

INTRODUCTION

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HOW TO USE THIS MANUAL INDEX

IN02E-01

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

GENERAL DESCRIPTION

IN02G-02

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

Read these precautions before starting any repair task.

TROUBLESHOOTING

IN02H-03

TROUBLESHOOTING tables are included for each system to help you diagnose the problem and find the cause. The fundamentals of how to proceed with troubleshooting are described on page IN-19. Be sure to read this before performing troubleshooting.

PREPARATION

IN02J-01

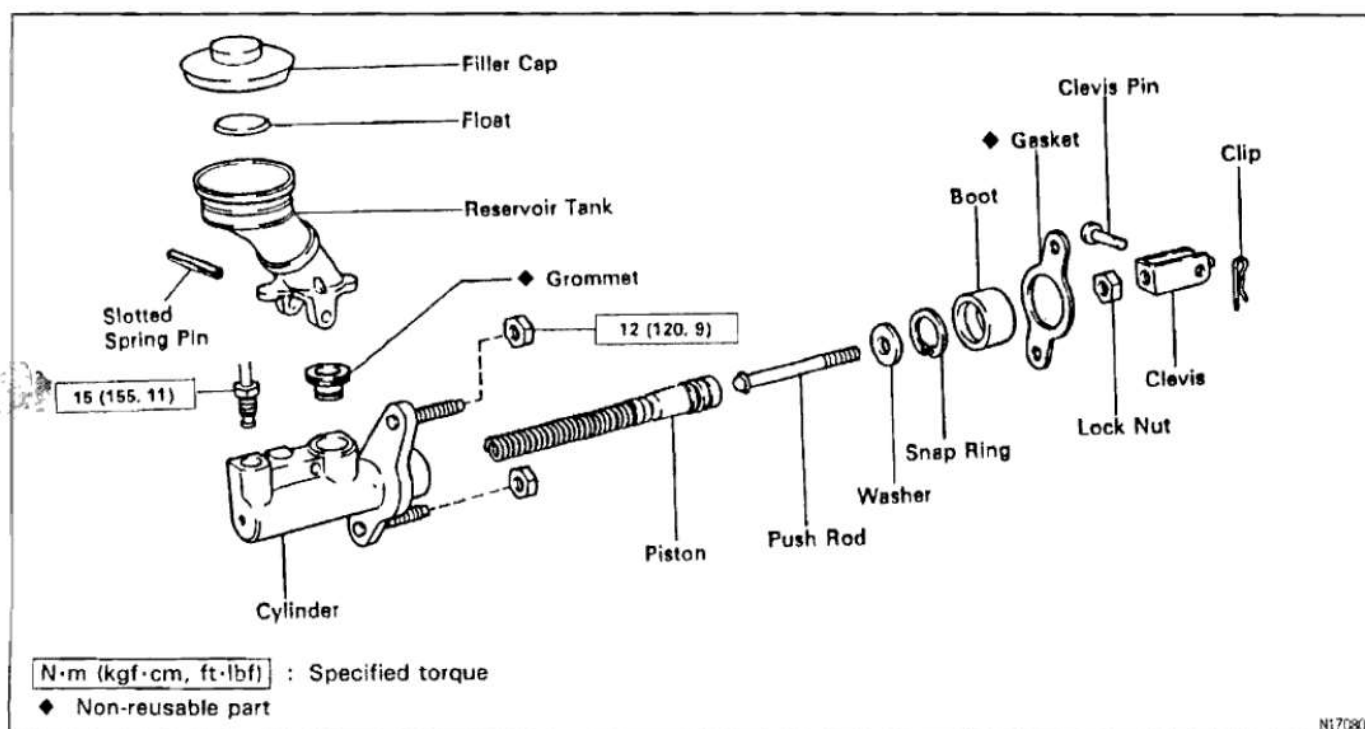
Preparation lists the SST (Special Service Tools), recommended tools, equipment, lubricant and SSM (Special Service Materials) which should be prepared before beginning the operation and explains the purpose of each one.

REPAIR PROCEDURES

IN02K-04

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

Example:

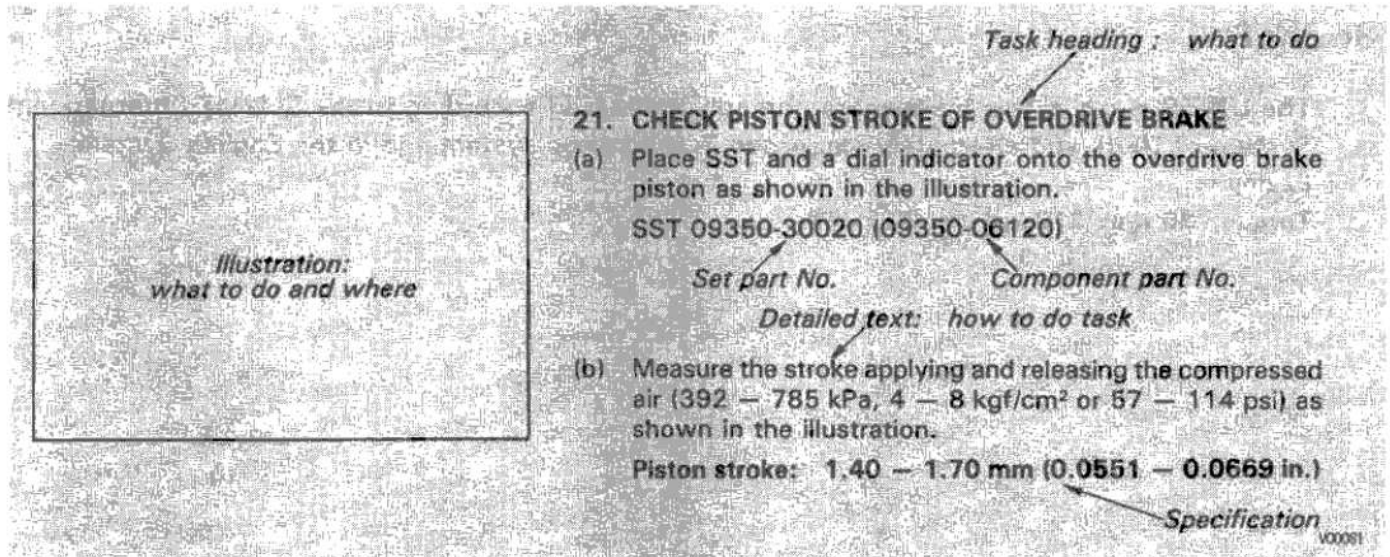


The procedures are presented in a step—by—step format:

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

Example:

IN



Task heading : what to do

21. CHECK PISTON STROKE OF OVERDRIVE BRAKE

(a) Place SST and a dial indicator onto the overdrive brake piston as shown in the illustration.
SST 09350-30020 (09350-06120)
Set part No. Component part No.

Detailed text: how to do task

(b) Measure the stroke applying and releasing the compressed air (392 — 785 kPa, 4 — 8 kgf/cm² or 57 — 114 psi) as shown in the illustration.

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

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

REFERENCES

IN02L-01

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

SPECIFICATIONS

IN02M-01

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

CAUTIONS, NOTICES, HINTS:

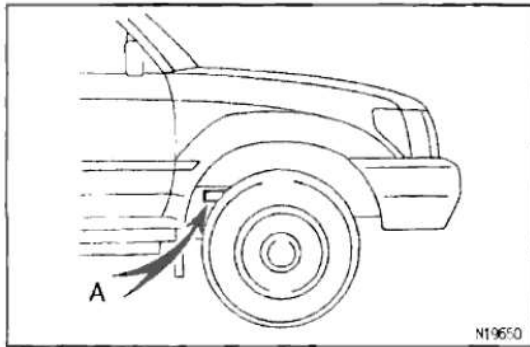
- **CAUTIONS** are presented in bold type, and indicate there is a possibility of injury to you or other people.
- **NOTICES** are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- **HINTS** are separated from the text but do not appear in bold. They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

SI UNIT

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

Example:

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



IDENTIFICATION INFORMATION

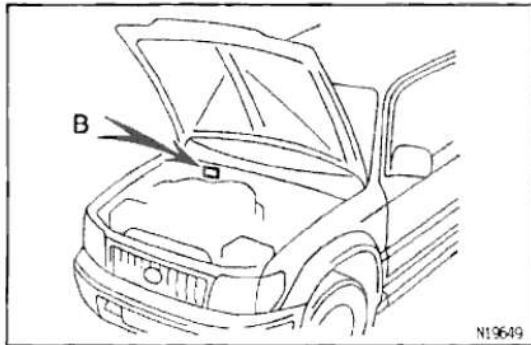
VEHICLE IDENTIFICATION NUMBER

IN079-02

The vehicle identification number is stamped on the vehicle identification number, manufacture's plate and certification label.

