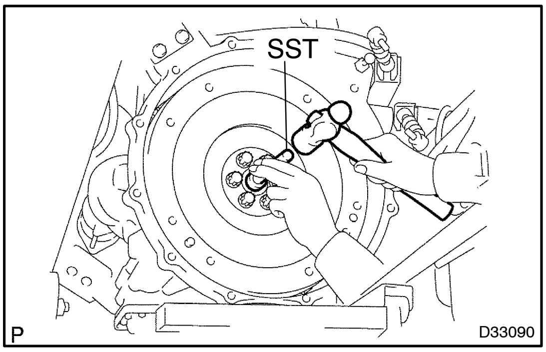
12. INSPECT CLUTCH RELEASE BEARING ASSY

(a) Turn the bearing by hand while applying force in the axial direction.

If necessary, replace the release bearing assy.

HINT:

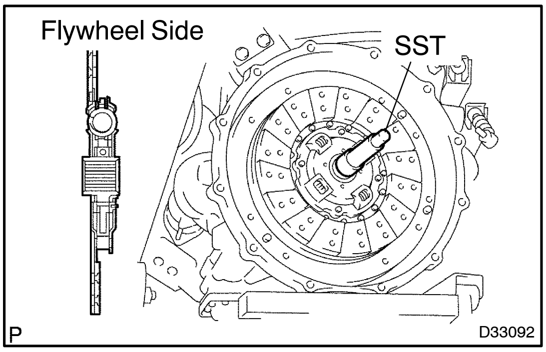
The bearing is permanently lubricated and requires no cleaning or lubrication.



13. INSTALL PILOT BEARING

(a) Using SST and a hammer, tap in a new pilot bearing.
SST 09304–12012

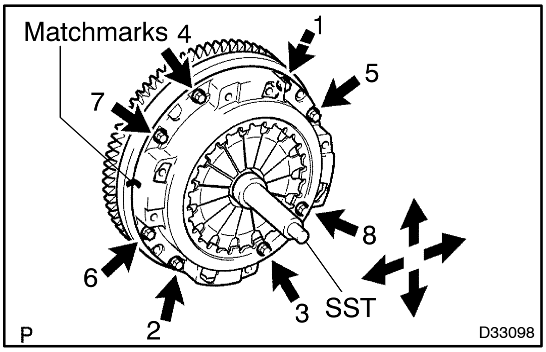
HINT:
After assembling the input shaft bearing to the hub, make sure that it rotates smoothly.



14. INSTALL CLUTCH DISC ASSY

(a) Insert SST into the clutch disc, then insert them into the flywheel.
SST 09301–00120

NOTICE:
Take care not to insert the clutch disc in the wrong direction.

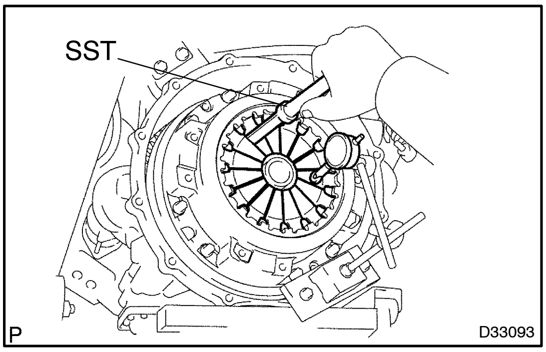


15. INSTALL CLUTCH COVER ASSY

(a) Align the matchmarks on the clutch cover and flywheel.
(b) As shown in the illustration, tighten the bolts in the order, starting from the bolt near the knock pin on the top.
Torque: 43.1 N·m (440 kgf·cm, 32 ft·lbf)

HINT:

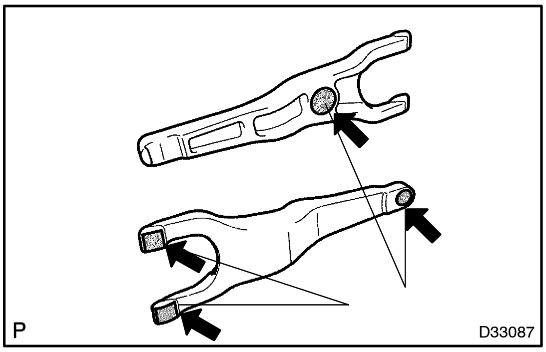
- Following the order in the illustration, gradually tighten the bolts one at a time.
- Check that the disc is in the center. Then, lightly move SST up and down, right and left and tighten the bolts.
SST 09301–00120



16. INSPECT AND ADJUST CLUTCH COVER ASSY

(a) Using a dial indicator with a roller instrument, check the diaphragm spring tip alignment.
Maximum non–alignment: 0.5 mm (0.020 in.)

If alignment is not as specified, adjust the diaphragm spring tip alignment using SST.
SST 09333–00013



17. INSTALL CLUTCH RELEASE FORK SUB–ASSY

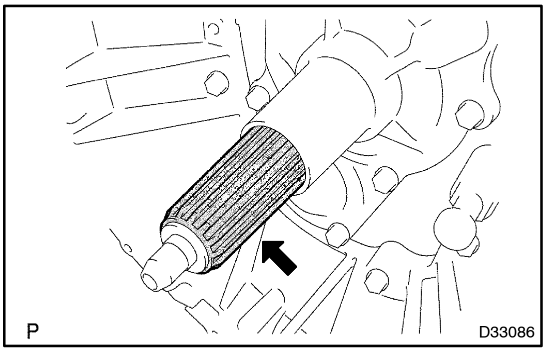
(a) Apply release hub grease to the contact of the release fork and hub, the contact of release fork and push rod and the release fork pivot points.

Grease:

Part No. 08887–01806, RELEASE HUB GREASE or equivalent

(b) Install the release fork to the hub bearing.

18. INSTALL CLUTCH RELEASE FORK BOOT



19. INSTALL CLUTCH RELEASE BEARING ASSY

(a) Apply clutch spline grease to the input shaft spline.

Grease:

Part No. 08887–01706, CLUTCH SPLINE GREASE or equivalent

(b) Install the bearing to the release fork, and then install them to the transmission unit.

NOTICE:

After the installation, move the fork forward and backward to check that the release bearing slides smoothly.

20. INSTALL MANUAL TRANSMISSION UNIT ASSY (See page 41–3)

POWER STEERING

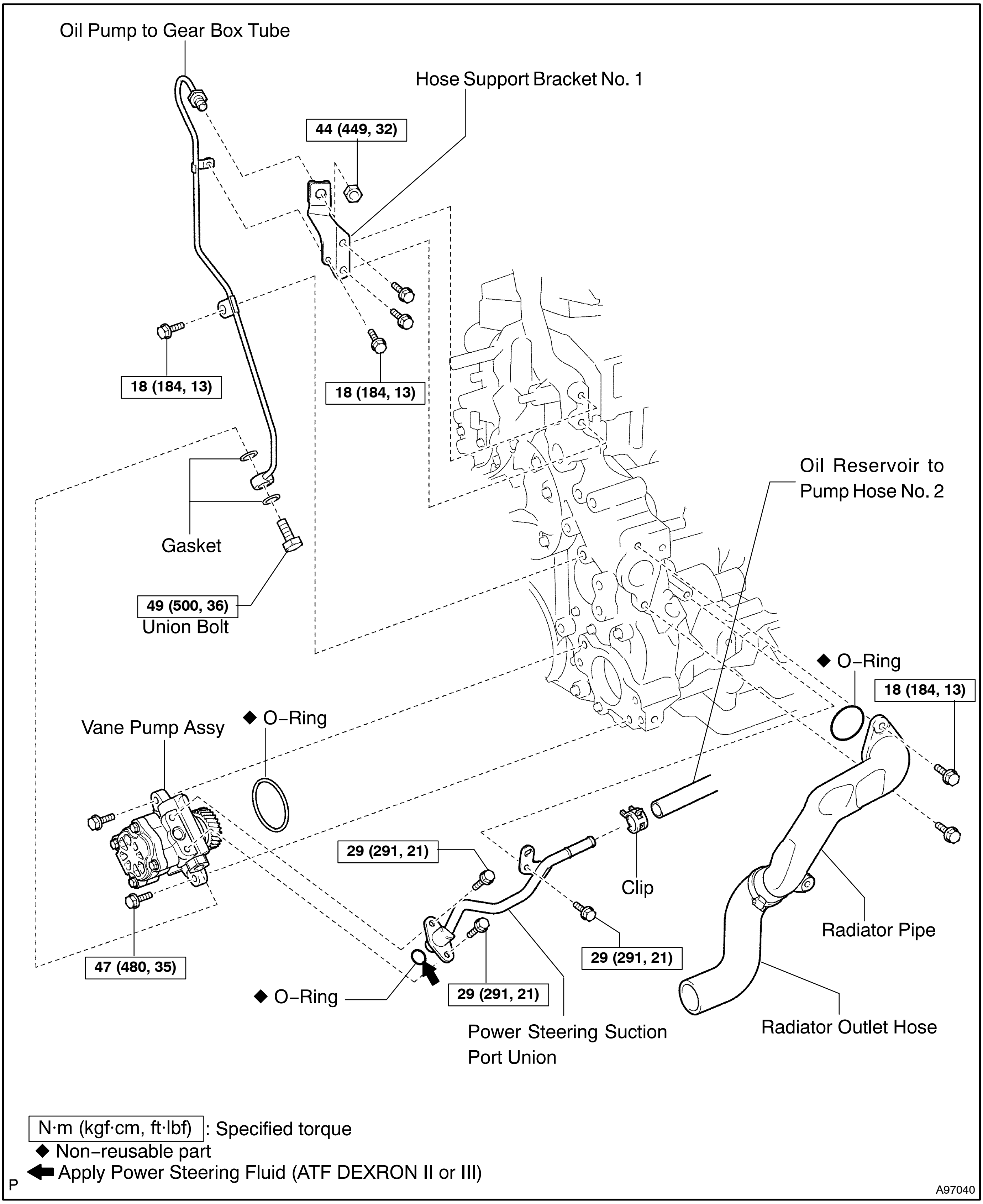
VANE PUMP ASSY (N04C−TF) . . . . 51−1
COMPONENTS . . . . 51−1
OVERHAUL . . . . 51−2

