

INTRODUCTION

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INTRODUCTION — HOW TO USE THIS MANUAL

HOW TO USE THIS MANUAL

INDEX

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

GENERAL DESCRIPTION

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

Read these precautions before starting any repair task.

TROUBLESHOOTING

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

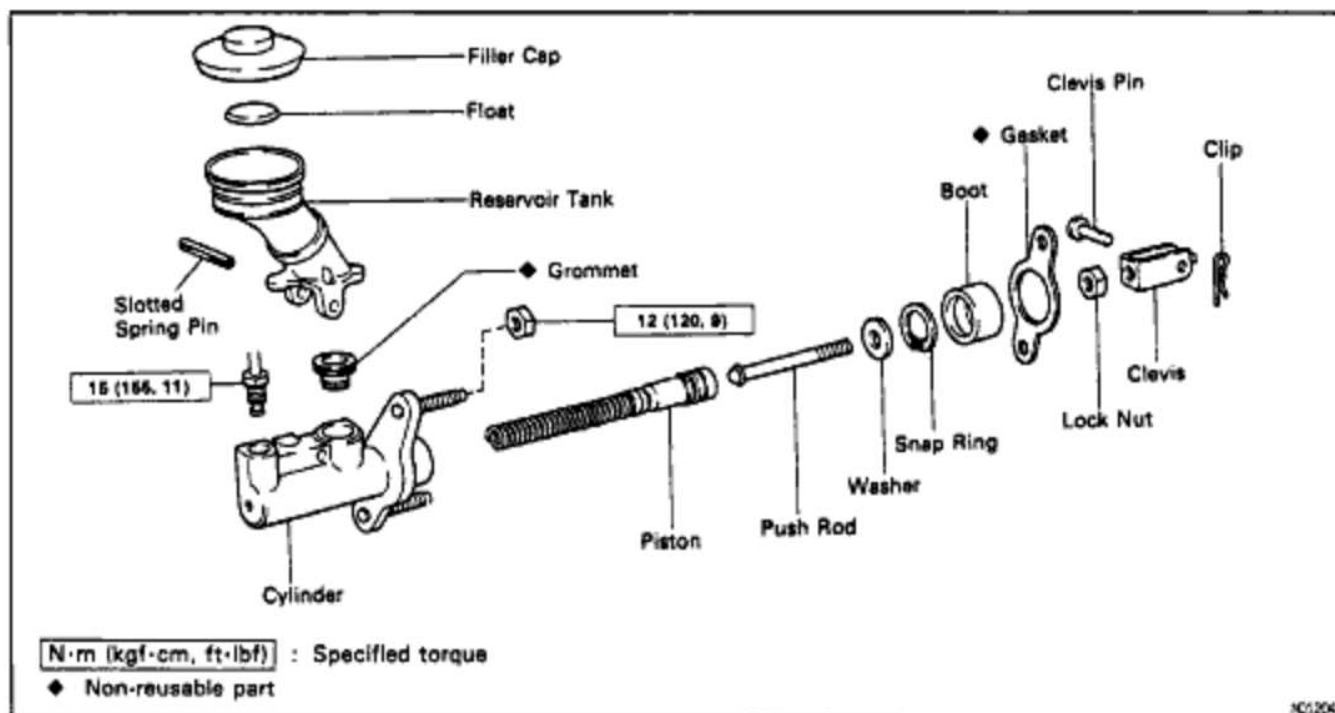
PREPARATION

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

REPAIR PROCEDURES

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

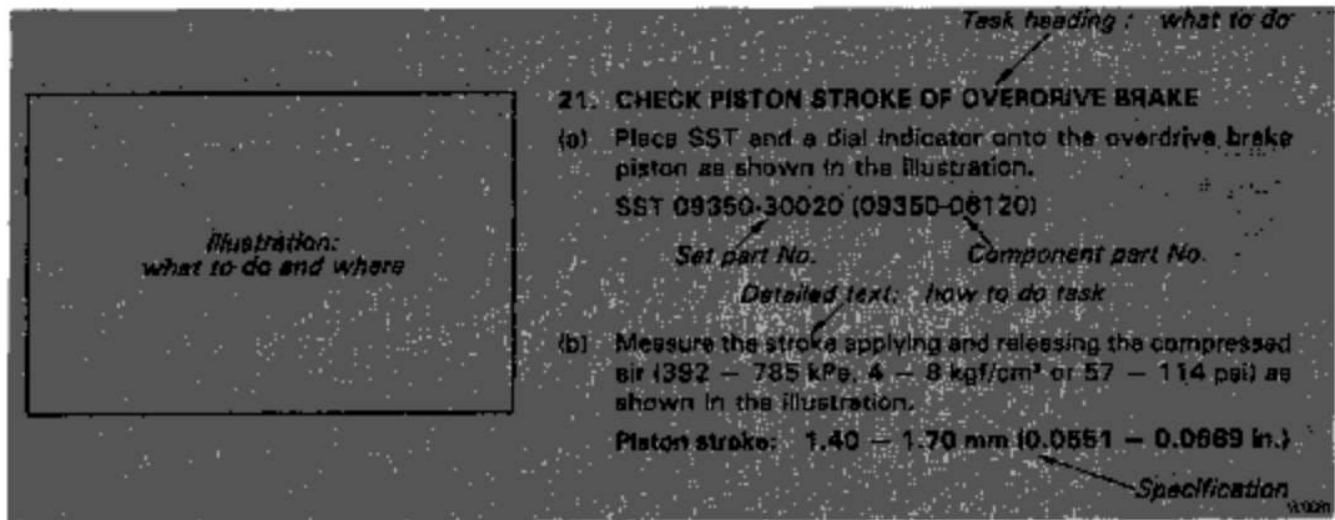
Example:



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

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

Example:



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

REFERENCES

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

SPECIFICATIONS

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

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CAUTIONS, NOTICES, HINTS:

IN03B-01

- **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.

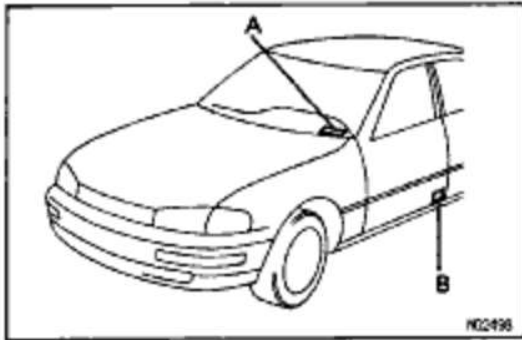
SI UNIT

IN03F-01

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)

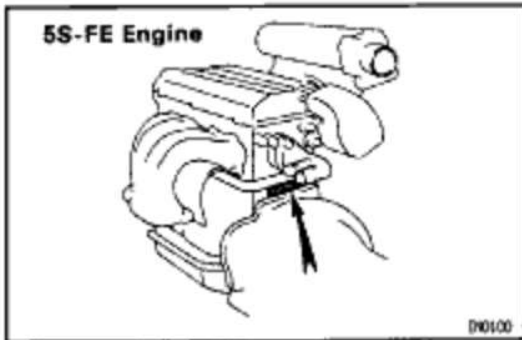


IDENTIFICATION INFORMATION

VEHICLE IDENTIFICATION NUMBER

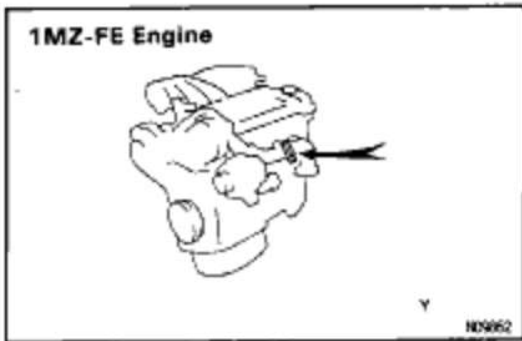
The vehicle identification number is stamped on the vehicle identification number plate and certification label.

- A. Vehicle Identification Number Plate
- B. Certification Label



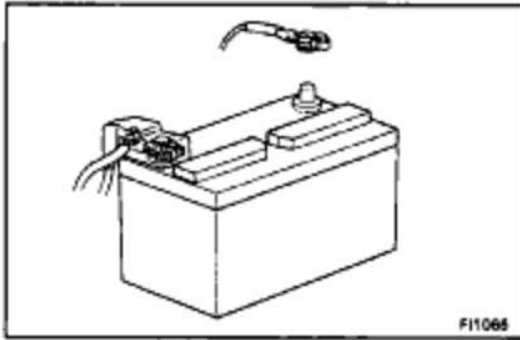
ENGINE SERIAL NUMBER

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



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INTRODUCTION – GENERAL REPAIR INSTRUCTIONS

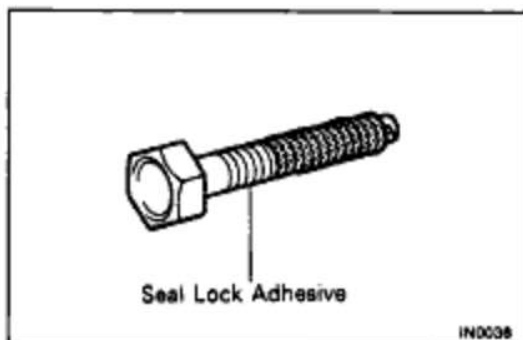


GENERAL REPAIR INSTRUCTIONS

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:

CAUTION: Work must be started after approx 90 seconds from the time the ignition switch is turned to the "LOOK" position and the negative (-) terminal cable is disconnected from the battery (See page RS-2).