A. Vehicle Identification Number

IN



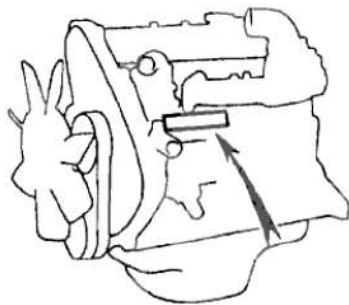
B. Manufacture's Plate

ENGINE SERIAL NUMBER

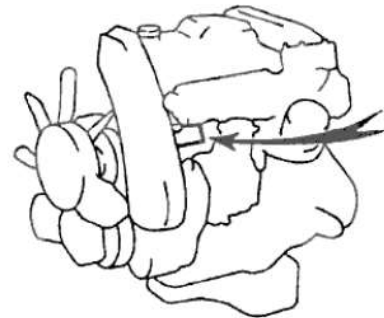
IN04V-02

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

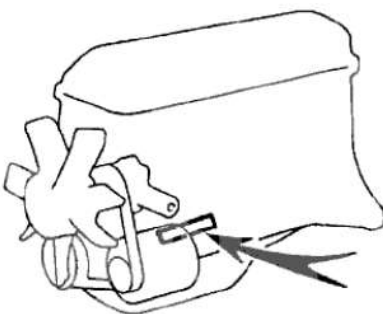
3L-Engine



1KZ-T, 1KZ-TE Engine



3RZ-F, 3RZ-FE Engine

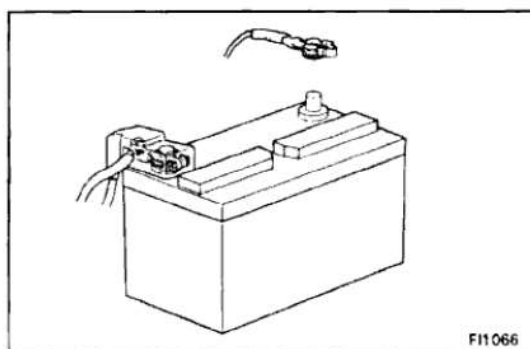


5VZ-FE Engine



N19545 N09034
N17730 N17731

Z19427

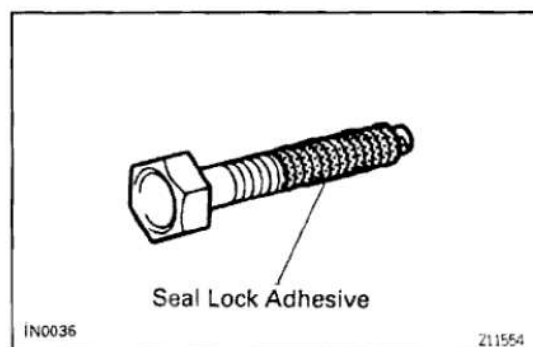


GENERAL REPAIR INSTRUCTIONS

1. Use fender, seat and floor covers to keep the vehicle clean and prevent damage.
2. During disassembly, keep parts in the appropriate order to facilitate reassembly.
3. Observe the following:
 - (a) Before performing electrical work, disconnect the negative (–) terminal cable from the battery.
 - (b) If it is necessary to disconnect the battery for inspection or repair, always disconnect the negative (–) terminal cable which is grounded to the vehicle body.
 - (c) To prevent damage to the battery terminal, loosen the cable nut and raise the cable straight up without twisting or prying it.
 - (d) Clean the battery terminals and cable ends with a clean shop rag. Do not scrape them with a file or other abrasive objects.
 - (e) Install the cable ends to the battery terminals with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the cable ends onto the terminals.
 - (f) Be sure the cover for the positive (+) terminal is properly in place.
4. Check hose and wiring connectors to make sure that they are secure and correct.
5. Non-reusable parts
 - (a) Always replace cotter pins, gaskets, O-rings and oil seals etc. with new ones.
 - (b) Non-reusable parts are indicated in the component illustrations by the "◆" symbol.
6. Precoated parts

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

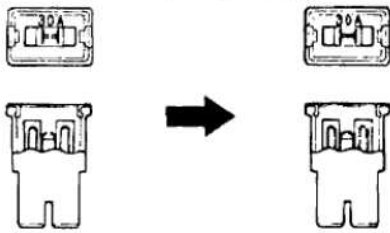
 - (a) If a precoated part is retightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.
 - (b) When reusing precoated parts, clean off the old adhesive and dry with compressed air. Then apply the specified seal lock adhesive to the bolt, nut or threads.
 - (c) Precoated parts are indicated in the component illustrations by the "★" symbol.
7. When necessary, use a sealer on gaskets to prevent leaks.
8. Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.



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

IN

Medium Current Fuse and High Current Fuse
Equal Amperage Rating



BE1367

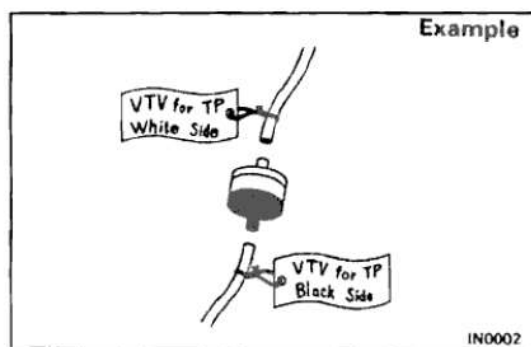
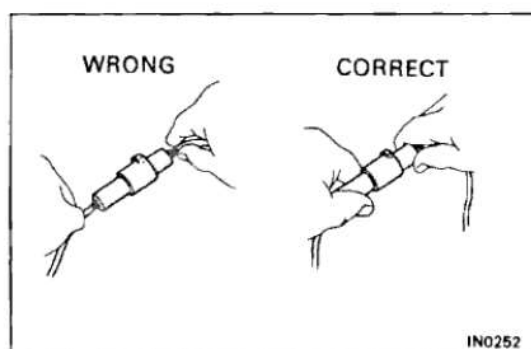
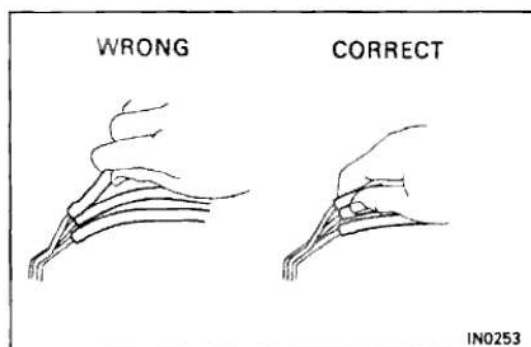
10. When replacing fuses, be sure the new fuse has the correct amperage rating. **DO NOT** exceed the rating or use one with a lower rating.

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

V00076

11. 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 IN-36).
- (a) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels at the opposite end in order to ensure safety.

IN



- (b) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on a vehicle raised on a jack alone, even for a small job that can be finished quickly.
12. Observe the following precautions to avoid damage to the following parts:
 - (a) Do not open the cover or case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)
 - (b) To disconnect vacuum hoses, pull on the end, not the middle of the hose.
 - (c) To pull apart electrical connectors, pull on the connector itself, not the wires.
 - (d) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.
 - (e) When steam cleaning an engine, protect the electronic components, air filter and emissions-related components from water.
 - (f) Never use an impact wrench to remove or install temperature switches or temperature sensors.
 - (g) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
 - (h) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.
13. Tag hoses before disconnecting them:
 - (a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
 - (b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.
14. Unless otherwise stated, all resistance is measured at an ambient temperature of 20°C (68°F). Because the resistance may be outside specifications if measured at high temperatures immediately after the vehicle has been running, measurements should be made when the engine has cooled down.

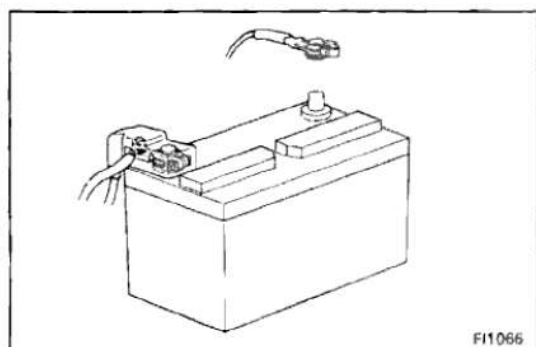
PRECAUTION FOR VEHICLES EQUIPPED WITH SRS AIRBAG AND SEAT BELT PRETENSIONER

IN07J-04

The LAND CRUISER /LAND CRUISER PRADO specifications is equipped with an SRS (Supplemental Restraint System), such as the driver airbag, front passenger airbag and seat belt pretensioner.

Failure to carry out service operations in the correct sequence could cause the airbag system to unexpectedly deploy during servicing, possibly leading to a serious accident.

Further, if a mistake is made in servicing the airbag system, it is possible the airbag may fail to operate when required. Before servicing (including removal or installation of parts, inspection or replacement), be sure to read the following items carefully, then follow the correct procedure described in this manual.



1. Malfunction symptoms of the airbag system are difficult to confirm, so the diagnostic codes become the most important source of information when troubleshooting. When troubleshooting the airbag system, always inspect the diagnostic codes before disconnecting the battery (See page RS-32).
2. Work must be started after approx 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

(The airbag system is equipped with a back-up power source so that if work is started within 90 seconds of disconnecting the negative (-) terminal cable from the battery, the airbag may deploy.)

When the negative (-) terminal cable is disconnected from the battery, memory of the clock and audio systems will be cancelled. So before starting work, make a record of the contents memorized by each memory system. Then when work is finished, reset the clock and audio systems as before.