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1−YXZE05A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

VANE PUMP ASSY (N04C–TF)

COMPONENTS

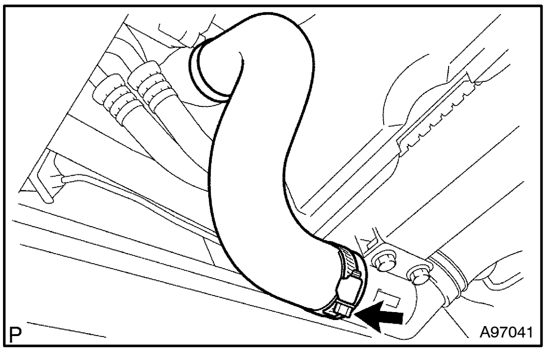
510IN–01



510IO–01

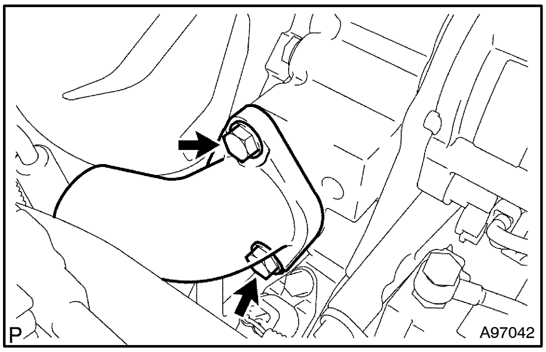
OVERHAUL

1. DRAIN COOLANT



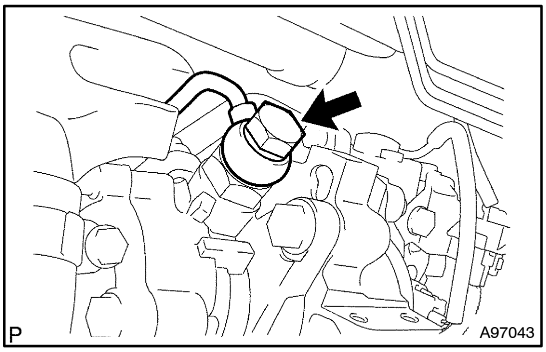
2. DISCONNECT RADIATOR OUTLET HOSE

(a) Loosen the clamp and disconnect the radiator outlet hose from the radiator.



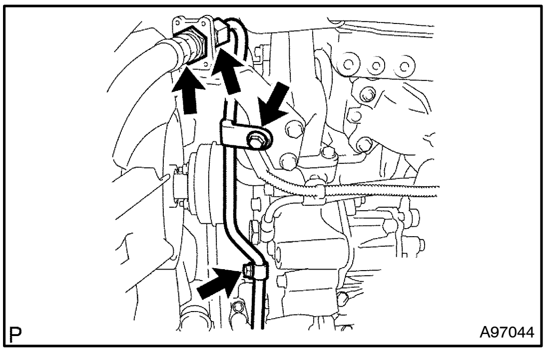
3. REMOVE RADIATOR PIPE

(a) Remove the 2 bolts and radiator pipe.
(b) Remove O–ring from the radiator pipe.

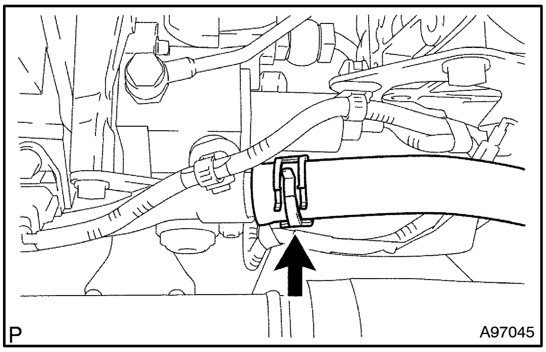


4. REMOVE OIL PUMP TO GEAR BOX TUBE

(a) Remove the union bolt and 2 gaskets, and disconnect the tube from the vane pump.

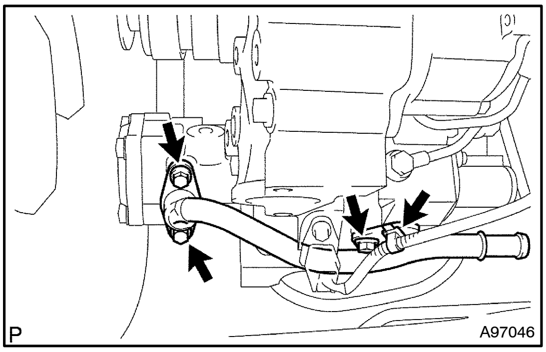


(b) Fix the oil pump to gear box tube and disconnect the pressure feed hose from the oil pump to gear box tube.
(c) Remove 2 bolts and nut, and disconnect the tube from the timing gear cover and bracket.



5. DISCONNECT OIL RESERVOIR TO PUMP HOSE NO.2

(a) Slide the clip and disconnect the oil reservoir to pump hose from the power steering suction port union.

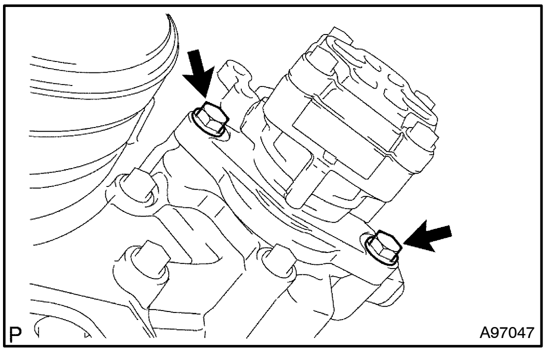


6. REMOVE POWER STEERING SUCTION PORT UNION

(a) Remove the sensor harness clamp from the power steering suction port union.

(b) Remove the 3 bolts and power steering suction port union from the vane pump and setting plate.

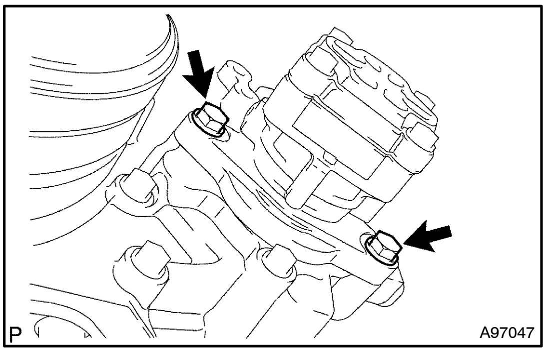
(c) Remove the O–ring from the union.