- (a) Before performing electrical work, disconnect the negative cable from the battery terminal.
 - (b) If it is necessary to disconnect the battery for inspection or repair, always disconnect the cable from the negative (-) terminal which is grounded to the vehicle body.
 - (c) To prevent damage to the battery terminal post, loosen the terminal nut and raise the cable straight up without twisting or prying it.
 - (d) Clean the battery terminal posts and cable terminals with a clean shop rag. Do not scrape them with a file or other abrasive objects.
 - (e) Install the cable terminal to the battery post with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the terminal onto the post.
 - (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.



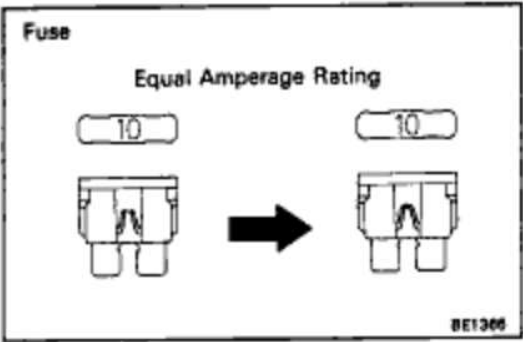
6. Precoated parts

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.

INTRODUCTION – GENERAL REPAIR INSTRUCTIONS

- (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.



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.

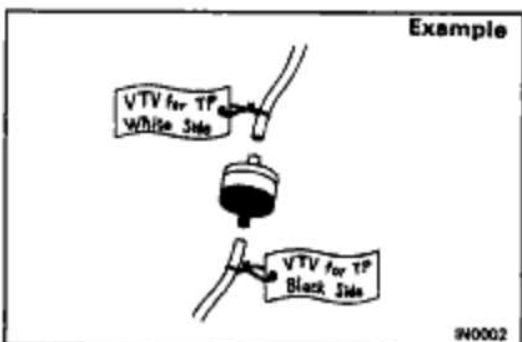
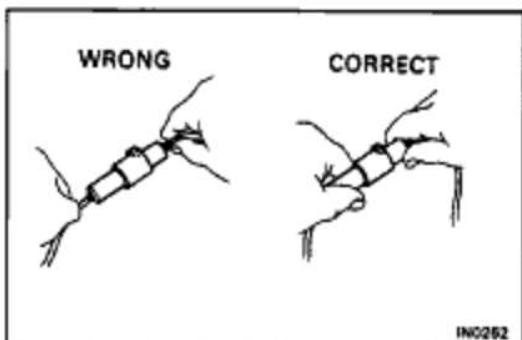
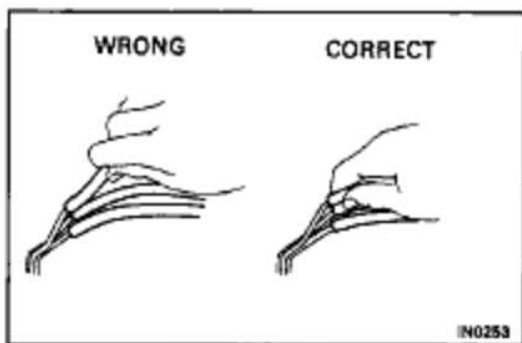
Illustration	Symbol	Part Name	Abbreviation
 BE5584	 IN0365	FUSE	FUSE
 BE5585	 IN0366	MEDIUM CURRENT FUSE	M-FUSE
 BE5586	 IN0367	HIGH CURRENT FUSE	H-FUSE
 BE5587	 IN0367	FUSIBLE LINK	FL
 BE5588	 IN0368	CIRCUIT BREAKER	CB

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INTRODUCTION – GENERAL REPAIR INSTRUCTIONS

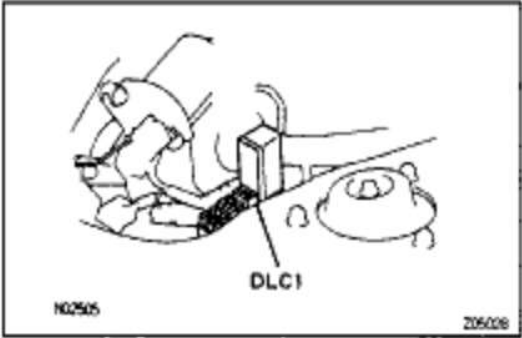
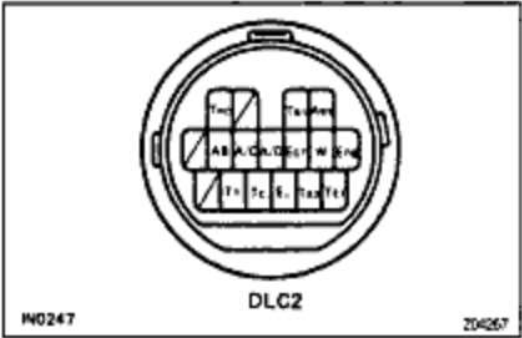
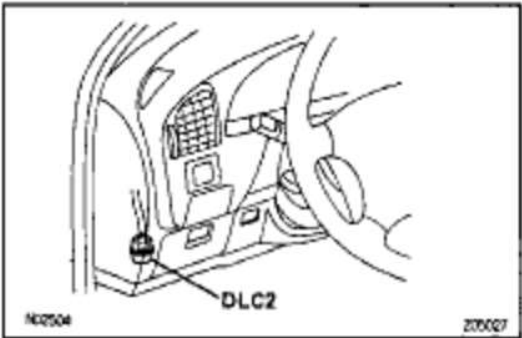
11. Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations (See page IN-37)
 - (a) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels at the opposite end in order to ensure safety.
 - (b) 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 parts:
 - (a) Do not open the cover or case of the ECU, ECM, PCM or TCM 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 distributor, air filter, and VCV 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.

INTRODUCTION – GENERAL REPAIR INSTRUCTIONS

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.



FOR VEHICLES WITH DATA LINK CONNECTOR 2 (DLC2)

The DLC2 is provided inside the cabin (located under the left side instrument panel) as a connector exclusively for diagnosis of data from the engine, automatic transmission, ABS, A/C, Airbag and Cruise Control System to improve serviceability. The DLC1 inside the engine compartment is used for engine adjustment.

Connecting the following terminals of the DLC2 to terminal E, selects the diagnosis mode shown.

NOTICE: Never make a mistake with the terminal connection position as this will cause a malfunction.

Terminal	System
T _n	Engine and automatic transmission (Normal mode)
TE2 and TE1	Engine and automatic transmission (Test mode)
T _e	ABS, A/C, Airbag and Cruise Control System
T _r	Automatic transmission

Refer to the respective system for the inspection method.

HINT: By connecting the DLC2 up to a monitor specifically designed for use with the DLC2, the diagnosis result for each system can be read easily.

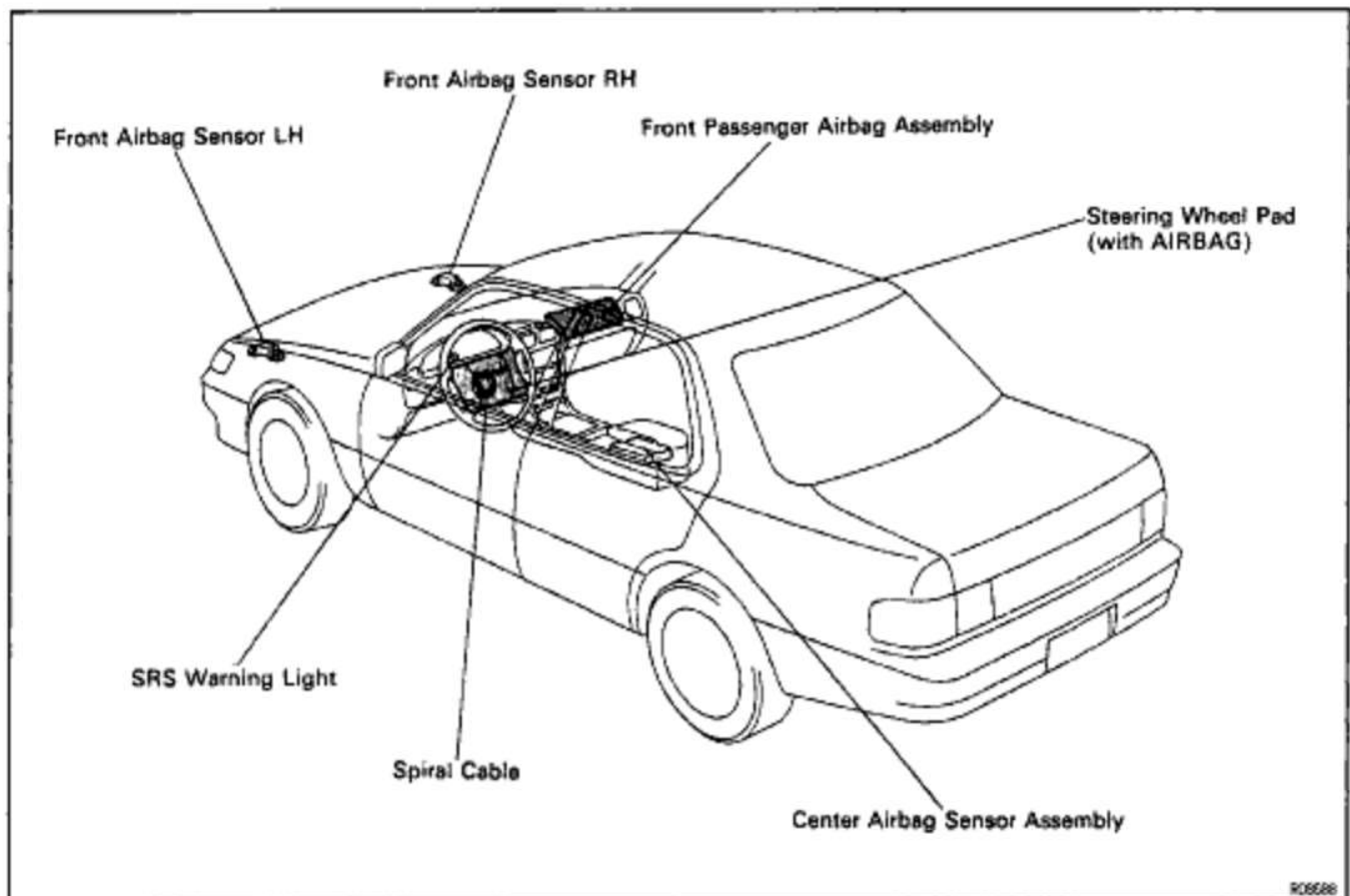
PRECAUTION FOR VEHICLES EQUIPPED WITH SRS AIRBAG