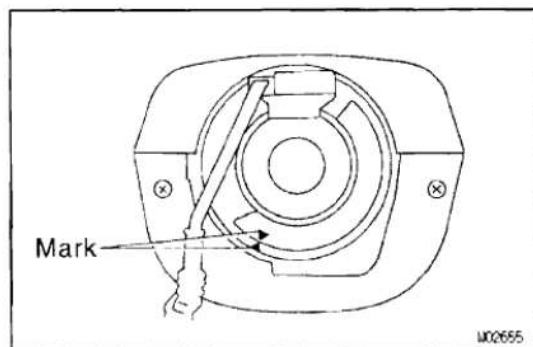
To avoid erasing the memory of each memory system, never use a back-up power supply from outside the vehicle.

3. Even in cases of a minor collision where the airbag does not deploy, the airbag sensor assembly, front passenger airbag assembly, seat belt pretensioner and steering wheel pad should be inspected (See page RS-9, 24, BO-73).

IN

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4. Never use airbag parts from another vehicle. When replacing parts, replace them with new parts.
5. Before repairs, remove the airbag sensors if shocks are likely to be applied to the sensors during repairs.
6. Never disassemble and repair the airbag sensor assembly, steering wheel pad, front passenger airbag assembly or seat belt pretensioners in order to reuse it.
7. If the airbag sensor assembly, steering wheel pad, front passenger airbag assembly or seat belt pretensioners have been dropped, or if there are cracks, dents or other defects in the case, bracket or connector, replace them with new ones.
8. Do not expose the airbag sensor assembly, steering wheel pad, front passenger airbag assembly or seat belt pretensioners directly to hot air or flames.
9. Use a volt/ohmmeter with high impedance (10 k Ω /V minimum) for troubleshooting of the electrical circuit.
10. Information labels are attached to the periphery of the airbag components. Follow the notices.
11. After work on the airbag system is completed, perform the airbag warning light check (See page RS-32).



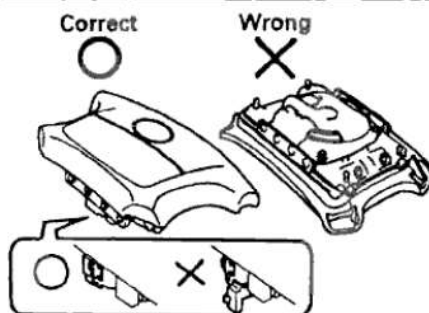
Spiral Cable (in Combination Switch)

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 result. Refer to page SR-24 concerning correct steering wheel installation.

Steering Wheel Pad (with Airbag)

1. **When removing the steering wheel pad or handling a new steering wheel pad, it should be placed with the pad top surface facing up.**
In this case, the twin-lock type connector lock lever should be in the locked state and care should be taken to place it so the connector will not be damaged. Do not store a steering wheel pad on top of another one. (Storing the pad with its metallic surface up may lead to a serious accident if the airbag inflates for some reason.)
2. **Never measure the resistance of the airbag squib.** (This may cause the airbag to deploy, which is very dangerous.)
3. Grease should not be applied to the steering wheel pad and the pad should not be cleaned with detergents of any kind.
4. Store the steering wheel pad where the ambient temperature remains below 93°C (200°F), without high humidity and away from electrical noise.
5. When using electric welding, first disconnect the airbag connector (yellow color and 2 pins) under the steering column near the combination switch connector before starting work.
6. **When disposing of a vehicle or the steering wheel pad alone, the airbag should be deployed using an SST before disposal (See page RS-14). Carry out the operation in a place away from electrical noise.**

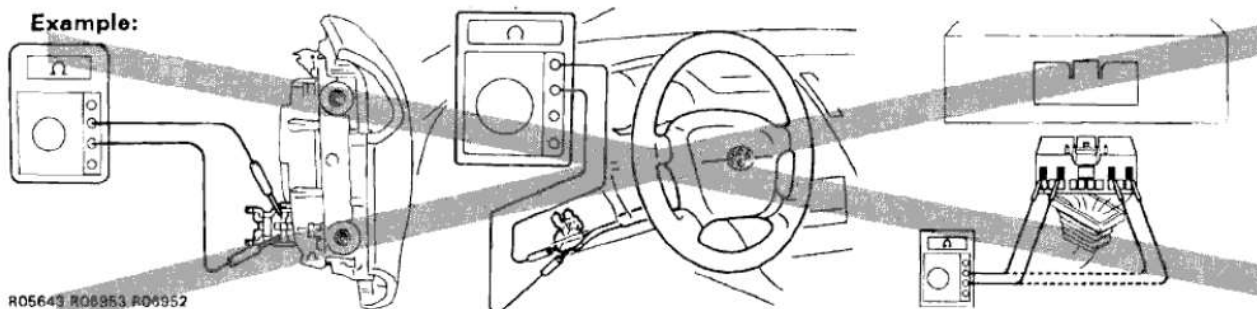
Example:



N01580

Z13953

Example:

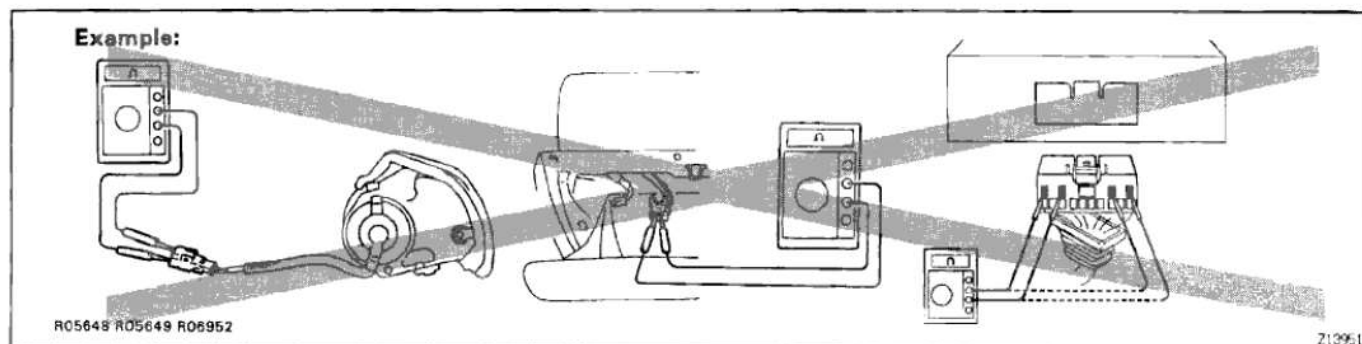
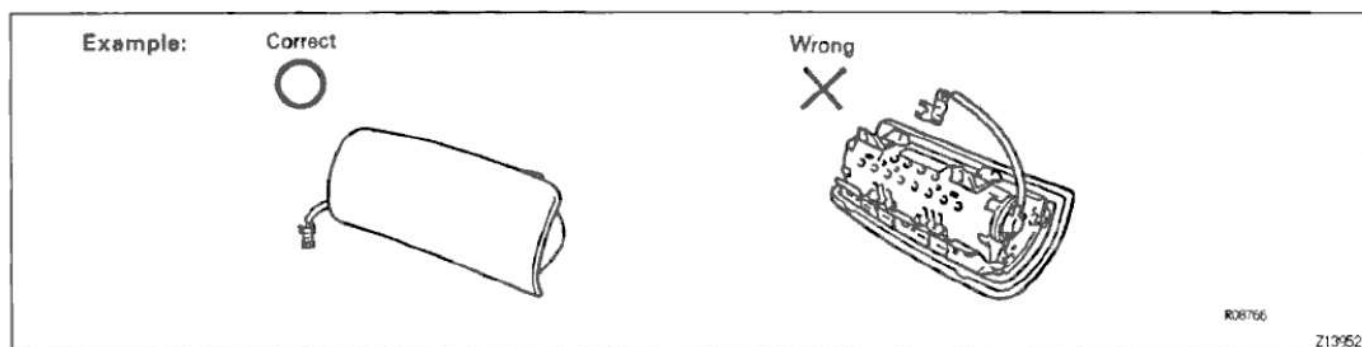


R05643 R06953 R06952

Z13950

Front Passenger Airbag Assembly

1. Always store a removed or new front passenger airbag assembly with the airbag deployment direction facing up.
Storing the airbag assembly with the airbag deployment direction facing down could cause a serious accident if the airbag inflates.
2. Never measure the resistance of the airbag squib. (This may cause the airbag deploy, which is very dangerous.)
3. Grease should not be applied to the front passenger airbag assembly and the airbag door should not be cleaned with detergents of any kind.
4. Store the airbag assembly where the ambient temperature remains below 93°C (200°F), without high humidity and away from electrical noise.
5. When using electric welding, first disconnect the airbag connector (yellow color and 2 pins) installed on the glove compartment finish plate at the left side of the glove compartment before starting work.
6. When disposing of a vehicle or the airbag assembly alone, the airbag should be deployed using an SST before disposal (See page RS-14). Carry out the operation in a safe place away from electrical noise.



Seat Belt Pretensioner

1. Before doing any operation which will apply a strong shock to the vehicle, or before removing the seat belt pretensioner, be sure to apply the sensor shock.
2. Never disassemble the seat belt pretensioner.
3. Do not subject the seat belt pretensioner to shocks or bring magnets close to it.
4. Do not expose the seat belt pretensioner to high temperature or fire.
5. Do not drop the seat belt pretensioner. Never use a seat belt pretensioner which has been dropped.
6. Never install the seat belt pretensioner in another vehicle.
7. Store removed seat belt pretensioners on a flat, stable surface.
8. After frontal collision, always check whether the seat belt pretensioners have been activated.
9. When disposing of a vehicle or the pretensioner by itself, always activate the pretensioner before disposal (See page BO-74).
10. The seat belt pretensioner is hot when activated, so let it cool down fully before you dispose of it. Never apply water to the seat belt pretensioner.