7. REMOVE VANE PUMP ASSY

(a) Remove the 2 bolts and vane pump.

(b) Remove O–ring from the vane pump.



8. INSTALL VANE PUMP ASSY

(a) Insert the O–ring to the vane pump.

NOTICE:

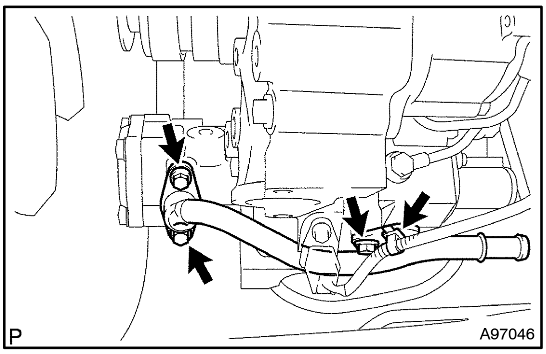
Insert the O–ring securely until it touches the bottom of the groove.

(b) Install the vane pump with the 2 bolts.

Torque: 47 N·m (480 kgf·cm, 35 ft·lbf)

NOTICE:

Should be no clearance between the vane pump and engine case.



9. INSTALL POWER STEERING SUCTION PORT UNION

(a) Apply power steering fluid to a new O–ring for the suction port union.

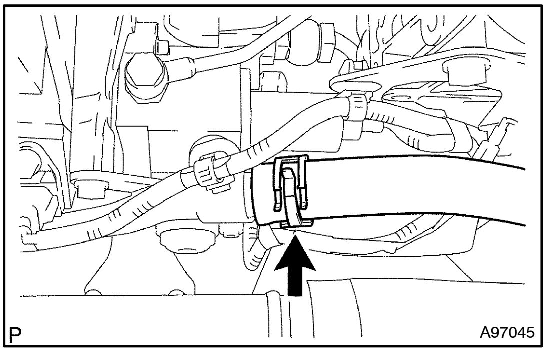
(b) Install the O–ring to the union.

(c) Install the union to the vane pump and setting plate with the 3 bolts.

Torque: 29 N·m (291 kgf·cm, 21 ft·lbf)

(d) Install the sensor clamp to the power steering suction port union.

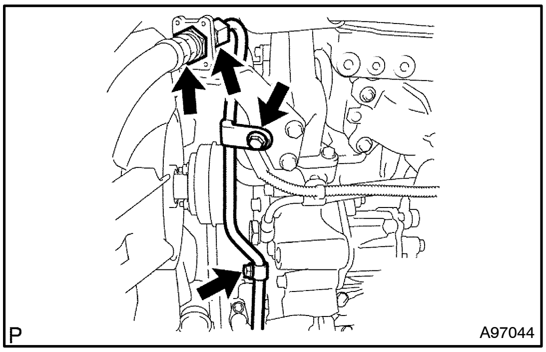
NOTICE:
Do not twist the sensor harness.



10. CONNECT OIL RESERVOIR TO PUMP HOSE NO.2

(a) Connect the oil reservoir to pump hose to the power steering suction port union.

(b) Install the clip.



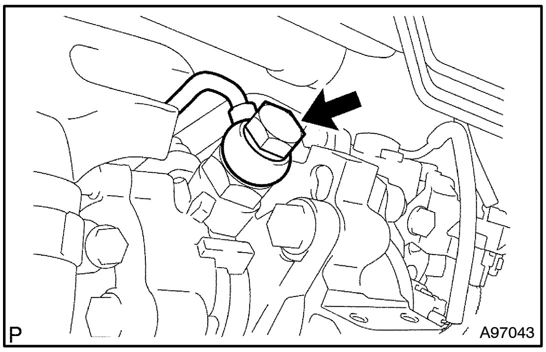
11. INSTALL OIL PUMP TO GEAR BOX TUBE

(a) Install the oil pump to gear box tube to the timing gear case and bracket with the 2 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

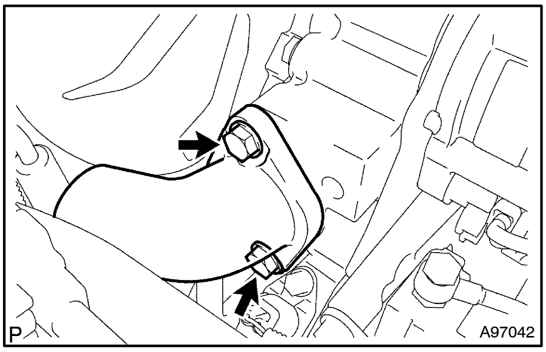
(b) Install the oil pump to gear box tube to the bracket with the nut.
Torque: 44 N·m (449 kgf·cm, 32.5 ft·lbf)

(c) Fix the oil pump to gear box tube.

(d) Using SST, connect the gear box tube to the oil pump to gear box tube.
SST 09922–10010
Torque: 44 N·m (449 kgf·cm, 33 ft·lbf)



(e) Install the oil pump to gear box tube to the vane pump with 2 new gaskets and the union bolt.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)



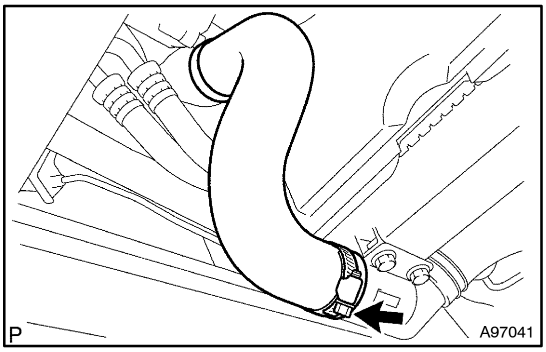
12. INSTALL RADIATOR PIPE

(a) Insert a new O–ring in the groove of the radiator pipe.

NOTICE:
The O–ring has to be inserted into groove securely.

(b) Install the radiator pipe to the timing gear case with the 2 bolts.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

NOTICE:
- **The contact surfaces should be free from any dust.**
- **Do not damage the O–ring.**



13. CONNECT RADIATOR OUTLET HOSE

(a) Connect the radiator outlet hose to the radiator.

(b) Tighten the clamp.