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The 1994 CAMRY specifications is equipped with an SRS (Supplemental Restraint System) airbag. 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.

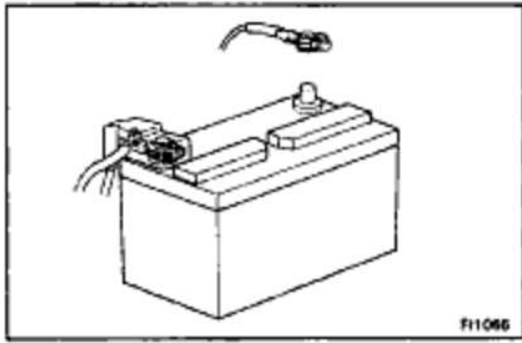
Further, if a mistake is made in servicing the airbag system, it is possible the airbag may fail to operate when required. Before performing servicing (including removal or installation of parts, inspection or replacement), be sure to read the following items carefully, then follow the correct procedure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

Locations of Airbag Components



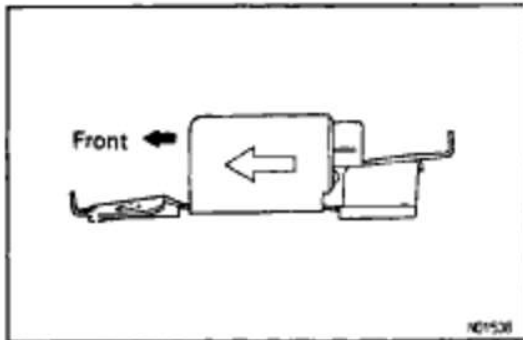
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INTRODUCTION – PRECAUTION



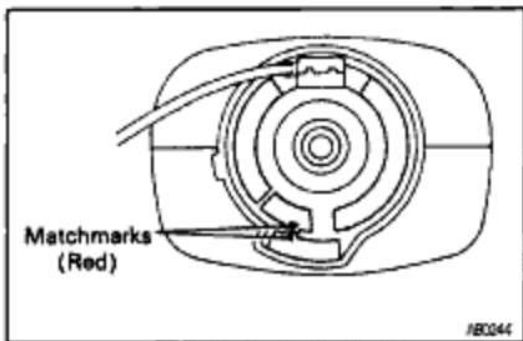
1. Malfunction symptoms of the airbag system are difficult to confirm, so the diagnostic codes become the most important source of information when troubleshooting. When troubleshooting the airbag system, always inspect the diagnostic codes before disconnecting the battery (See page [RS-55](#)).
2. **Work 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 of the battery, the airbag may be deployed.)
 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 front airbag sensors , passenger's airbag assembly and the steering wheel pad should be inspected (See page [RS-17](#), 29, 43).
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. The center airbag sensor assembly contains mercury. After performing replacement, do not destroy the old part. When scrapping the vehicle or replacing the center airbag sensor assembly itself, remove the center airbag sensor assembly and dispose of it as toxic waste.
7. Never disassemble and repair the front airbag sensors, center airbag sensor assembly or steering wheel pad in order to reuse it.
8. If the front airbag sensors, center airbag sensor assembly or steering wheel pad have been dropped, or if there are cracks, dents or other defects in the case, bracket or connector, replace them with new ones.
9. Do not expose the front airbag sensors, center airbag sensor assembly or steering wheel pad directly to hot air or flames.
10. Use a volt/ohmmeter with high impedance (10 k Ω /V minimum) for troubleshooting of the electrical circuit.

11. Information labels are attached to the periphery of the airbag components. Follow the notices.
12. After work on the airbag system is completed, perform the airbag warning light check (See page RS-55).



Front Airbag Sensor

1. Never reuse the front airbag sensors involved in a collision when the airbag has deployed. (Replace both left and right airbag sensors.)
2. Install the front airbag sensor with the arrow on the sensor facing toward the front of the vehicle.
3. The front airbag sensor set bolts have been anti-rust treated. When the sensor is removed, always replace the set bolts with new ones.
4. The front airbag sensor is equipped with an electrical connection check mechanism. Be sure to lock this mechanism securely when connecting the connector. If the connector is not securely locked, a malfunction code will be detected by the diagnosis system (See page RS-13).



Spiral Cable (in Combination Switch)

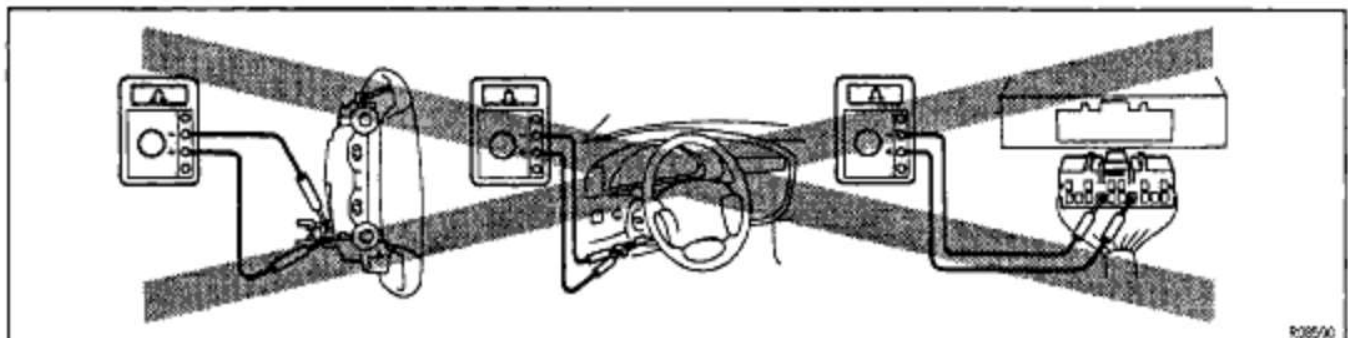
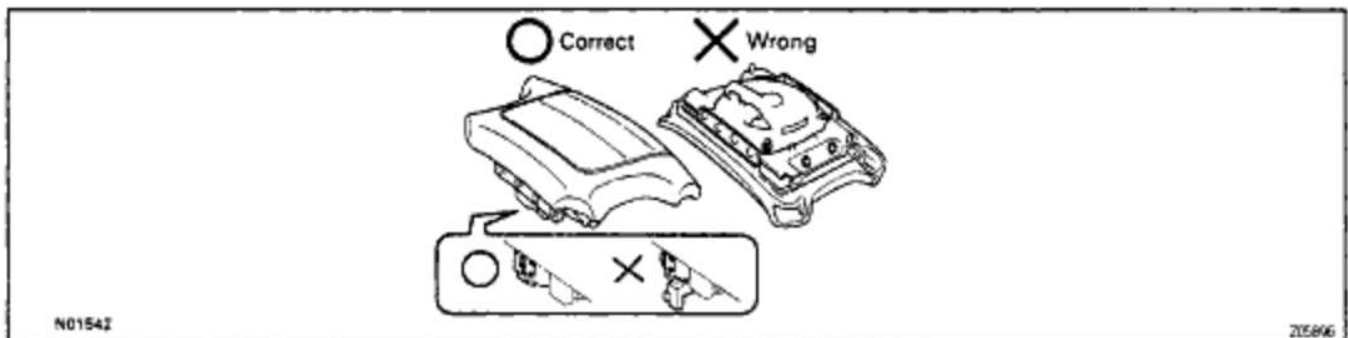
The steering wheel must be fitted correctly to the steering column with the spiral cable at the neutral position; otherwise cable disconnection and other troubles may result. Refer to page RS-19 concerning correct steering wheel installation.