Airbag Sensor Assembly

The connector to the airbag sensor assembly should be connected or disconnected with the sensor mounted on the floor. If the connector is connected or disconnected while the airbag sensor assembly is not mounted to the floor, it could cause undesired ignition of the airbag system.

Wire Harness and Connector

The airbag system's wire harness is integrated with the cowl wire harness assembly. The wires for the airbag wire harness are encased in a yellow corrugated tube. All the connectors for the system are also a standard yellow color. If the airbag system wire harness becomes disconnected or the connector becomes broken due to an accident, etc., repair or replace it.

WHEN SERVICING FULL—TIME 4WD VEHICLES

The Full—Time 4WD LAND CRUISER /LAND CRUISER PRADO is equipped with the mechanical lock type center differential system.

When carrying out any kind of servicing or testing on a full—time 4WD in which the front or rear wheels are made to rotate (braking test, speedometer test, on—vehicle wheel balancing, etc.), or when towing the vehicle, be sure to observe the precautions given below.

If incorrect preparations or test procedures are used, the test will not only be unsuccessful, but may be dangerous as well.

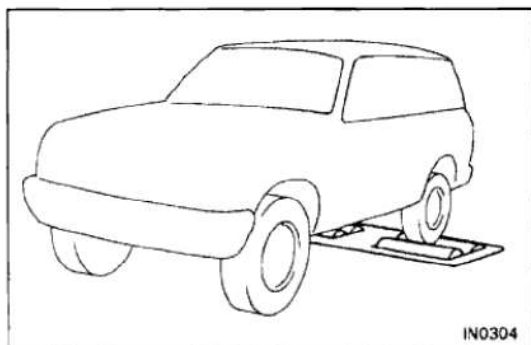
Therefore, before beginning any such servicing or test, be sure to check the following items:

- (1) Whether wheels should be touching ground or jacked up
- (2) Transmission gear position
- (3) Maximum testing vehicle speed
- (4) Maximum testing time
- (5) Transfer gear position

Also, make sure the following are observed:

CAUTION:

- Never accelerate or decelerate the vehicle suddenly
- Observe the other cautions given for each individual test



Before Beginning Test

During tests with a brake tester or chassis dynamometer, such as braking force tests or speedometer tests, if only the front or rear wheels are to be rotated, it is necessary to set the position of the center differential to the FREE position or to the LOCK position depending on the type of test being performed.

- (1) Select the position of the center differential by select the transfer shift lever HL position.
- (2) After selecting the position, confirm the operation of indicator light.

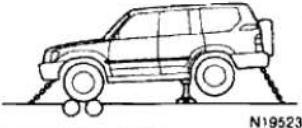
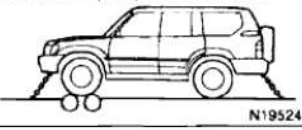
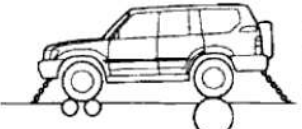
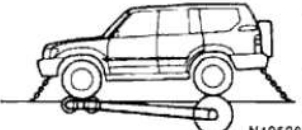
Braking Force Test

Vehicle Speed: Below 0.5 km/h or 0.3 mph

When doing low-speed type brake tester measurements, observe the following instructions.

- (1) Position the wheels to be tested (front or rear) on the tester.
- (2) Shift the transmission shift lever to Neutral.
- (3) Idle the engine, operate the brake booster and do the test.

Speedometer Test or Other Tests (Using Speedometer Tester or Chassis Dynamometer)

No.	Chassis Dynamometer Type	Vehicle Condition	Vehicle Speed and Test Time	4-Wheel Drive Control Lever Position
1	2-Wheel Chassis Dynamometer	 N19523	Low speed (60 km/h or less) and 1 minute or less	HL (Locked)
		Remove propeller Shaft.  N19524	No restriction on vehicle speed or duration of test	HL (Locked)
2	4-Wheel Free Chassis Dynamometer	 N19525	Low speed (60 km/h or less) and 1 minute or less	HL (Locked)
		 N19526	No restriction on vehicle speed or duration of test	HL (Locked)
3	4-Wheel Driven Chassis Dynamometer	 N19526	No restriction on vehicle speed or duration of test	HF (Free)

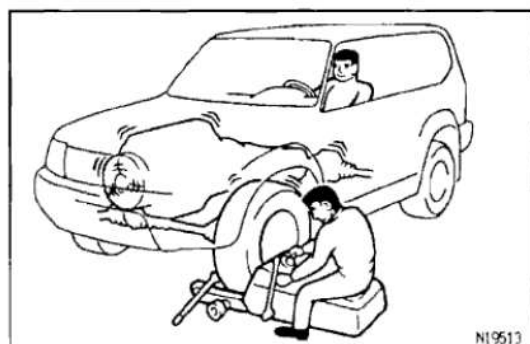
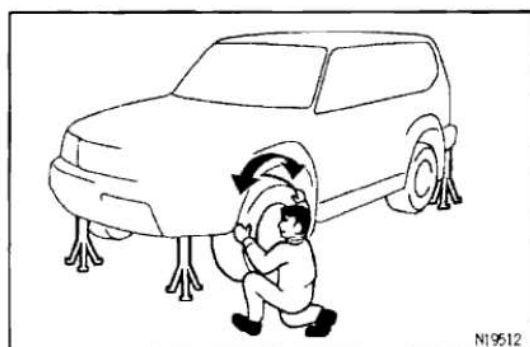
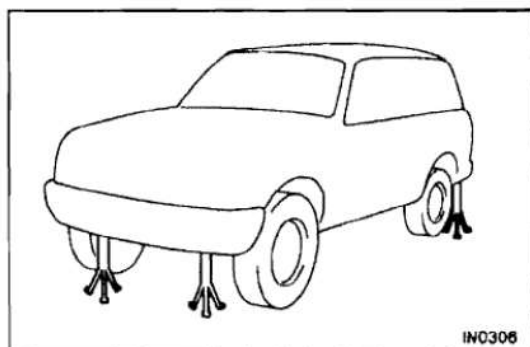
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NOTICE:

1. Confirm that the vehicle is securely immobilized.
2. Never operate the clutch or brakes suddenly, suddenly drive the wheels, or suddenly decelerate.

On—Vehicle Wheel Balancing

When doing on—vehicle wheel balancing on a full—time 4WD vehicle, to prevent the wheels from rotating at different speeds in different directions from each other (which could damage the center differential), always be sure to observe the following precautions:



- (1) All 4 wheels should be jacked up, clearing the ground completely.
- (2) The center differential should be in the LOCK position with the transfer gear in HL position.
- (3) The parking brake lever should be fully released.

- (4) None of the brakes should be allowed to drag.

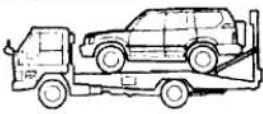
- (5) The wheels should be driven with both the engine and the wheel balancer.

HINT: When doing this, be careful of the other wheels, which will rotate at the same time.

- (6) Avoid sudden acceleration, deceleration and braking.
- (7) Carry out the wheel balancing with the transmission in D range or 3rd gear.

WHEN TOWING FULL-TIME 4WD VEHICLES

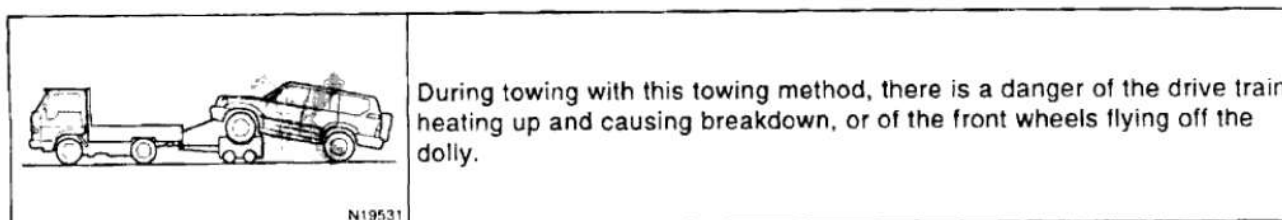
1. Only use one of the methods shown below to tow the vehicle.
2. When there is trouble with the chassis and drive train, use method ① (flat bed truck)

Towing Method \ Condition	Parking Brake	Transmission Shift Lever Position (M/T)	Transmission Shift Lever Position (A/T)	Transfer Shift Lever Position
① Flat Bed Truck  N19527	Applied		"P" Range	"H" Position
② Wheel Lift Type Truck with Dollies – From Front  N20098				
③ Wheel Lift Type Truck with Dollies – From Rear  N20099				
④ Towing with Rope  N19530	Released	Neutral	"N" Range	"HF" Position
HINT : Do not tow the vehicle at a speed faster than 45 km/h (30mph) or distance greater than 80 km (50 miles).				

V08065

HINT: Do not use any towing methods other than shown above.

For example, the towing method shown below is dangerous, so do not use it.