14. ADD ENGINE COOLANT (See page 16–3)

15. ADD POWER STEERING FLUID

16. BLEED AIR FROM POWER STEERING FLUID

17. CHECK AMOUNT OF POWER STEERING FLUID

18. CHECK FOR LEAKAGE OF POWER STEERING FLUID

HEATER & AIR CONDITIONER

REFRIGERANT LINE (N04C–TF) 55–1

COMPONENTS 55–1

V COOLER BELT (N04C–TF) 55–2

REPLACEMENT 55–2

COOLER COMPRESSOR ASSY (N04C–TF) . 55–3

COMPONENTS 55–3

REPLACEMENT 55–4

COOLER CONDENSOR ASSY (N04C–TF) .. 55–8

COMPONENTS 55–8

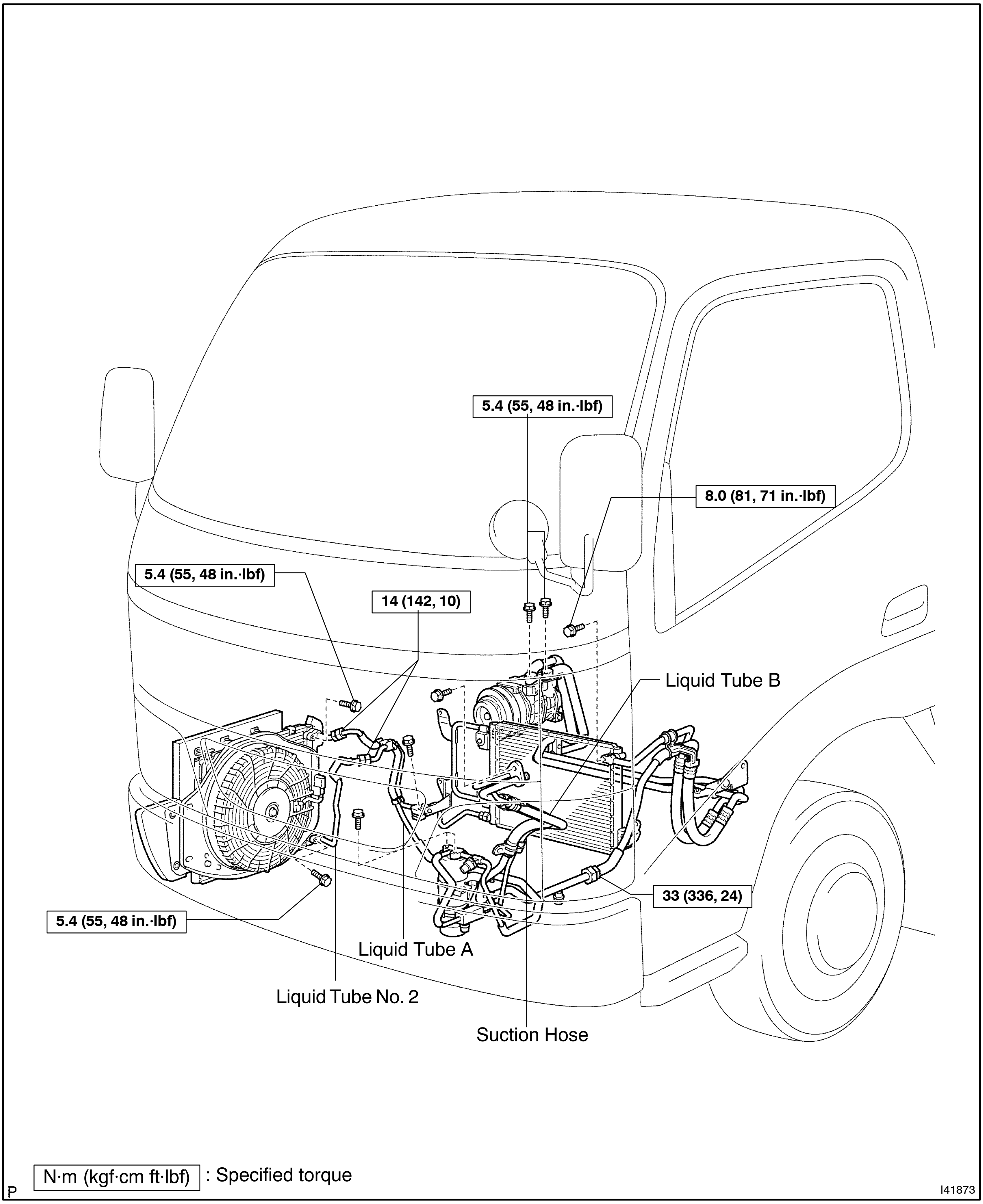
REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)

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

REFRIGERANT LINE (N04C–TF)

551EG–02

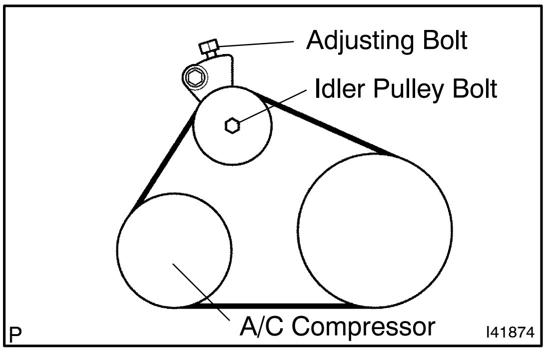
COMPONENTS



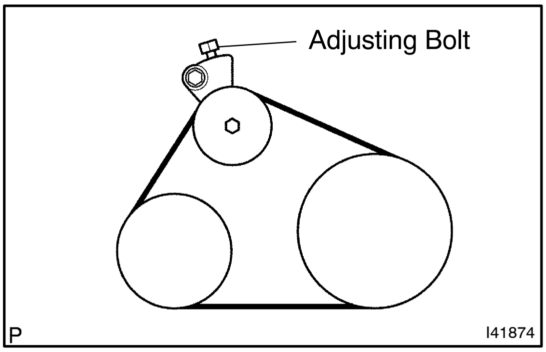
V COOLER BELT (N04C–TF)

551EK–02

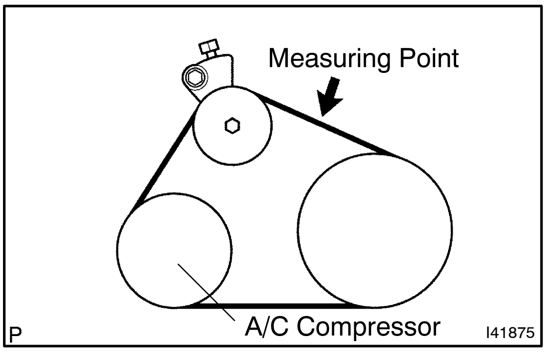
REPLACEMENT



1. **REMOVE V COOLER BELT**
(a) Loosen the idler pulley bolt.
(b) Loosen the adjusting bolt and remove the belt.

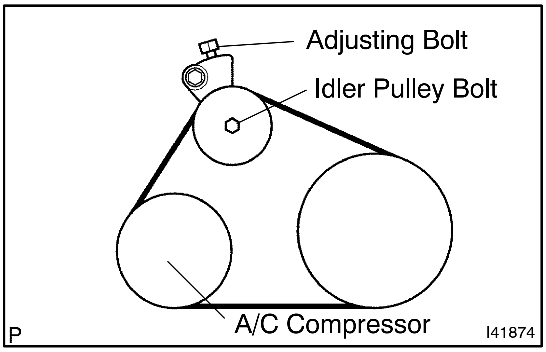


2. **INSTALL V COOLER BELT**
(a) Install a new belt and extend the belt by tightening the adjusting bolt.



3. **ADJUST V COOLER BELT**
(a) Check the drive belt deflection by pressing on the belt at the point in the illustration with force of 98 N (10 kgf, 22 lbf).
Standard:

Belt	Deflection
New	8.5 to 9.5 mm (0.33 to 0.37 in.)
Used	10 to 13 mm (0.39 to 0.51 in.)