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INTRODUCTION – PRECAUTION

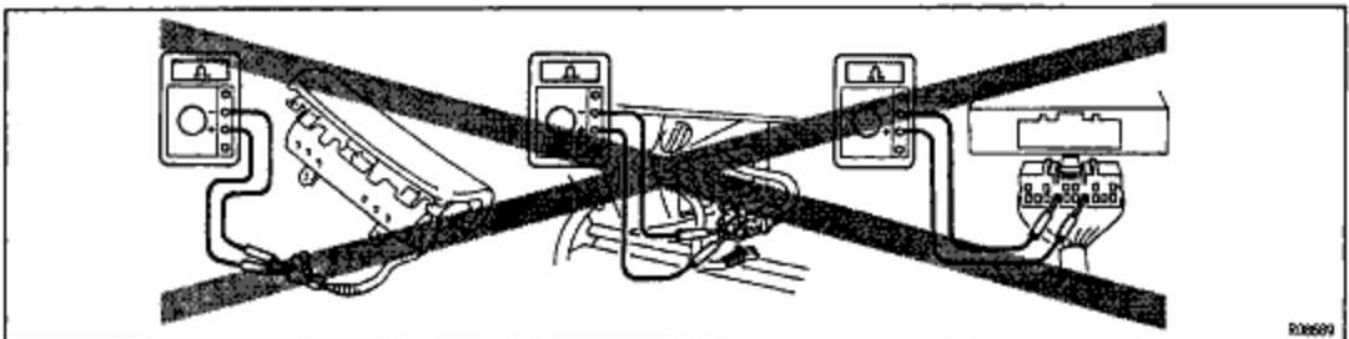
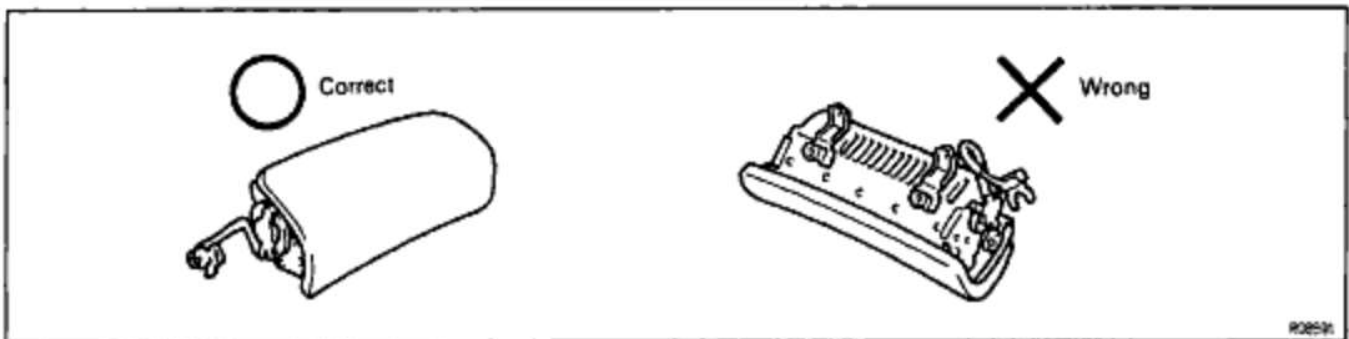
Steering Wheel Pad (with Airbag)

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. And 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-22). Perform the operation in a place away from electrical noise.



Front Passenger Airbag Assembly

1. Always store a removed or new front passenger airbag assembly with the airbag door facing up. Storing the airbag assembly with the airbag door 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-35). Perform the operation in a safe place away from electrical noise.



Center Airbag Sensor Assembly

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

Wire Harness and Connector

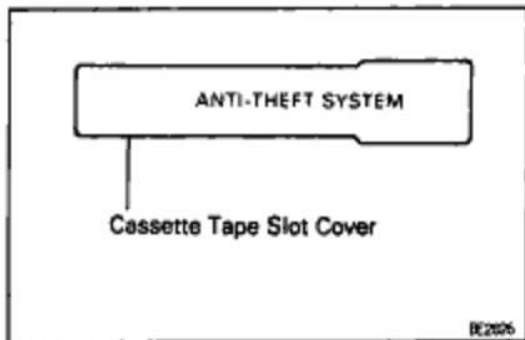
The airbag system's wire harness is integrated with the cowl wire harness assembly. The wires for the airbag wire harness are encased in a yellow corrugated tube. All the connectors for the system are also a standard yellow color. If the airbag system wire harness becomes disconnected or the connector becomes broken due to an accident, etc., repair or replace it as shown on page [RS-50](#).

FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

1990-95

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.**



FOR VEHICLES WITH AN AUDIO SYSTEM WITH BUILT-IN ANTI-THEFT SYSTEM

Audio System displaying the sign "ANTI-THEFT SYSTEM" shown on the left has a built-in anti-theft system which makes the audio system soundless if stolen.

If the power source for the audio system is cut even once, the anti-theft system operates so that even if the power source is reconnected, the audio system will not produce any sound unless the ID number selected by the customer is input again. Accordingly, when performing repairs on vehicles equipped with this system, before disconnecting the battery terminals or removing the audio system the customer should be asked for the ID number so that the technician can input the ID number afterwards, or else a request made to the customer to input the ID number. For the method to input the ID number or cancel the anti-theft system, refer to the Owner's Manual.

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 ECM, ECU and sensors of the vehicle's electronic system.
- (2) Install the antenna feeder at least 20 cm (7.87 in.) away from the ECM, ECU and sensors of the vehicle's electronics systems. For details about ECM, 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

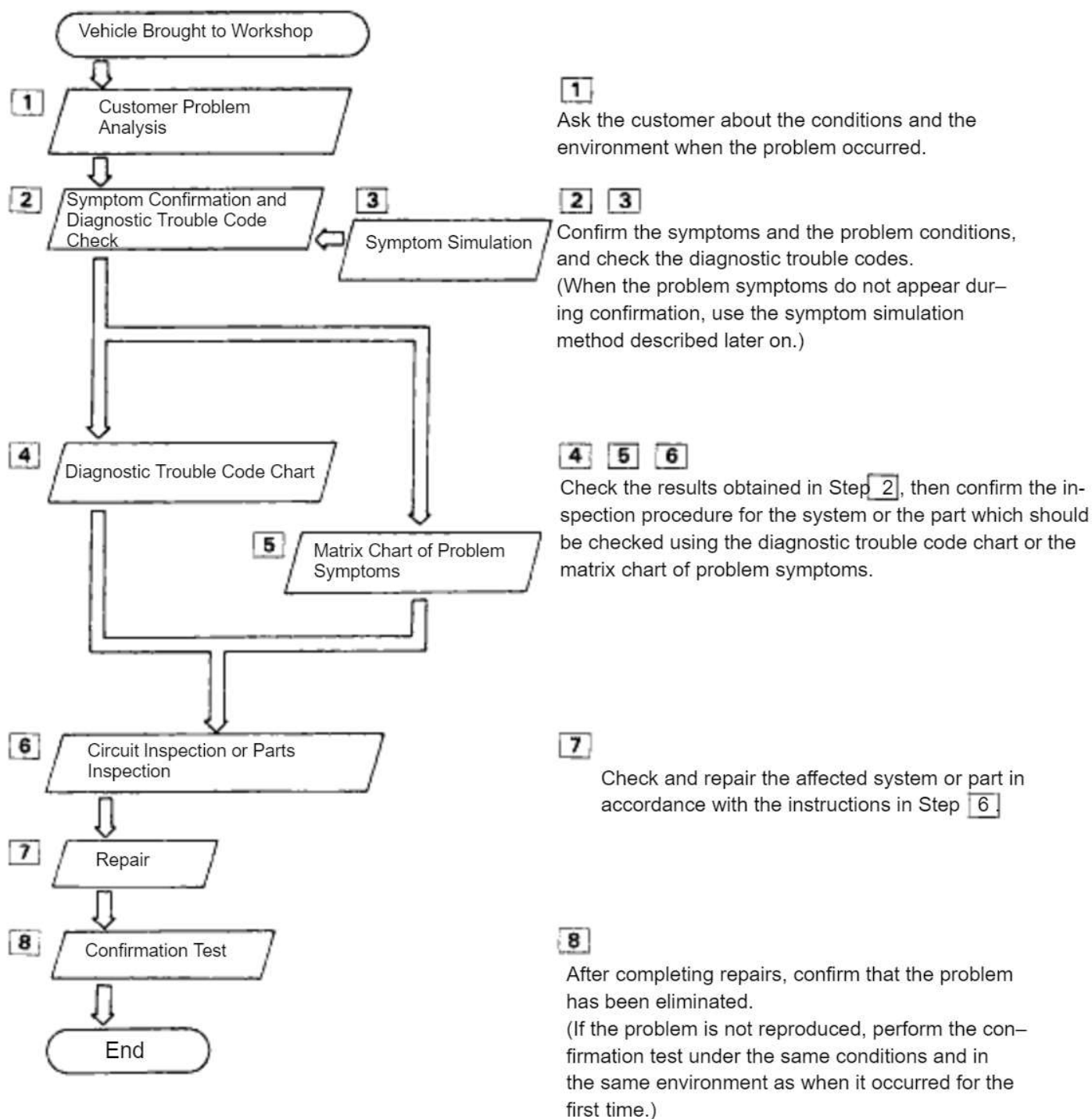
A large number of ECU controlled systems are used in the TOYOTA CAMRY*. In general, the ECU controlled system is considered to be a very intricate system requiring a high level of technical knowledge and expert skill to troubleshoot. However, the fact is that if you proceed to inspect the circuits one 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:

Repair Manual	System		Page
Vol. 1	1.	5S-FE Engine	EG-291
		1MZ-FE Engine	EG-394
Vol. 2	2.	A140E Automatic Transaxle	AX-39
		A541E Automatic Transaxle	AX-49
	3.	Anti-Lock Brake	BR-90
	4.	Supplemental Restraint System	RS-53
	5.	Cruise Control	BE-161

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

HOW TO PROCEED WITH TROUBLESHOOTING

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



1 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) Engine control system check sheet.