V08066

FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

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

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

IF VEHICLE IS EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

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

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

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

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

System		Page
1.	Automatic Transmission	AT-19
2.	Anti-Lock Brake	BR-55
3.	Supplemental Restraint System	RS-29
4.	Cruise Control	BE-189

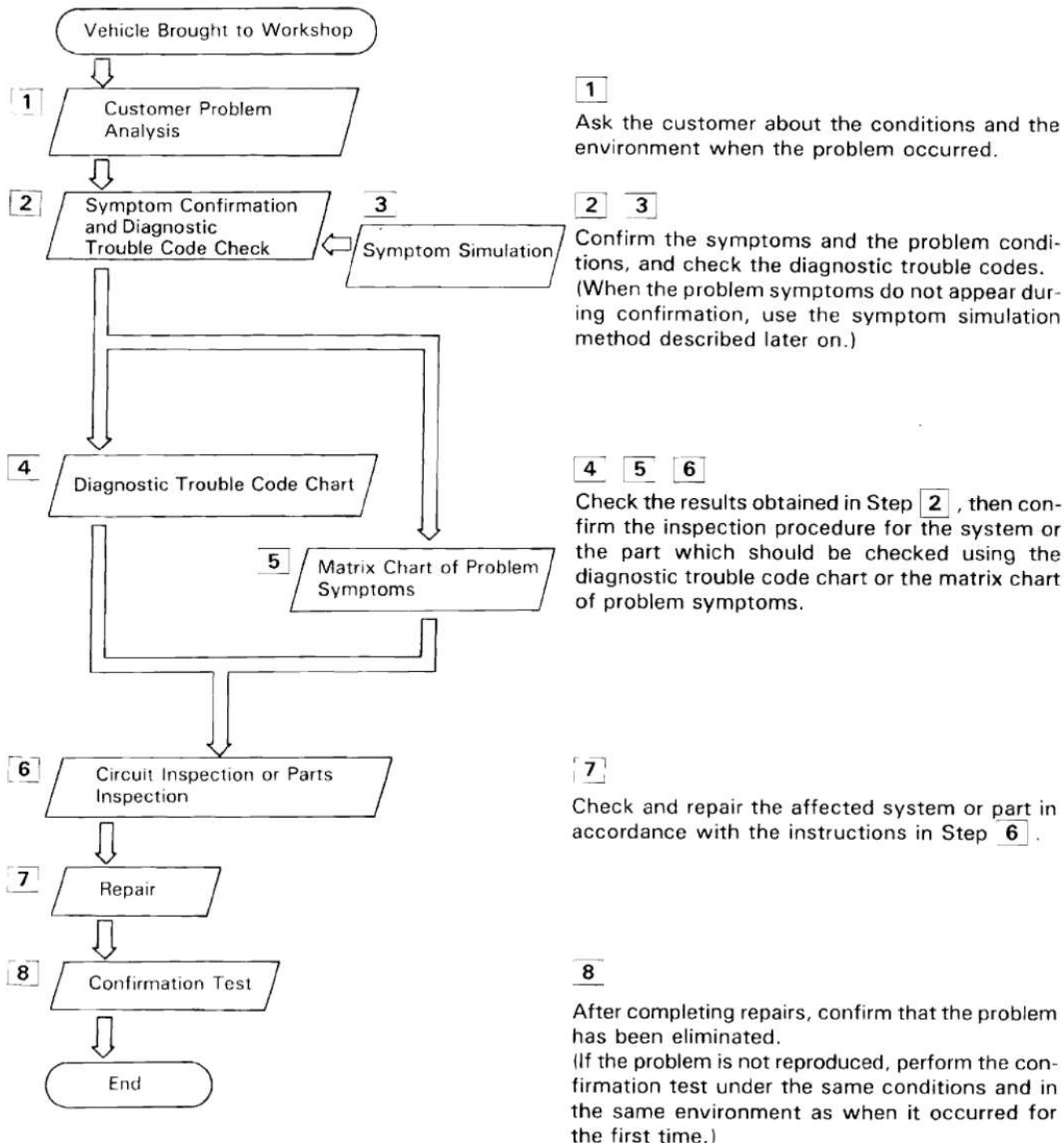
The troubleshooting procedure and how to make use of it are described on the following pages.

IN

HOW TO PROCEED WITH TROUBLESHOOTING

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

IN



1 CUSTOMER PROBLEM ANALYSIS

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

Important Points in the Problem Analysis

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

Important Points in the Customer Problem Analysis

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

(Sample) Transmission Control System Check Sheet

CUSTOMER PROBLEM ANALYSIS			
Electronically-Controlled Automatic Transmission Check Sheet		Inspector's Name	
Customer's Name		Registration No.	
		Registration Year	/ /
		Frame No.	
Date Vehicle Brought In	/ /	Odometer Reading	km mile
Date Problem Occurred	/ /		
How Often does Problem Occur	☐ Continuous ☐ Intermittent (times a day)		
Symptoms	☐ Vehicle does not move. (☐ Any range ☐ Particular range)		
	☐ No up-shift (☐ 1st → 2nd ☐ 2nd → 3rd ☐ 3rd → O/D)		
	☐ No down-shift (☐ O/D → 3rd ☐ 3rd → 2nd ☐ 2nd → 1st)		
	☐ Lock-up malfunction		
	☐ Shift point too high or too low.		
	☐ Harsh engagement (☐ N → D ☐ Lock-up ☐ Any drive range)		
	☐ Slip or shudder		
	☐ No Kick-down		
☐ Others			
		☐ Normal	

2 SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE CHECK

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

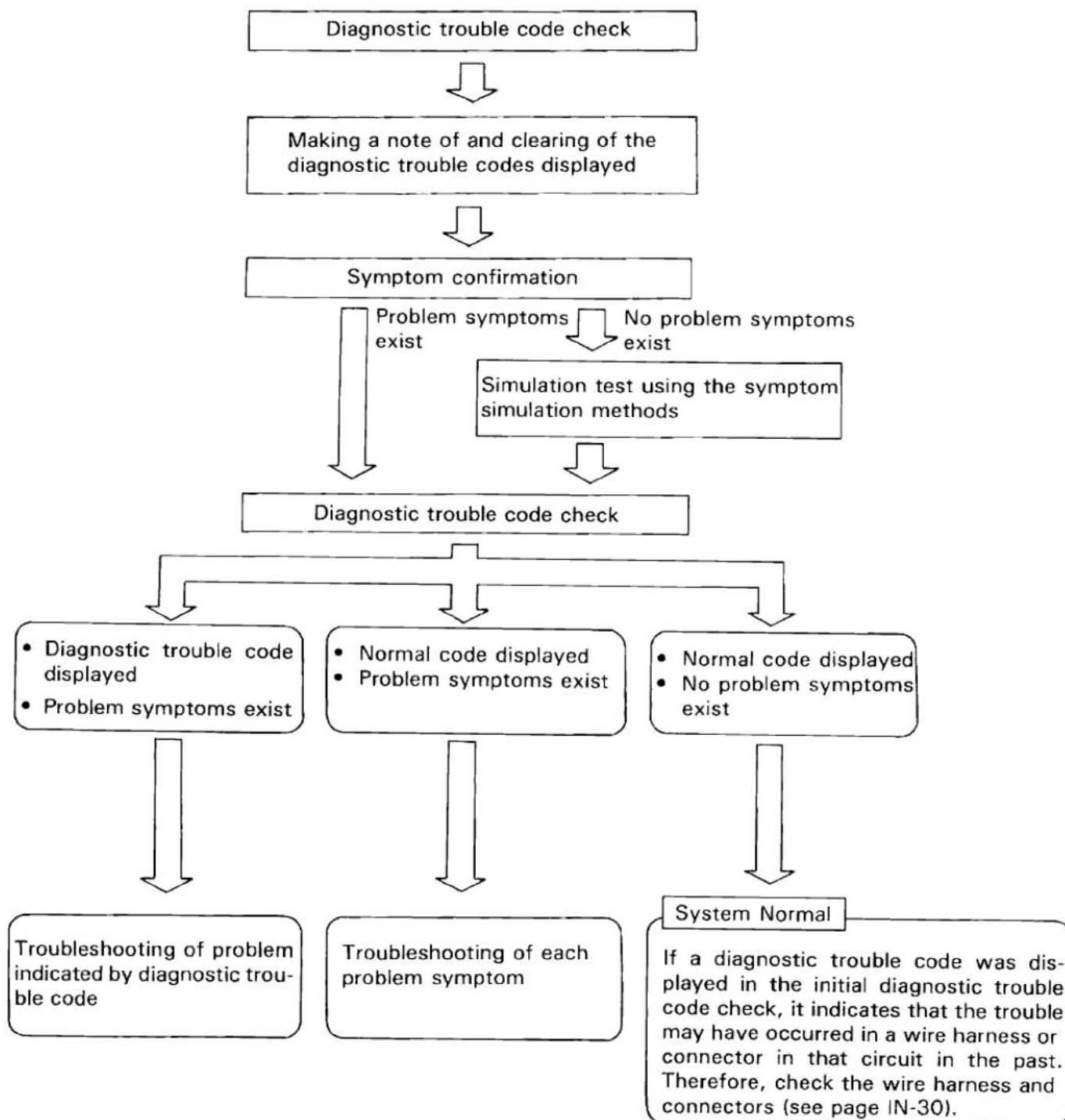
System	Diagnostic Trouble Code Check	Input Signal Check (Sensor Check)	Other Diagnosis Function
Automatic Transmission	☐ (with Test Mode)	☐	
Anti-Lock Brake	☐	☐	
Supplemental Restraint System	☐		
Cruise Control	☐	☐	Cancel Signal Check

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

DIAGNOSTIC TROUBLE CODE CHECK PROCEDURE

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

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



3 SYMPTOM SIMULATION

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

Important Points in the Symptom Simulation Test

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

1

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

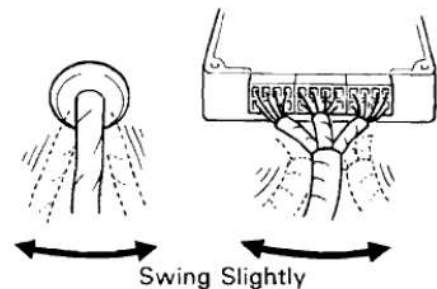
CONNECTORS

Slightly shake the connector vertically and horizontally.