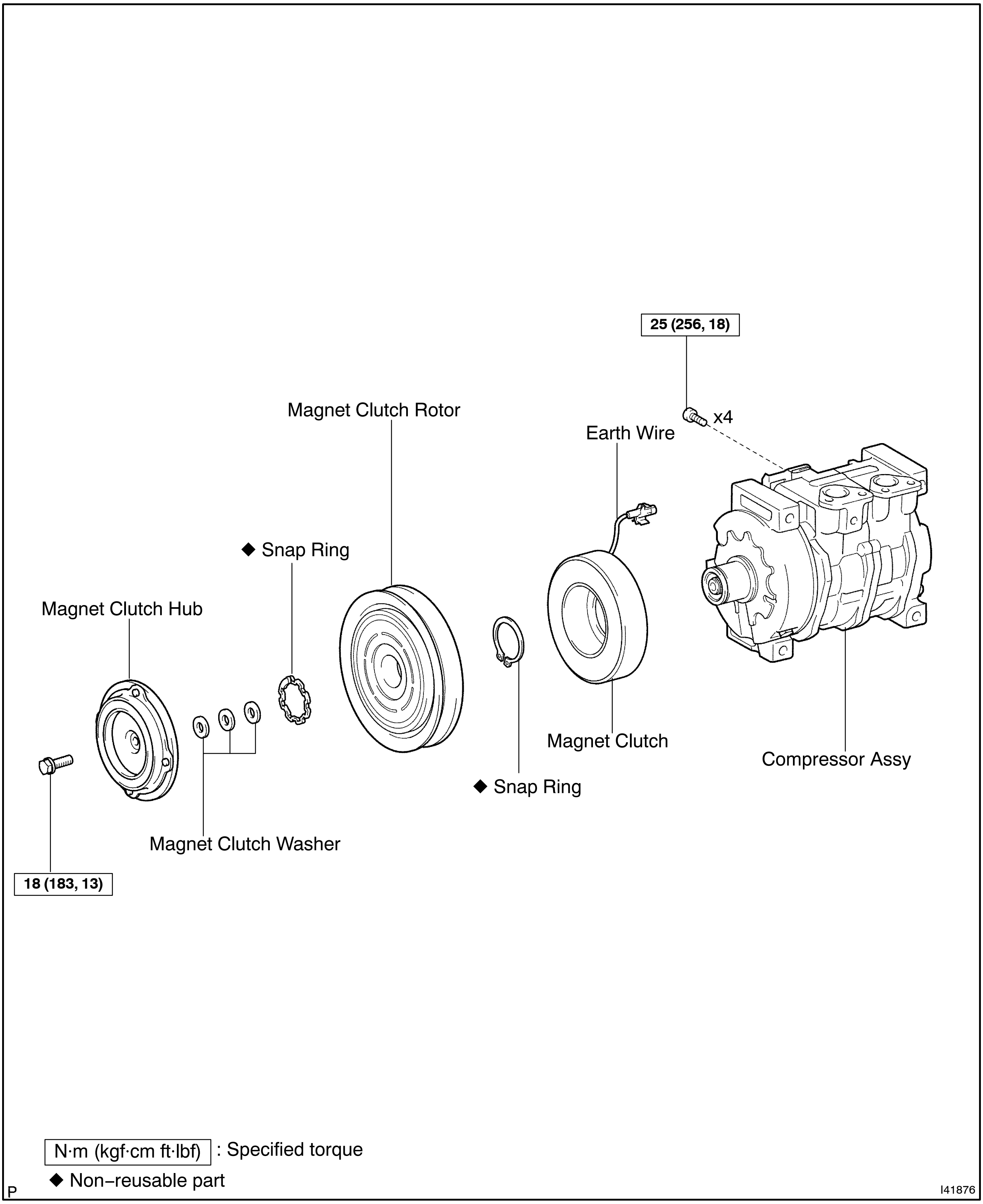


4. **FULLY TIGHTEN V COOLER BELT**
(a) Tighten the idler pulley bolt.
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)
(b) Tighten the adjusting bolt.
Torque: 6.0 N·m (61 kgf·cm, 53 in.·lbf)

COOLER COMPRESSOR ASSY (N04C–TF)

551EH–02

COMPONENTS

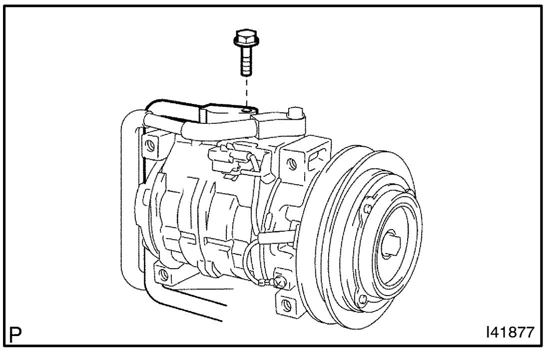


551EI–03

REPLACEMENT

1. DISCHARGE REFRIGERANT FROM REFRIGERATION SYSTEM (See Pub. No. S1–YXZE05A on page 55–14)

2. REMOVE V COOLER BELT (See page 55–2)



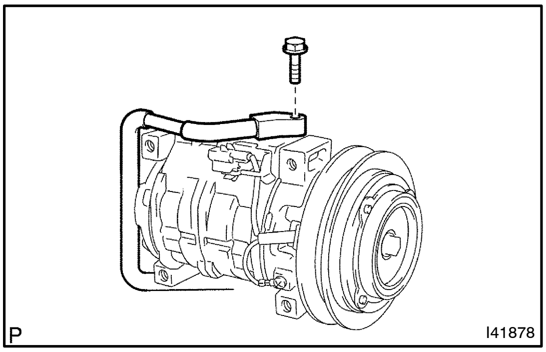
3. REMOVE COOLER REFRIGERANT DISCHARGE HOSE NO.2

(a) Remove the bolt and disconnect the hose.

(b) Remove the O–ring from the hose.

NOTICE:

Tape the disconnected parts of hoses and compressor, to protect it from dust and water.



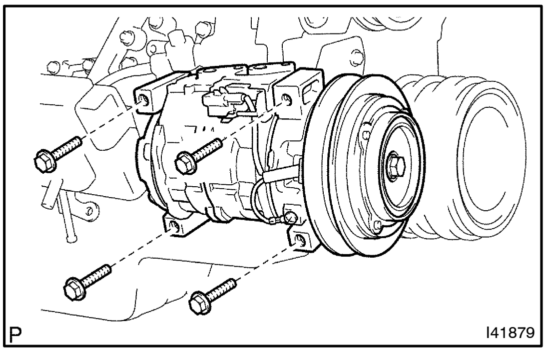
4. REMOVE SUCTION HOSE SUB–ASSY

(a) Remove the bolt and disconnect the hose.

(b) Remove the O–ring from the hose.

NOTICE:

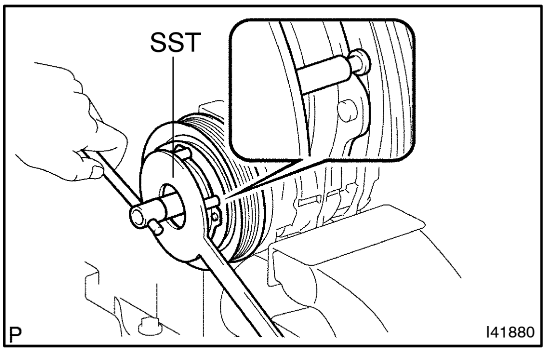
Tape the disconnected parts of hoses and compressor, to protect it from dust and water.



5. REMOVE COOLER COMPRESSOR ASSY

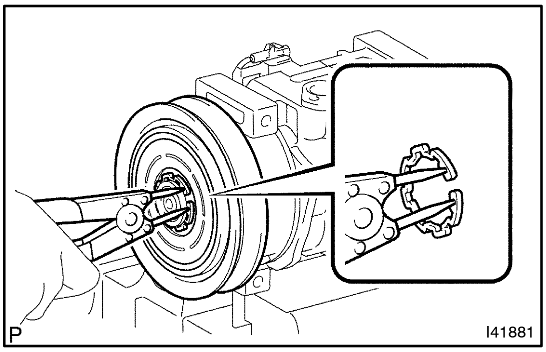
(a) Disconnect the connector.

(b) Remove the 4 bolts and compressor.

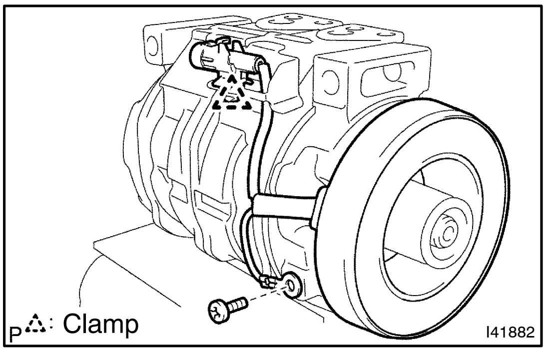


6. REMOVE MAGNET CLUTCH ASSY

(a) Using SST, remove the bolt, magnet clutch washer and magnet clutch hub.
SST 95047–10400 (DENSO Part No.)



(b) Using snap ring pliers, remove the snap ring and magnet clutch rotor.

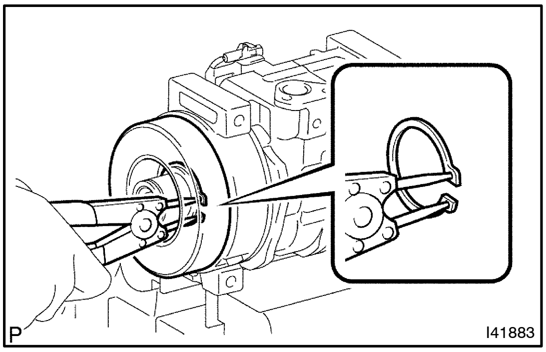


(c) Using a screwdriver, disengage the clamp.

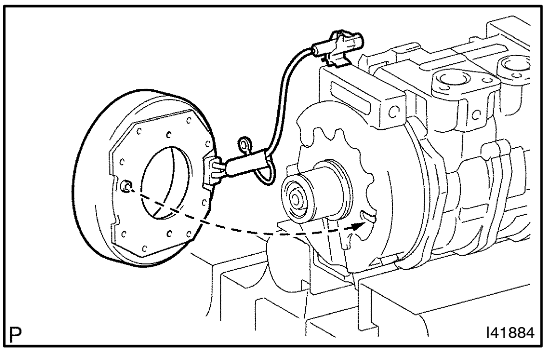
HINT:

Tape the screwdriver tip before use.