CUSTOMER PROBLEM ANALYSIS CHECK SHEET			
ENGINE CONTROL System Check Sheet			Inspector's Name _____
Customer's name		Model and model year	
Driver's name		Frame no.	
Date vehicle brought in		Engine model	
License no.		Odometer reading	km miles
Problem Symptoms	☐ Engine does not Start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion	
	☐ Difficult to Start	☐ Engine cranks slowly ☐ Other _____	
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal [☐ High ☐ Low (rpm)] ☐ Rough idling ☐ Other _____	
	☐ Poor Drivability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after-fire) ☐ Surging ☐ Knocking ☐ Other _____	
	☐ Engine Stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C operation ☐ Shifting from N to D ☐ Other _____	
	☐ Others		
Dates Problem Occurred			
Problem Frequency		☐ Constant ☐ Sometimes (times per day/month) ☐ Once only ☐ Other _____	
Conditions When Problem Occurs	Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Other _____	
	Outdoor Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (approx. °F/ °C)	
	Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other _____	
	Engine Temp.	☐ Cold ☐ Warm ☐ Hot ☐ Any temp. ☐ Other _____ ☐ Racing	

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INTRODUCTION – HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

2 SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE CHECK

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

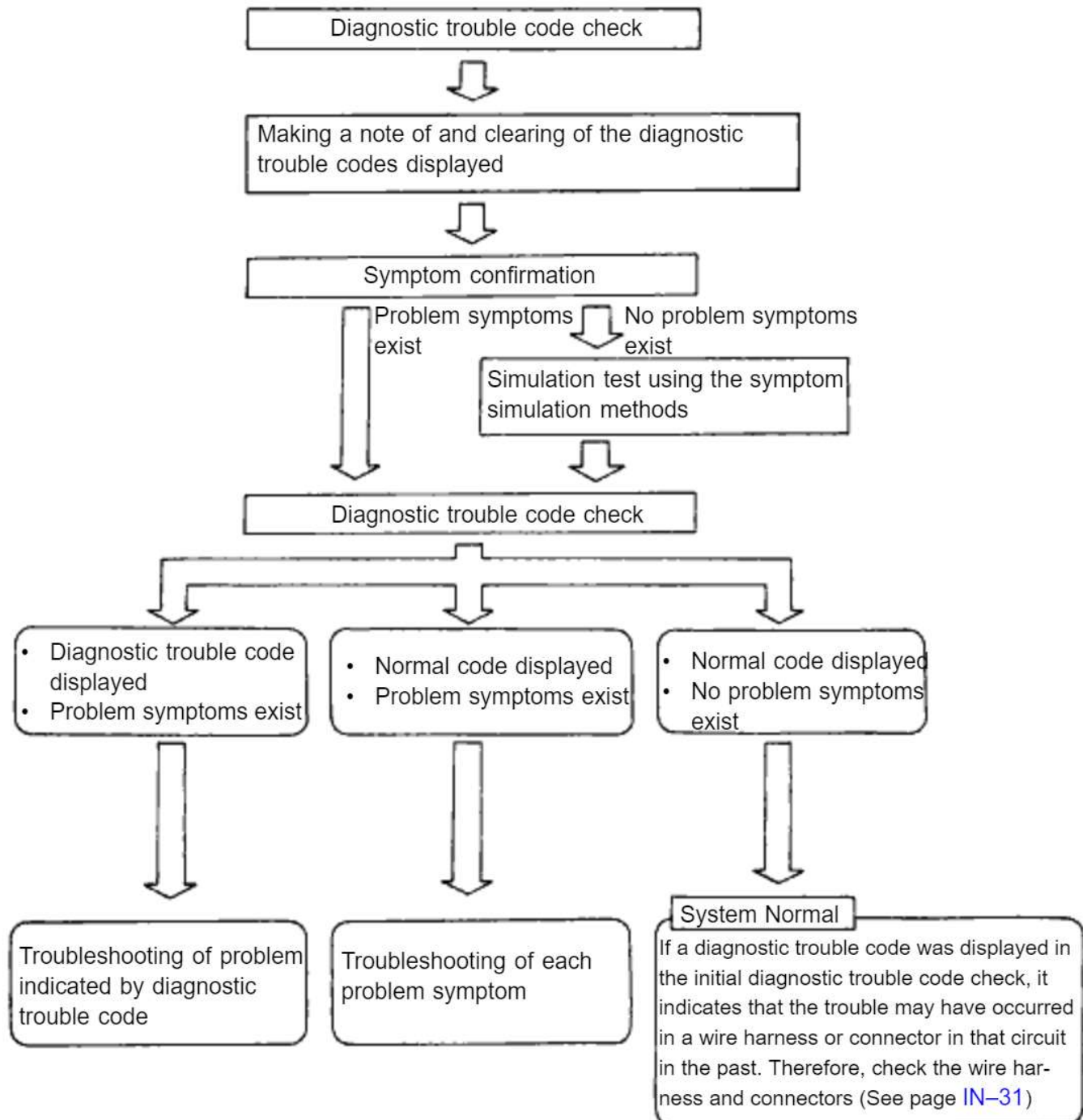
System		Diagnostic Trouble Code Check	Input Signal Check (Sensor Check)	Other Diagnosis Function
Engine	5S-FE	○ (with Test Mode)	○	
	1MZ-FE	○ (with Check Mode)	○	Diagnostic Test Mode
Automatic Transaxle	A140E	○ (with Test Mode)	○	
	A540E	○ (with Check Mode)	○	Diagnostic Test Mode
Anti-Lock Brake		○	○	
Supplemental Restraint System		○		
Cruise Control		○	○	

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.



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INTRODUCTION – HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

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

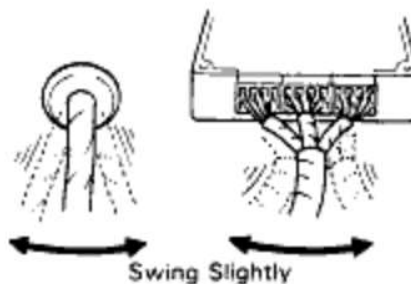
In the symptom simulation test, the problem symptoms should of course be confirmed, but the problem area or parts must also be found out. To do this, narrow down the possible problem circuits according to the symptoms before starting this test and connect a tester beforehand. After that, carry out the 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.

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.

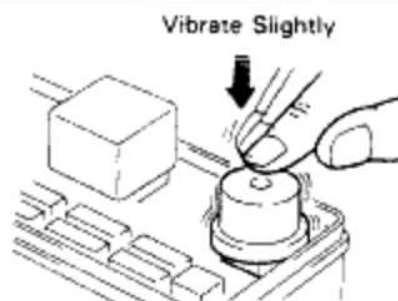


#12331
#12332

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.



#1233C

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



F12334

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)

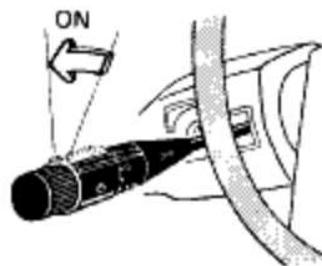
If a vehicle is subject to water leakage, the leaked water may contaminate the ECU. When testing a vehicle with a water leakage problem, special caution must be used.



F15045

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.



F12335

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INTRODUCTION – HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

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.

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

DIAGNOSTIC TROUBLE CODE CHART (SAE Controlled)

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

- Diagnostic Trouble Code Detecting Condition
Indicates the diagnostic trouble code set parameter.

DTC No.	Detection Item	Diagnostic Trouble Code Detecting Condition
P0100	Mass Air Flow Circuit Malfunction	Open or short in mass air flow meter circuit with engine speed 4,000 rpm or less.
P0101	Mass Air Flow Circuit Range/Performance Problem	Conditions a) and b) continue with engine speed 900 rpm or less. (2 trip detection logic) a) Closed throttle position switch: ON b) Mass air flow meter output > 2.2 V
P0110	Intake Air Temp. Circuit Malfunction	Open or short in intake air temp. sensor circuit.
P0115	Engine Coolant Temp. Circuit Malfunction	Open or short in engine coolant temp. sensor circuit.

- Trouble Area
Indicates the suspect area of the problem.

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

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

Trouble Area	MIL	Memory	See Page
• Open or short in mass air flow meter circuit • Mass air flow meter • ECM	○	○	EG-444
• Mass air flow meter	○	○	EG-450
• Open or short in intake air temp. sensor circuit. • Intake air temp. sensor • ECM	○	○	EG-451
• Open or short in engine coolant temp. sensor circuit.			