WIRE HARNESS

Slightly shake the wire harness vertically and horizontally. The connector joint, fulcrum of the vibration, and body through portion are the major areas to be checked thoroughly.



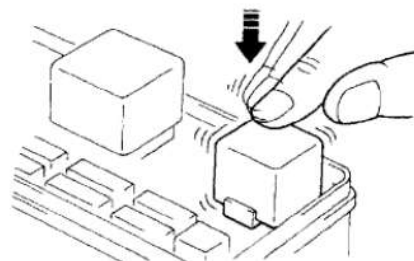
P19981
FI2332

PARTS AND SENSORS

Apply slight vibration with a finger to the part of the sensor considered to be the problem cause and check if the malfunction occurs.

HINT: Applying strong vibration to relays may result in open relays.

Vibrate Slightly



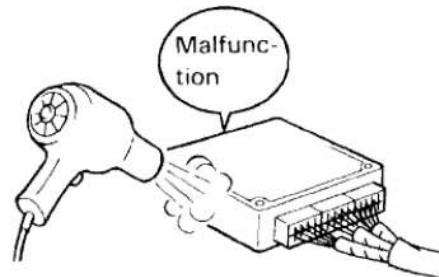
P20001

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

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

NOTICE:

- (1) Do not heat to more than 60°C (140°F). (Temperature limit that no damage is done to the component).
- (2) Do not apply heat directly to parts in the ECU.



FI2334

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

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

NOTICE:

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

(Service hint)

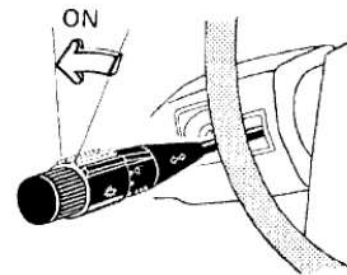
If a vehicle is subject to water leakage, the leaked water may contaminate the ECU. When testing a vehicle with a water leakage problem, special caution must be used.



FI6649

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

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



FI2336

IN

4 DIAGNOSTIC TROUBLE CODE CHART

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

The engine diagnostic trouble code chart is shown below as an example.

- DTC No.

Indicates the diagnostic trouble code.

- Page or Instructions

Indicates the page where the inspection procedure for each circuit is to be found, or gives instructions for checking and repairs.

- Detection Item

Indicates the system of the problem or contents of the problem.

DTC CHART

If a DTC is displayed during the DTC check, check the circuit listed for that code in the table below and proceed to the page given.

DTC No. (See page)	Detection Item	Trouble Area	O/D OFF Light Blinks	Memory
38 (AT-44)	ATF Temperature Sensor Circuit Malfunction	• Open or short in ATF temperature sensor circuit • ATF temperature sensor faulty • Engine & ECT ECU faulty	○	○
42 (AT-46)	No.1 Speed Sensor Circuit (Back-up Sensor) Malfunction	• Open or short in No.1 speed sensor circuit • No.1 speed sensor (in combination meter) faulty • Engine & ECT ECU faulty	○	○
61 (AT-49)	No.2 Speed Sensor Circuit Malfunction	• Open or short in No.2 speed sensor circuit • No.2 speed sensor (in ATM) faulty • Engine & ECT ECU faulty	○	○
62 (AT-52)	No.1 Solenoid Valve Circuit Malfunction	• Open or short in No.1 solenoid valve circuit • No.1 solenoid valve faulty • Engine & ECT ECU faulty	○	○
63 (AT-52)	No.2 Solenoid Valve Circuit Malfunction	• Open or short in No.2 solenoid valve circuit • No.2 solenoid valve faulty • Engine & ECT ECU faulty	○	○
64 (AT-56)	Lock-up Solenoid Valve Circuit Malfunction	• Open or short in lock-up solenoid valve circuit • Lock-up solenoid valve faulty • Engine & ECT ECU faulty	×	○

- Trouble Area

Indicates the suspect area of the problem.

5 MATRIX CHART OF PROBLEM SYMPTOMS

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

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

• Problem Symptom

• Page

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

• Circuit or Part Name

Indicates the circuit or part which needs to be checked.

MATRIX CHART OF PROBLEM SYMPTOMS

AT-64-61

If a normal code is displayed during the DTC check but the trouble still occurs, check the circuits for each symptom in the order given in the charts on the following pages and proceed to the page given for troubleshooting.

The Matrix Chart is divided into 3 chapters.

Chapter 1: Electronic Circuit Matrix Chart

Chapter 2: On-Vehicle Repair Matrix Chart

Chapter 3: Off-Vehicle Repair Matrix Chart

When troubleshooting, check Chapter 1 first. If instructions are given in Chapter 1 to proceed to Chapter 2 or 3, proceed as instructed.

1. If the instruction "Proceed to next circuit inspection shown on matrix chart" is given in the flow chart for each circuit, proceed to the circuit with the next highest number in the table to continue the check.
2. If the trouble still occurs even though there are no abnormalities in any of the other circuits, then check or replace the ECM.

Chapter 1. Electronic Circuit

See Page		AT-60	AT-63	AT-65	AT-69	AT-75	AT-78	AT-81	AT-35
Suspect Area		Neutral start switch circuit	O/D cancel signal circuit (5VZ-FE only)	O/D main switch & O/D OFF indicator light circuit	Pattern select switch circuit	Stop light switch circuit	Throttle position sensor circuit	Water temperature sensor circuit	ECM
No up-shift	A particular gear, from 1st to 3rd gear, is not up-shifted	1							2
	3rd → O/D			3			2	1	4
No down-shift	O/D → 3rd		2	1					3
	A particular gear, from 1st to 3rd gear, is not down-shifted	1							2
No lock-up						1			2
						1			2
On low					1				
	O/D main switch is OFF			1					
Engine is cold									

• Circuit Inspection, Inspection Order

Indicates the circuit which needs to be checked for each problem symptom. Check in the order indicated by the numbers.

IN

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6 CIRCUIT INSPECTION

How to read and use each page is shown below.

- Diagnostic Trouble Code No. and Detection Item

- Circuit Description

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

DTC	38	ATF Temperature Sensor Circuit Malfunction
-----	----	--

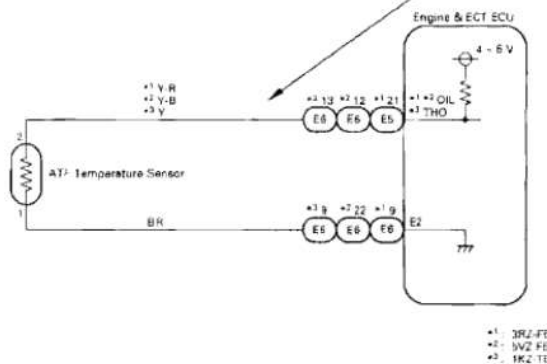
CIRCUIT DESCRIPTION

The ATF temperature sensor converts fluid temperature into a resistance value which is input into the Engine & ECT ECU.

DTC No.	DTC Detecting Condition	Trouble Area
38	Either a) or b) is detected for 0.5 sec. or more. a) Temp. sensor resistance is less than 79 Ω. b) After the engine has been operating for 15 minutes or more, the resistance at the temp. sensor is more than 156 kΩ.	- Open or short in ATF temperature sensor - ATF temperature sensor - Engine & ECT ECU

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

WIRING DIAGRAM



- Wiring Diagram

This shows a wiring diagram of the circuit. Use this diagram together with ELECTRICAL WIRING DIAGRAM to thoroughly understand the circuit.

Wire colors are indicated by an alphabetical code.

B = Black L = Blue R = Red

BR = Brown LG = Light Green V = Violet

G = Green O = Orange W = White

GR = Gray P = Pink Y = Yellow

The first letter indicates the basic wire color and the second letter indicates the color of the stripe.

*1 3R2 FE
*2 3W2 FE
*3 1K2 TE

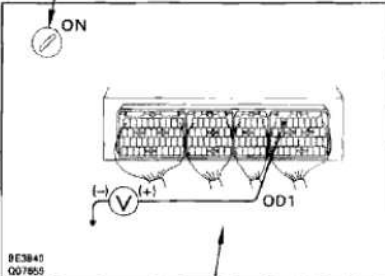
- Indicates the position of the ignition switch during the check.