(d) Remove the screw and earth wire.

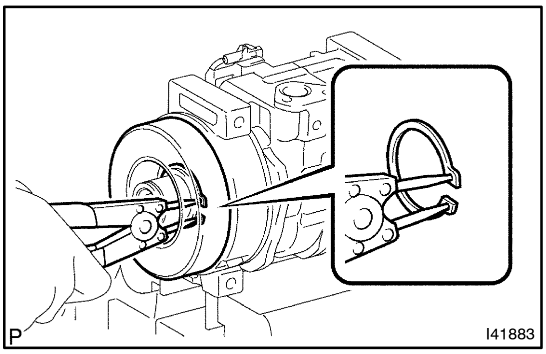


(e) Using snap ring pliers, remove the snap ring and magnet clutch.

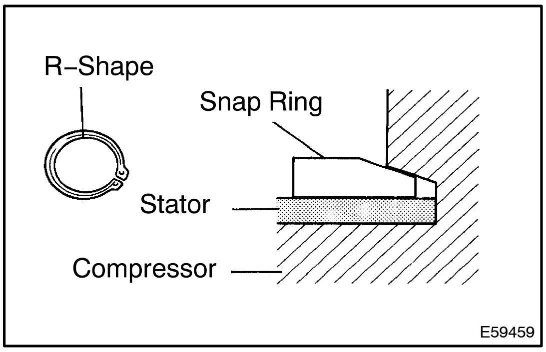


7. INSTALL MAGNET CLUTCH ASSY

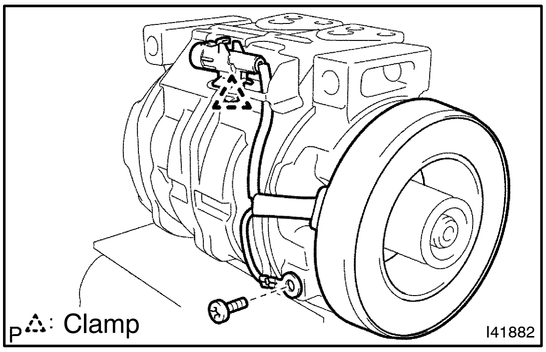
(a) Install the magnet clutch to the cooler compressor, as shown in the illustration.



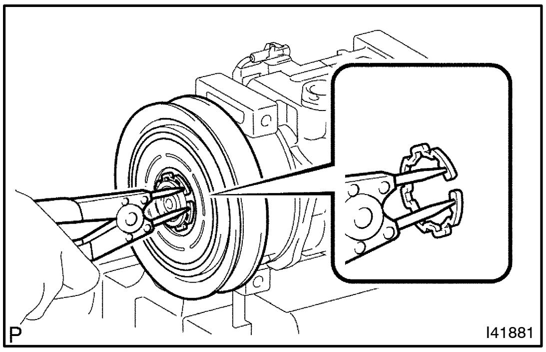
(b) Using snap ring pliers, install the magnet clutch with a new snap ring.



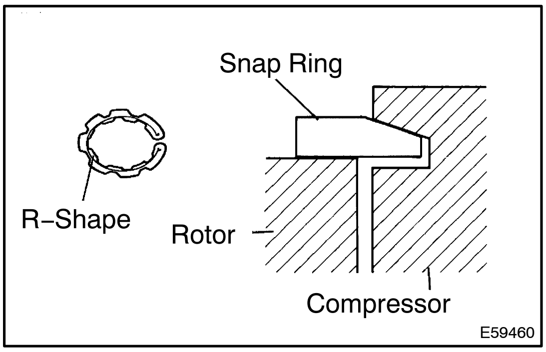
NOTICE:
The snap ring should be installed so that its beveled side faces up.



(c) Install the earth wire with the screw.
(d) Connect the clamp.

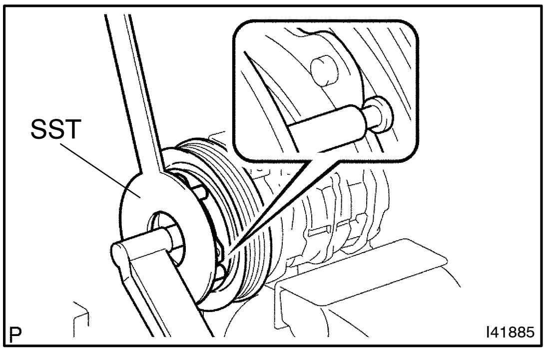


(e) Using snap ring pliers, install the magnet clutch rotor with a new snap ring.

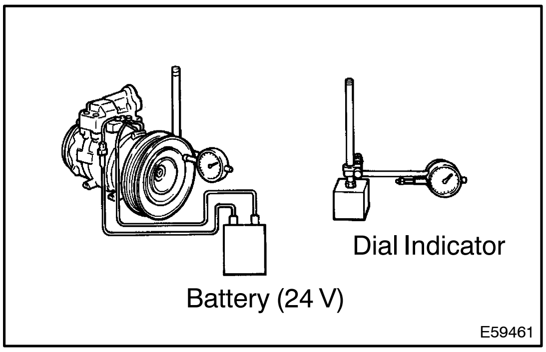


NOTICE:
- **The snap ring should be installed so that its beveled side faces up.**
- **When installing the snap ring, do not expand its bore over 30.5 mm.**

(f) Install the magnet clutch washer and magnet clutch hub.



(g) Using SST, install the bolt.
SST 95047–10400 (DENSO Part No.)
Torque: 18 N·m (183 kgf·cm, 13 ft·lbf)



8. INSPECT MAGNETIC CLUTCH CLEARANCE

(a) Set the dial indicator to the pressure plate of the magnetic clutch.

(b) Connect the magnetic clutch lead wire to the battery's positive terminal.

(c) Check the clearance between the pressure plate and rotor when connecting the battery's negative terminal to the lead wire.

Standard clearance:
0.5 ± 0.15 mm (0.020 ± 0.006 in.)

If the clearance is not within the standard, adjust it using shims to obtain the standard clearance.

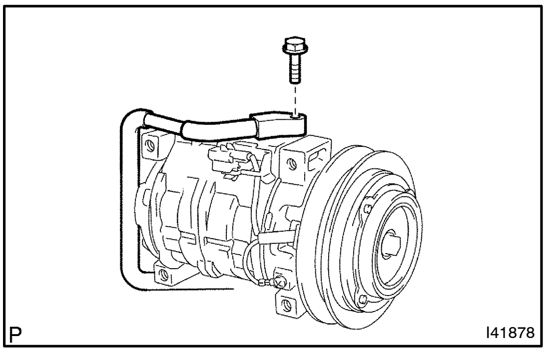
Shim thickness:
0.1 mm (0.004 in.)
0.3 mm (0.012 in.)
0.5 mm (0.020 in.)

9. INSTALL COOLER COMPRESSOR ASSY

(a) Replacing a new compressor:
Drain compressor oil from a new compressor.
Draining compressor oil:
(Oil value of new compressor) – (Oil value of replaced compressor)

(b) Install the compressor with the 4 bolts.
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)

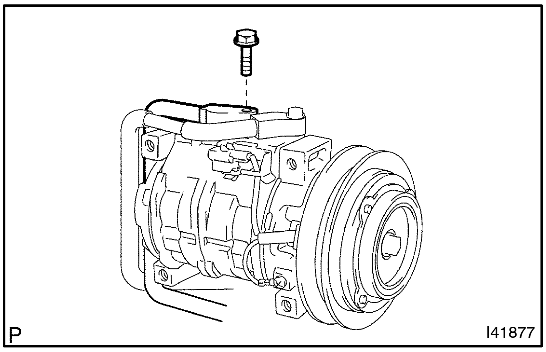
(c) Connect the connector.