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 troubleshooting the problem when a "Normal" code is displayed in the diagnostic trouble code check but the problem is still occurring. Numbers in the table indicate the inspection order in which the circuits or parts should be checked.

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

• 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

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

See page		EG-557	EG-565	EG-575	EG-586	AC-36	ST-47, 63	EG-35	AX-81	IN-35
Suspect area		Starter signal circuit	ECM power source circuit	Fuel pump control circuit	Fuel pressure control VSV circuit	A/C signal circuit (Compressor circuit)	Starter and Starter relay	Compression	A/T faulty	Engine control module (ECM)
Does not start	Engine does not crank						1			
	No initial combustion		1	2						
	No complete combustion			1						
Difficult to start	Under normal condition	1		2				3		
	Cold engine	1		2						
	Hot engine	1		3	2					
	High engine idle speed					1				

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

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INTRODUCTION – HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

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	DTC No.	Detection Item
	P0325	Knock Sensor 1 Circuit Malfunction
	P0330	Knock Sensor 2 Circuit Malfunction

CIRCUIT DESCRIPTION

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

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
P0325	No knock sensor 1 signal to ECM with engine speed 2,000 rpm or more.	- Open or short in knock sensor 1 circuit. - Knock sensor 1 (looseness) - ECM
P0330	No knock sensor 2 signal to ECM with engine speed 2,000 rpm or more.	- Open or short in knock sensor 2 circuit. - Knock sensor 2 (looseness) - ECM

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

DIAGNOSTIC CHART

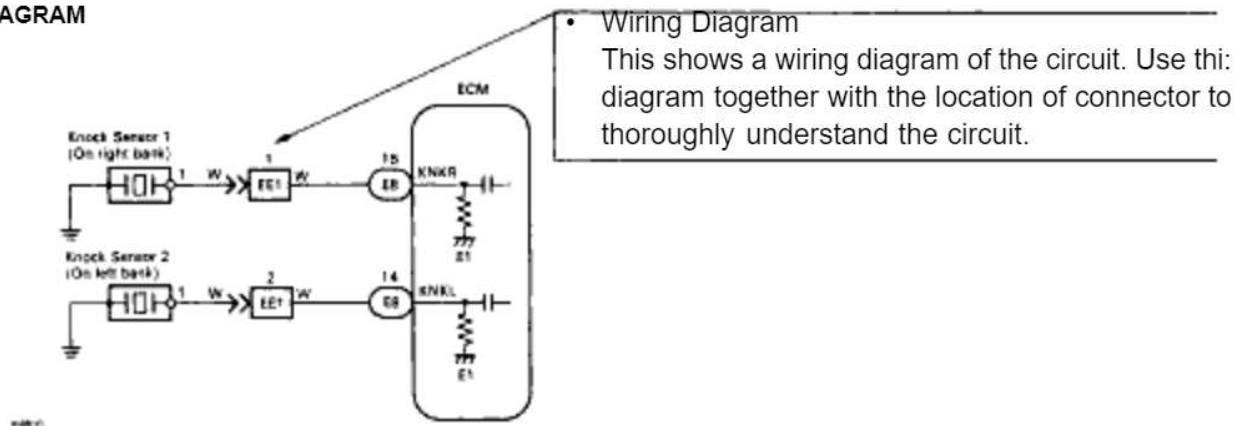
HINT: DTC P0325 is for the right bank knock sensor circuit.
DTC P0330 is for the left bank knock sensor circuit.