Inspection Procedure

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

1 Check voltage between terminal OD1 of Engine & ECT ECU and body ground.



PREPARATION:
Turn the ignition switch ON.

CHECK:
Measure voltage between terminal OD1 of Engine & ECT ECU and body ground.

OK:
Voltage: 9 ~ 14 V

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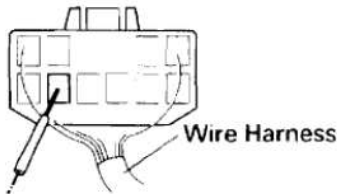
OK

Proceed to next circuit inspection shown on matrix chart (See page AT-39).

2 Check voltage between terminal OD of cruise control ECU harness side connector and body ground.



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



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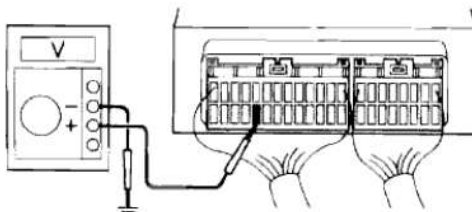
Check from the connector back side.
(with harness)



BE4077

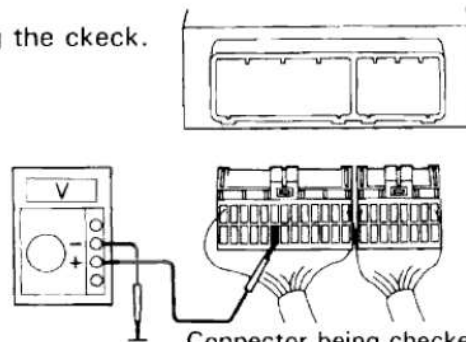
Check from the connector front side (without harness)
In this case, care must be taken not to bend the terminals.

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



Connector being checked is connected.

BR5459



Connector being checked is disconnected.

BR5450

HOW TO USE THE DIAGNOSTIC CHART AND INSPECTION PROCEDURE

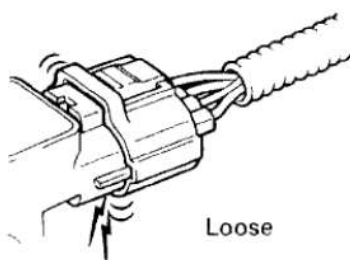
1. For troubleshooting, diagnostic trouble code charts or problem symptom charts are provided for each circuit with detailed inspection procedures on the following pages.
2. When all the component parts, wire harnesses and connectors of each circuit except the ECU are found to be normal in troubleshooting,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

Check Wire Harness and Connector

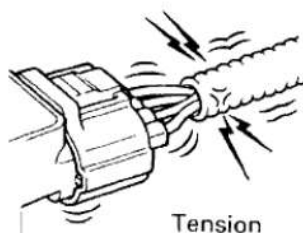
The problem in the wire harness or connector is an open circuit or a short circuit.

OPEN CIRCUIT:

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



F17049



F17048

HINT:

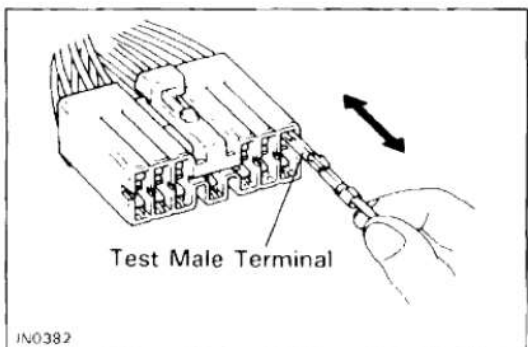
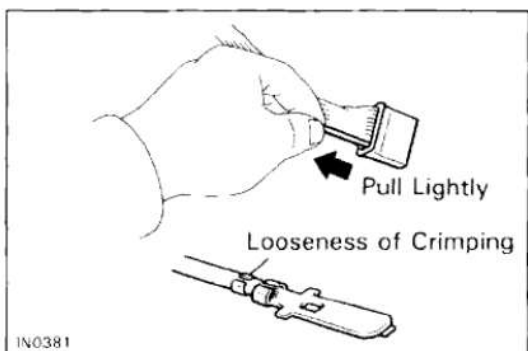
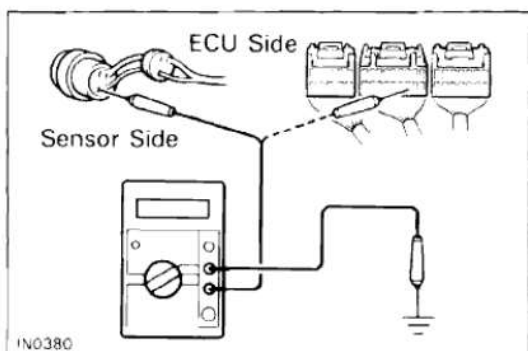
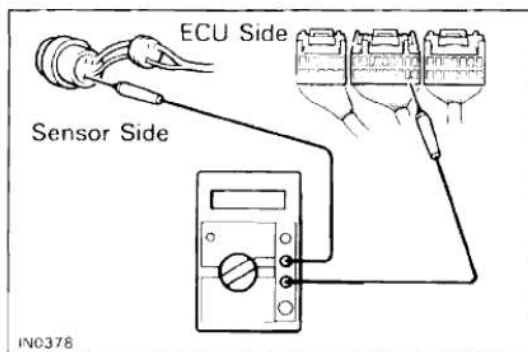
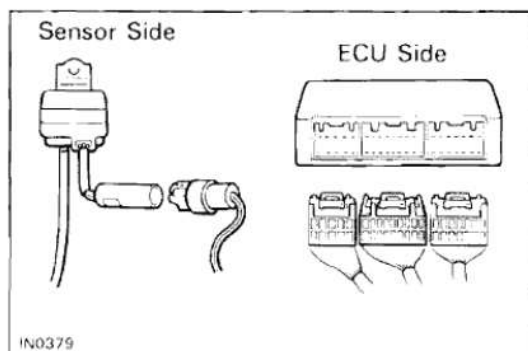
1. It is rarely the case that a wire is broken in the middle of it. Most cases occur at the connector. In particular, carefully check the connectors of sensors and actuators.
2. Faulty contact could be due to rusting of the connector terminals, to foreign materials entering terminals or a drop in the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

SHORT CIRCUIT:

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

HINT:

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



1. CONTINUITY CHECK (OPEN CIRCUIT CHECK)

- (1) Disconnect the connectors at both ECU and sensor sides.
- (2) Measure the resistance between the applicable terminals of the connectors.

Resistance: 1 Ω or less

HINT:

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

2. RESISTANCE CHECK (SHORT CIRCUIT CHECK)

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

Resistance: 1 M Ω or higher

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

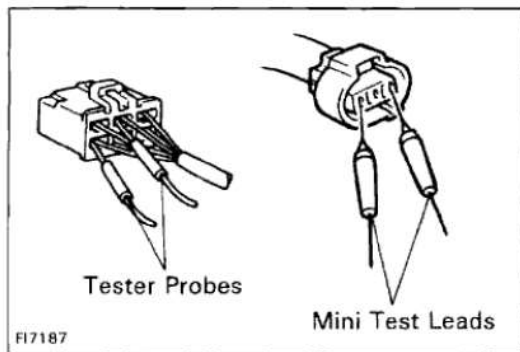
3. VISUAL CHECK AND CONTACT PRESSURE CHECK

- (1) Disconnect the connectors at both ends.
- (2) Check for rust or foreign material, etc. on the terminals of the connectors.
- (3) Check crimped portions for looseness or damage and check if the terminals are secured in the lock position.

HINT: The terminals should not come out when pulled lightly.

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

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



4. CONNECTOR HANDLING

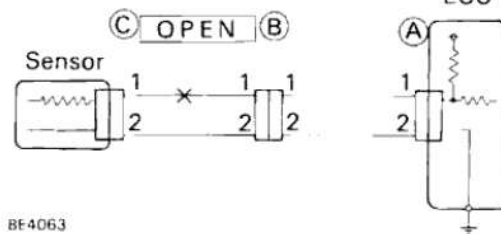
When inserting tester probes into a connector, insert them from the rear of the connector. When necessary, use mini test leads. For water resistant connectors which cannot be accessed from behind, take good care not to deform the connector terminals.

Actual examples of the inspection method for open circuit and short circuit are explained below.

1. OPEN CIRCUIT CHECK

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

Fig. 1



BF4063

(a) Continuity Check

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

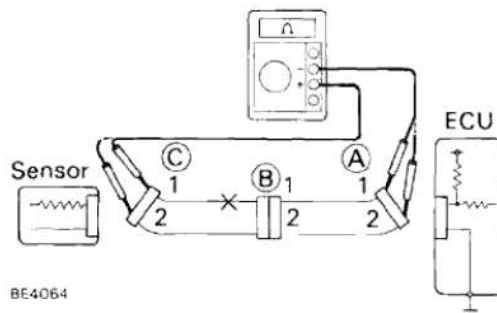
In the case of Fig. 2,

Between terminal 1 of connector (A) and terminal 1 of connector (C) → No continuity (open)

Between terminal 2 of connector (A) and terminal 2 of connector (C) → Continuity

Therefore, it is found out that there is an open circuit between terminal 1 of connector (A) and terminal 1 of connector (C).