10. INSTALL SUCTION HOSE SUB–ASSY

(a) Coat a new O–ring with compressor oil and install the suction hose.
Compressor oil: ND–OIL 8 or equivalent

(b) Connect the suction hose with the bolt.
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)



11. INSTALL COOLER REFRIGERANT DISCHARGE HOSE NO.2

(a) Coat a new O–ring with compressor oil and install the discharge hose.
Compressor oil: ND–OIL 8 or equivalent

(b) Connect the liquid hose with the bolt.
Torque: 5.4 N·m (55 kgf·cm, 48 in.·lbf)

12. INSTALL V BELT (See page 55–2)

13. ADJUST V BELT (See page 55–2)

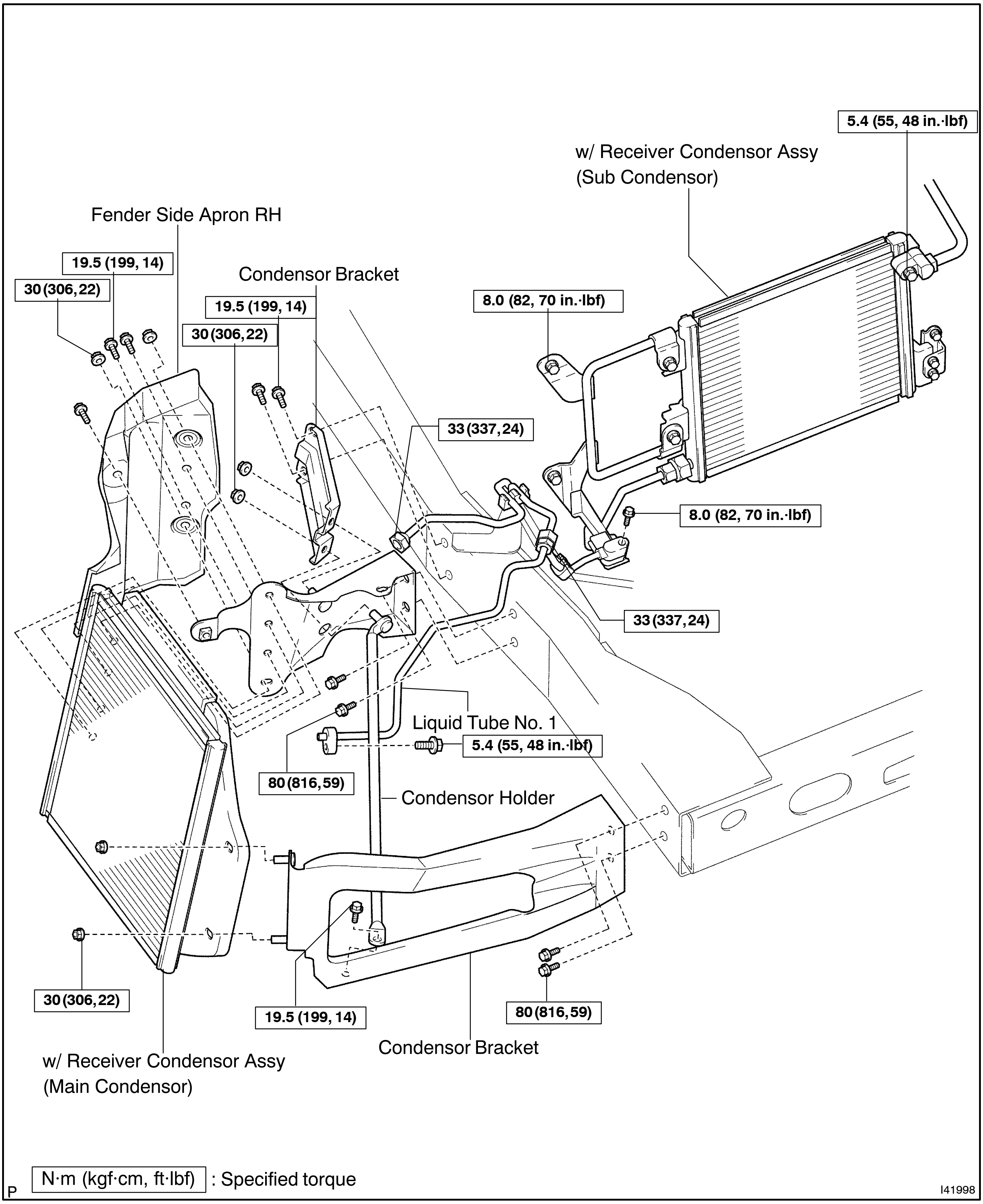
14. CHARGE REFRIGERANT (See Pub. No. S1–YXZE05A on page 55–14)

15. INSPECT LEAKAGE OF REFRIGERANT

COOLER CONDENSOR ASSY (N04C–TF)

COMPONENTS

551EJ–02



WIRING

POWER SOURCE 68–1
LOCATION 68–1

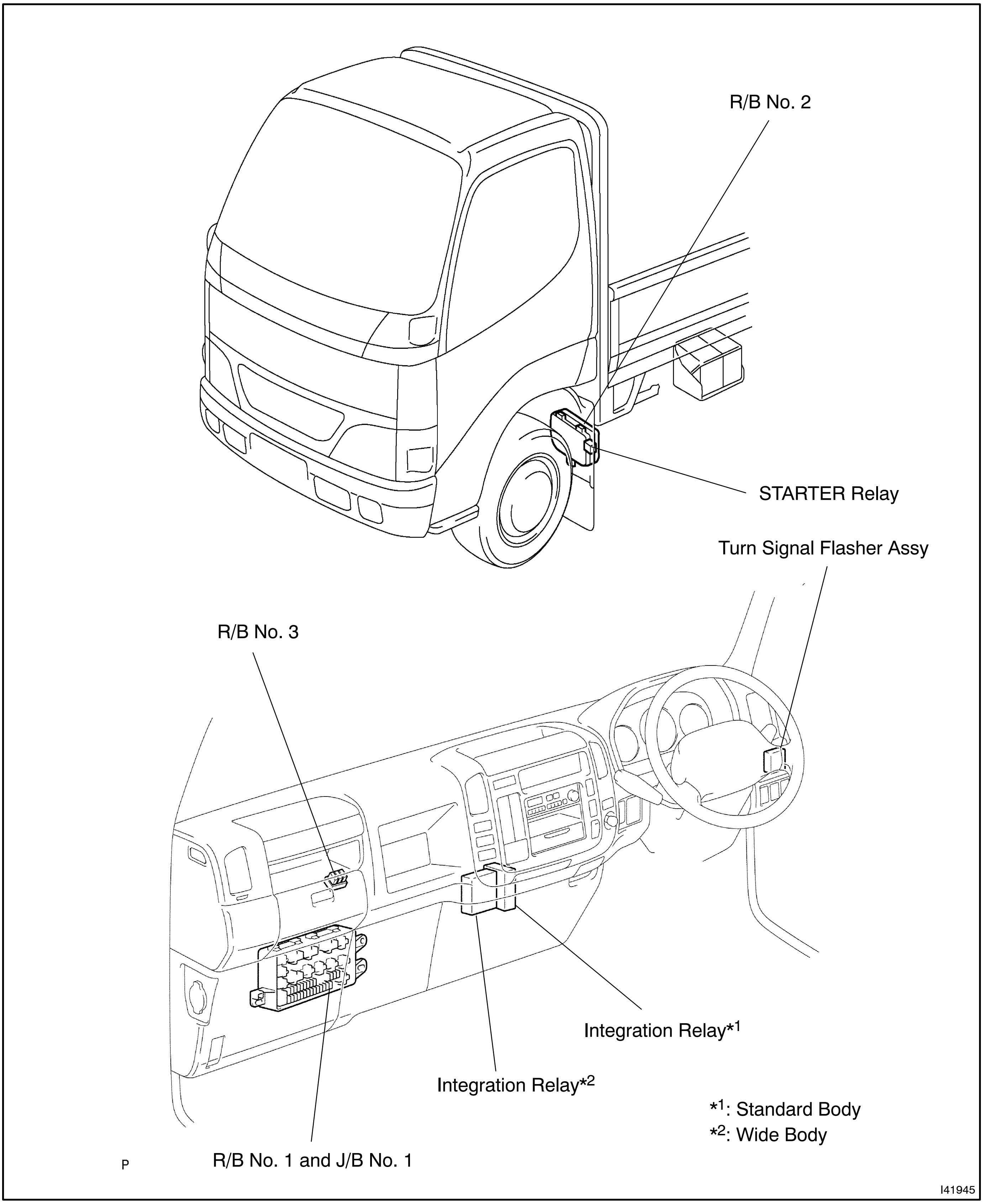
REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A)