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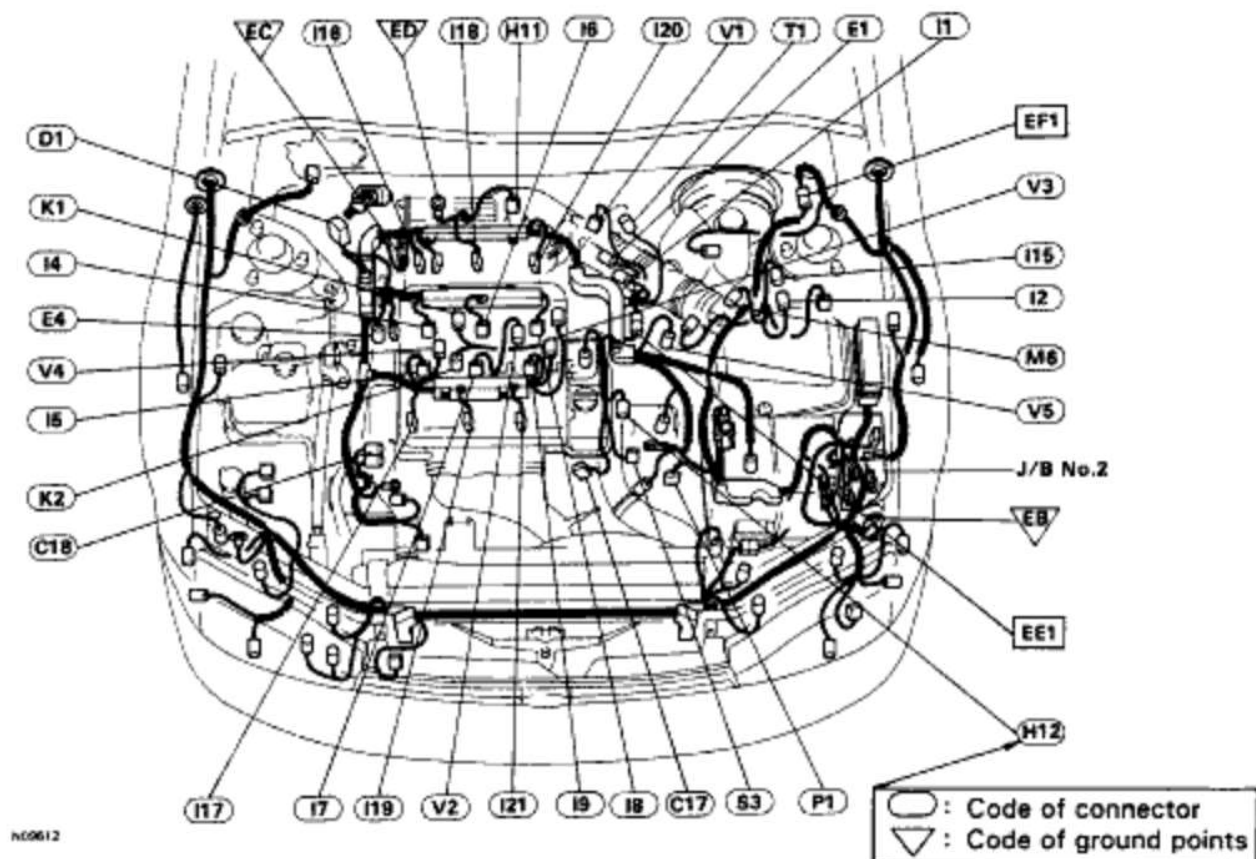
graph TD
    Start([Start]) --> Step1[1 Check knock sensor circuit.]
    Step1 -- Type II --> GoTo3[Go to step 3.]
    Step1 -- Type I --> Step2[2 Check for open and short in harness and connector between EE1 connector and ECM.]
    Step2 -- NG --> Repair[Repair or replace harness or connector.]
    Step2 -- OK --> ReplaceECM[Check and replace ECM.]
  
```

- Diagnostic Chart
The troubleshooting procedure for the circuit is shown in a flow chart. Use it 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. For details of each inspection, the page number of the related "Inspection Procedure" is included.

WIRING DIAGRAM

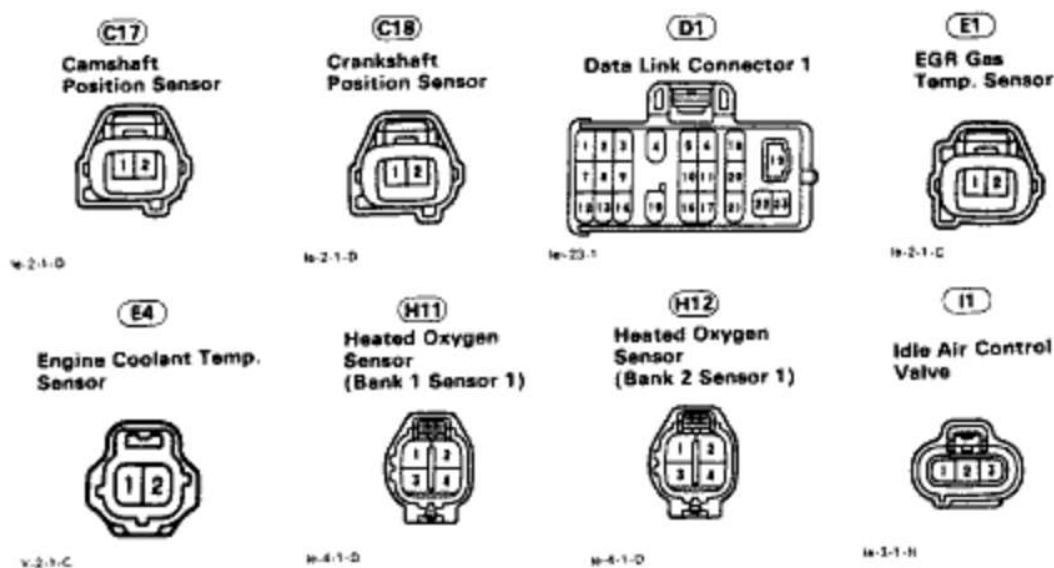


Location of Connectors in Engine Compartment



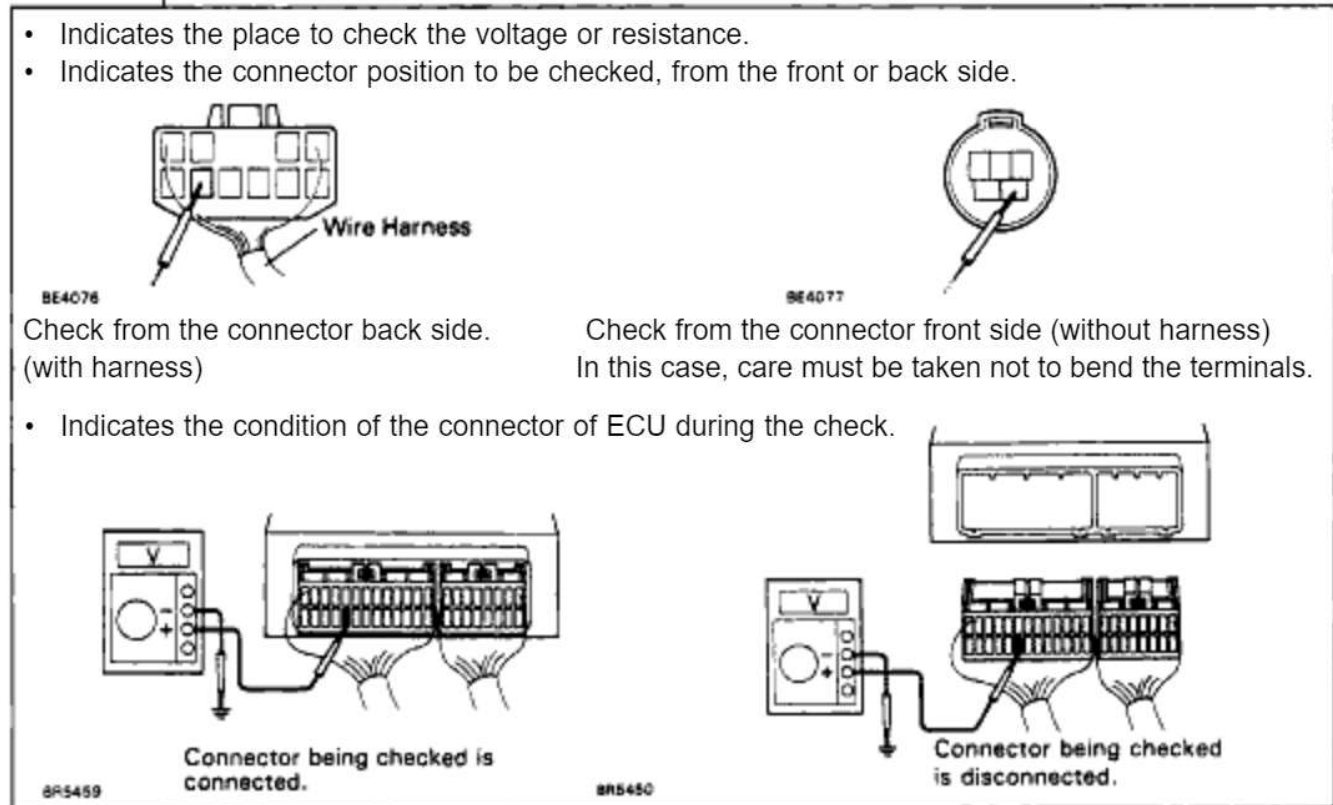
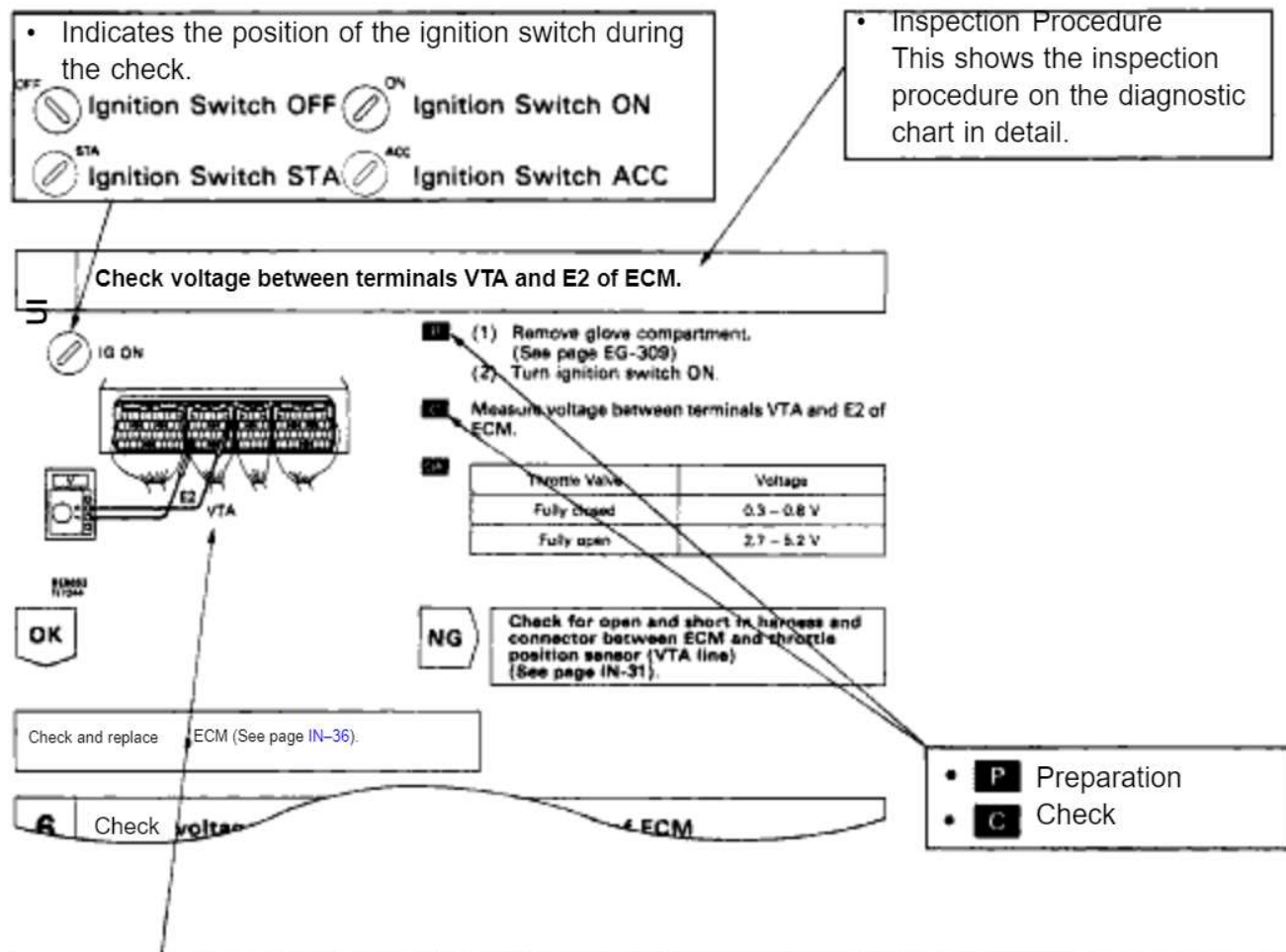
- Location of connectors

This diagram shows the wire harnesses and connectors used in one system. The connector shows the harness side connector, so when checking the part side connector (sensor, actuator, etc.), be careful not to mistake the terminal positions.



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INTRODUCTION – HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS



HOW TO USE THE DIAGNOSTIC CHART AND INSPECTION PROCEDURE

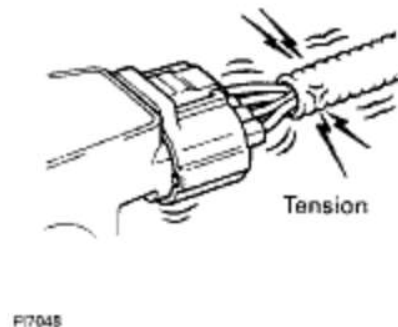
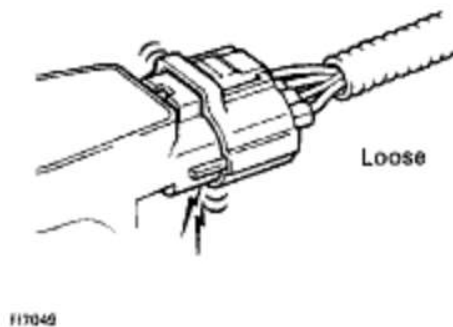
1. For troubleshooting, diagnostic trouble code charts or problem symptom charts are provided for each circuit with detailed inspection procedures on the following page.
2. When all the component parts, wire harnesses and connectors of each circuit except the ECU are found to be normal in troubleshooting, 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.



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:

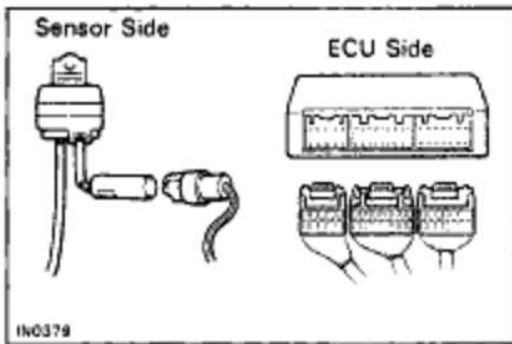
This could be due to a short circuit between the wire harness and the body ground or to a short inside the switch, etc.

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.

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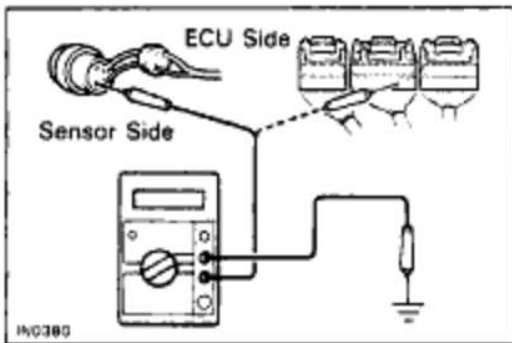
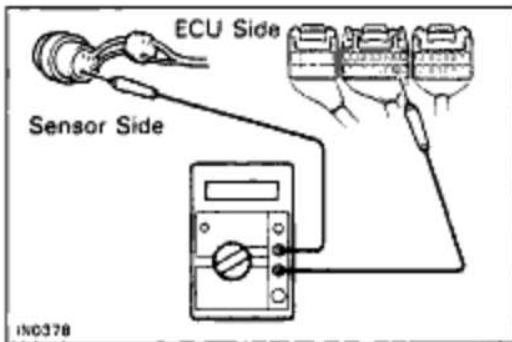
INTRODUCTION – HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

**1. CONTINUITY CHECK (OPEN CIRCUIT CHECK)**

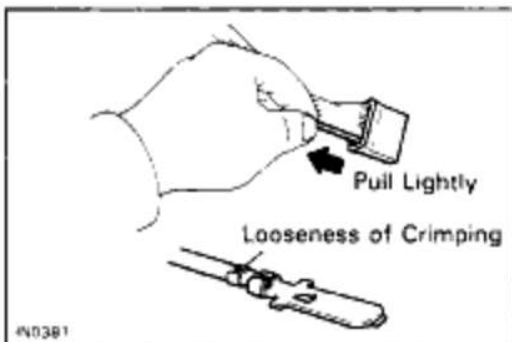
- (1) Disconnect the connectors at both ECU and sensor sides.
- (2) Measure the resistance between the applicable terminals of the connectors.

Resistance: 1Ω or less**HINT:**

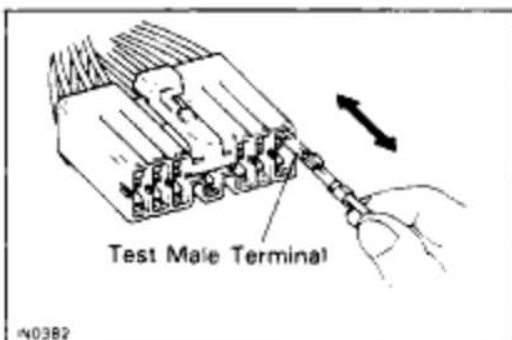