Fig. 2



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- (2) Disconnect connector (B) and measure the resistance between connectors (A) and (B1), (B2) and (C).

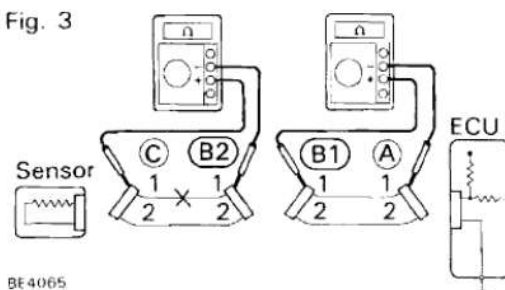
In the case of Fig. 3,

Between terminal 1 of connector (A) and terminal 1 of connector (B1) → Continuity

Between terminal 1 of connector (B2) and terminal 1 of connector (C) → No Continuity (open)

Therefore, it is found out that there is an open circuit between terminal 1 of connector (B) and terminal 1 of connector (C).

Fig. 3



BE4065

(b) Voltage Check

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

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

If the results are:

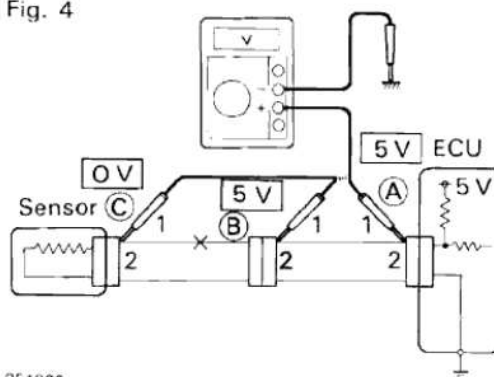
5 V: Between Terminal 1 of connector (A) and Body Ground

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

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

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

Fig. 4

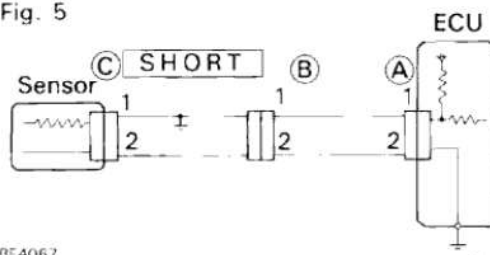


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2. SHORT CIRCUIT CHECK

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

Fig. 5



BE4067

(a) Continuity Check with Ground

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

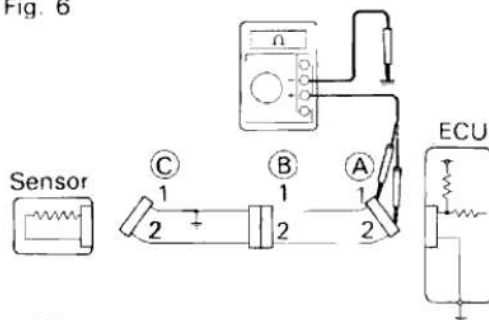
In the case of Fig. 6,

Between terminal 1 of connector A and body ground → Continuity

Between terminal 2 of connector A and body ground → No continuity (short)

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

Fig. 6



BE4068

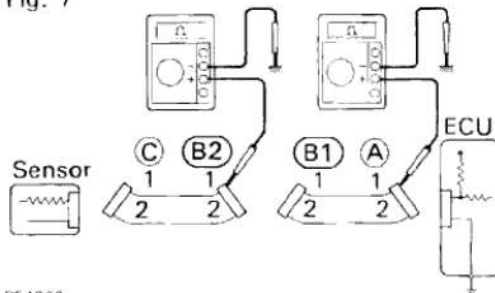
- (2) Disconnect connector B and measure the resistance between terminal 1 of connector A and body ground, and terminal 1 of connector B2 and body ground.

Between terminal 1 of connector A and body ground → No continuity (short)

Between terminal 1 of connector B2 and body ground → Continuity

Therefore, it is found out that there is a short circuit between terminal 1 of connector B2 and terminal 1 of connector C.

Fig. 7

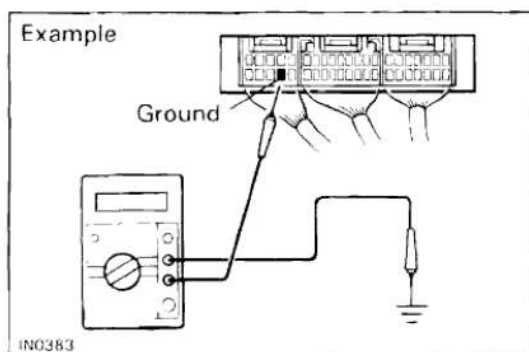


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Check and Replace ECU

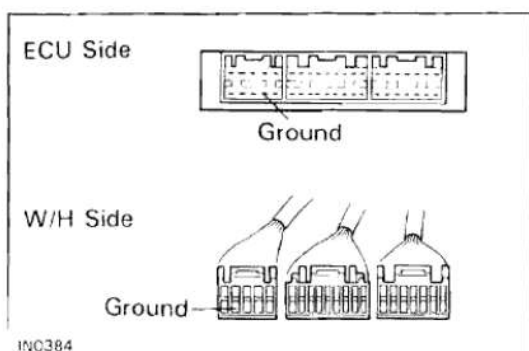
First check the ECU ground circuit. If it is faulty, repair it. If it is normal, the ECU could be faulty, so replace the ECU with a known good one and check if the symptoms appear.

IN



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

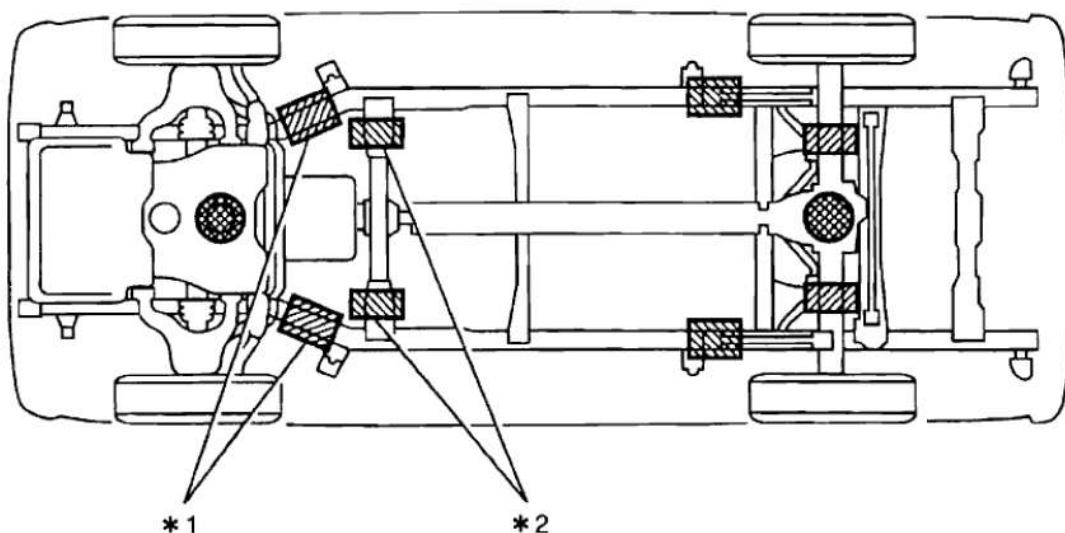
Resistance: 1 Ω or less



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

VEHICLE LIFT AND SUPPORT LOCATIONS

IR007-ST



JACK POSITION

Front Center of crossmember

Rear Center of rear axle housing

SUPPORT POSITION

Safety stand Swing arm type lift 

* 1 : Support position when equipping without side step.

* 2 : Support position when equipping with side step.

CAUTION : For 3 door models, do not use the swing arm type lift as this type lift may not support the short wheel based models securely.

ABBREVIATIONS USED IN THIS MANUAL

IM010-28

ABS	Anti-Lock Brake System
ALR	Automatic Locking Retractor
A/T	Automatic Transmission
ATF	Automatic Transmission Fluid
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
CB	Circuit Breaker
CRS	Child Restraint System
Diff. Lock	Differential Locking System
DP	Dash Pot
DTC	Diagnostic Trouble Code
ECU	Electronic Control Unit
E/G	Engine
ELR	Emergency Locking Retractor
ESA	Electronic Spark Advance
FIPG	Formed in Place Gasket
FL	Fusible Link
Fr	Front
IG	Ignition
IN	Intake (Manifold, Valve)
I/P	Instrument Panel
J/B	Junction Block
LED	Light Emitting Diode
LH	Left-Hand
LSPV	Load Sensing Proportioning Valve
Max.	Maximum
Min.	Minimum
MP	Multipurpose
M/T	Manual Transmission
O/D, OD	Overdrive
O/S	Oversize
PCV	Positive Crankcase Ventilation
PKB	Parking Brake
PS	Power Steering
RH	Right-Hand
Rr	Rear
SRS	Supplemental Restraint System
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch

IN

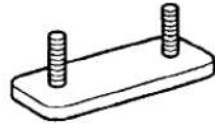
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TDC	Top Dead Center
TEMP.	Temperature
T/M	Transmission
U/S	Undersize
VCV	Vacuum Control Valve
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
w/	With
w/o	Without

STANDARD BOLT TORQUE SPECIFICATIONS

IN008-01

HOW TO DETERMINE BOLT STRENGTH

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

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