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

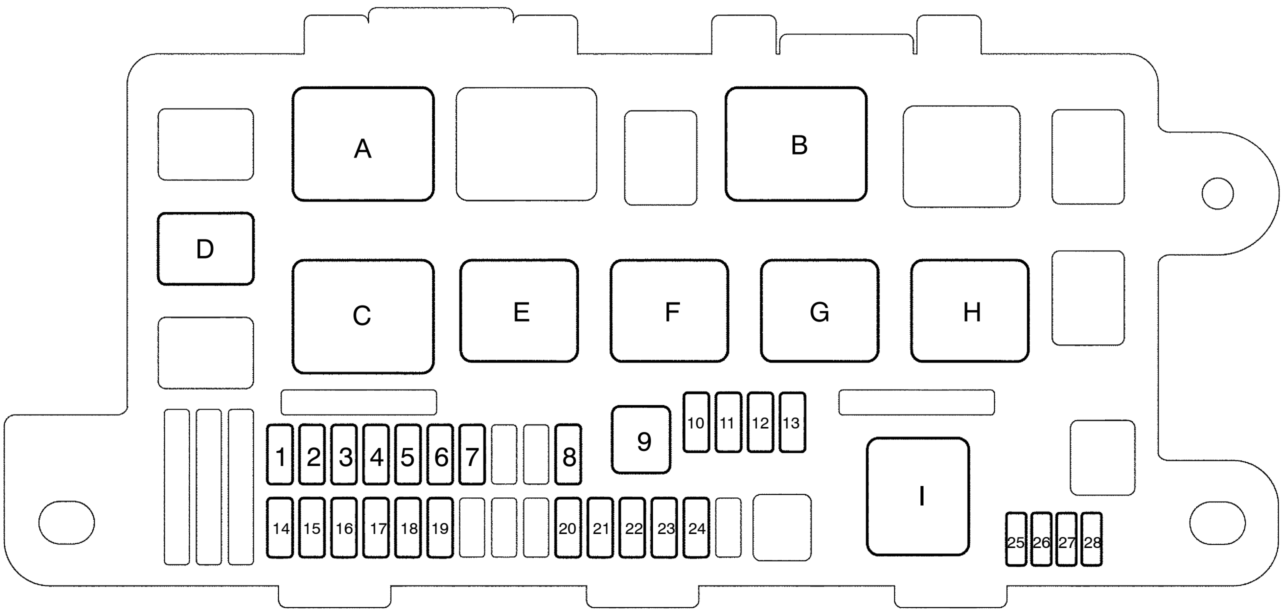
POWER SOURCE

LOCATION

6805B–01



R/B No. 1 and J/B No. 1



FUSE

- 1: CIG 10 A
- 2: RADIO 7.5 A
- 3: P–ACC 15 A
- 4: AIR BAG 15 A
- 5: ECU–IG2 15 A
- 6: WIP 20 A
- 7: ESSTART 7.5 A
- 8: A/C 10 A
- 9: POWER WINDOW 30 A
- 10: P–BAT 15 A
- 11: FOG 15 A
- 12: ECU+B 7.5 A
- 13: DOME 15 A*1, 7.5 A*2
- 14: ST 7.5 A
- 15: HORN 10 A
- 16: P–TAIL 10 A*1, 15 A*2
- 17: ILL 7.5 A
- 18: TAIL 7.5 A
- 19: OBD–2 7.5 A
- 20: HEAD (LH) 15 A
- 21: HEAD (RH) 15 A
- 22: ECU–IG 10 A*1, 15 A*2
- 23: GAUGE 10 A
- 24: P–IGN 15 A*1, 20 A*2
- 25: SPARE 20 A
- 26: SPARE 15 A
- 27: SPARE 10 A
- 28: SPARE 7.5 A

RELAY

- A: HTR
- B: H–LP
- C: HORN
- D: IG1–2
- E: P/W MAIN
- F: FOG
- G: ACC
- H: IG1–3
- I: TAIL

*1: S05C–TB
*2: N40C–TF

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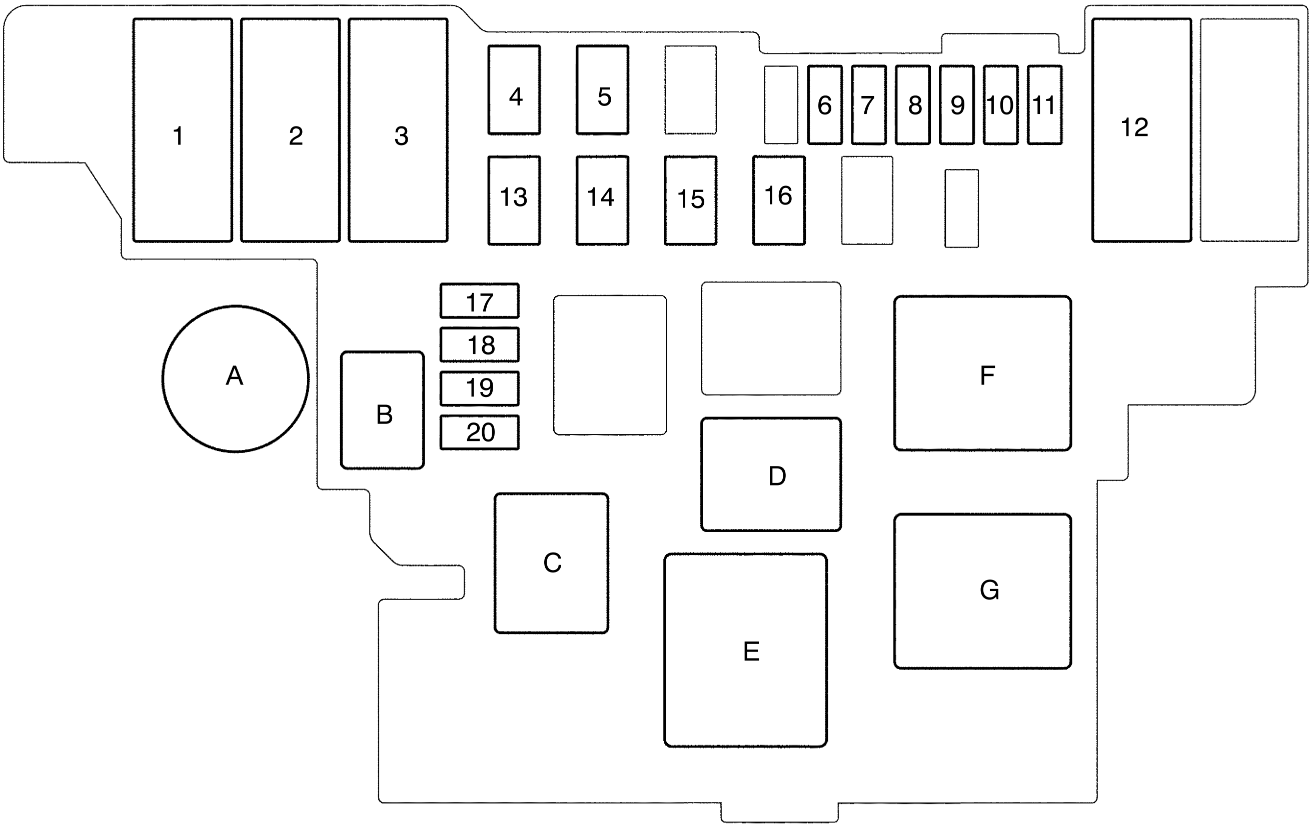
R/B No. 2



FUSE

1:	MAIN3	60 A	11:	IGN	15 A
2:	MAIN2	60 A	12:	GLOW	100 A
3:	ALT	80 A*1 100 A*2	13:	ABS	40 A*1 50 A*2
4:	AM1	30 A	14:	HTR	40 A
5:	HEAD	50 A	15:	E FAN	30 A
6:	E/G	15 A	16:	MAIN4	30 A*1 50 A*2
7:	HAZARD	10 A	17:	ABS SOL	20 A*1 30 A*2
8:	ALT–S	7.5 A	18:	PCV1	10 A
9:	AM2	20 A	19:	PCV2	10 A
10:	STOP	7.5 A	20:	E/G SW	7.5 A

RELAY

A: STARTER
B: STARTER
C: PCV*1
EDU*2
D: MAIN
E: ABS MTR MAIN
F: IG2
E: ABS SOL MAIN

*1: S05C–TB
*2: N40C–TF

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