- Measure the resistance while lightly shaking the wire harness vertically and horizontally.
- When tester probes are inserted into a connector, insert the probes from the back. For waterproof connectors in which the probes cannot be inserted from the back, be careful not to bend the terminals when inserting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

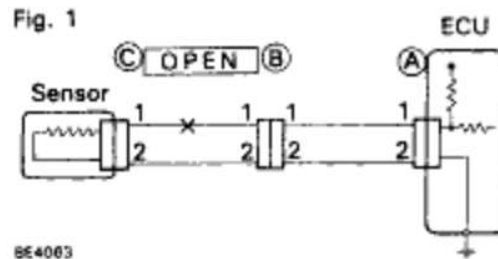
- (4) Prepare a test male terminal and insert it in the female terminal, then pull it out.

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

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.



(a) Continuity Check

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

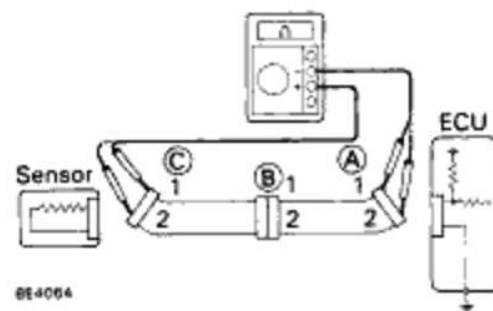
In the case of Fig. 2,

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



(2) Disconnect connector (B) and measure the resistance between connectors (A) and (B), (B) and (C),

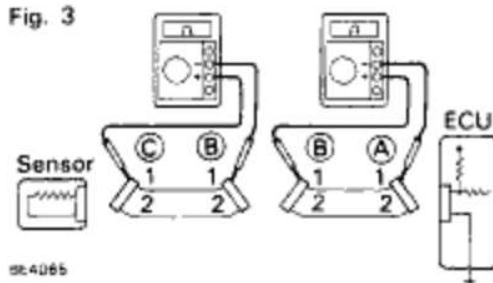
In the case of Fig. 3,

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

Between terminal 1 of connector (B) 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



IN-34**INTRODUCTION – HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS****(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:

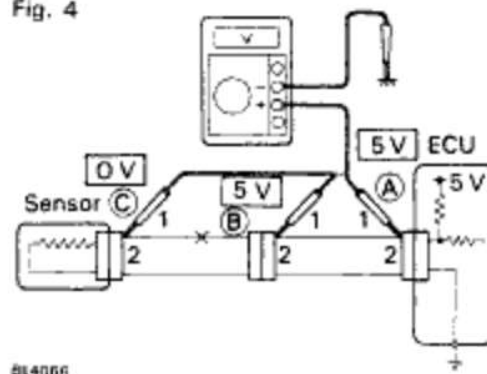
5 V: Between Terminal 1 of connector (A) and Body Ground

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

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

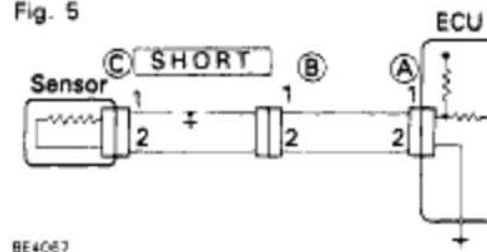
then it is found out that there is an open circuit in the wire harness between terminal 1 of (B) and terminal 1 of (C).

Fig. 4

**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



(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.

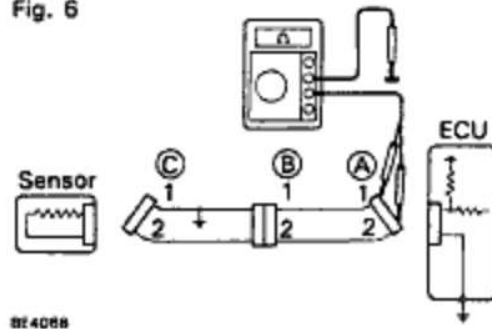
In the case of Fig. 6,

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

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

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



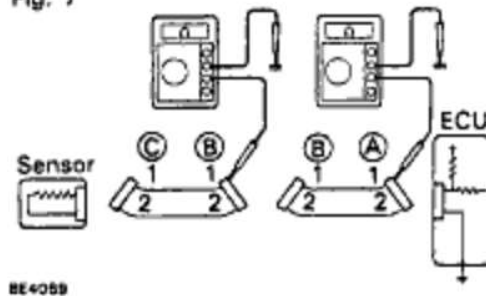
(2) Disconnect connector (B) and measure the resistance between terminal 1 of connector (A) and body ground, and terminal 1 of connector (B) and body ground.

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

Between terminal 1 of connector (B) and body ground → Continuity

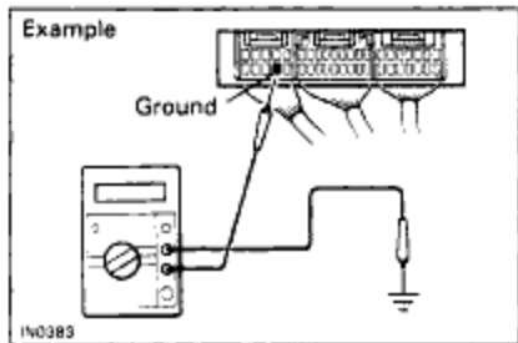
Therefore, it is found out that there is a short circuit between terminal 1 of connector (B) and terminal 1 of connector (C).

Fig. 7



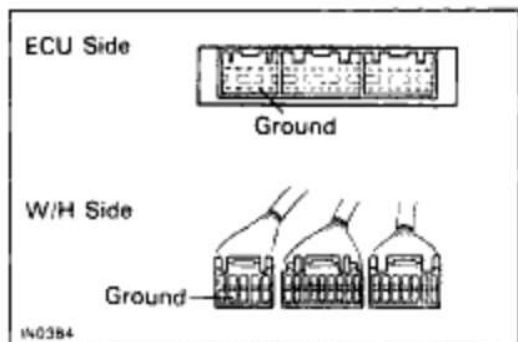
Check and Replace ECU

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



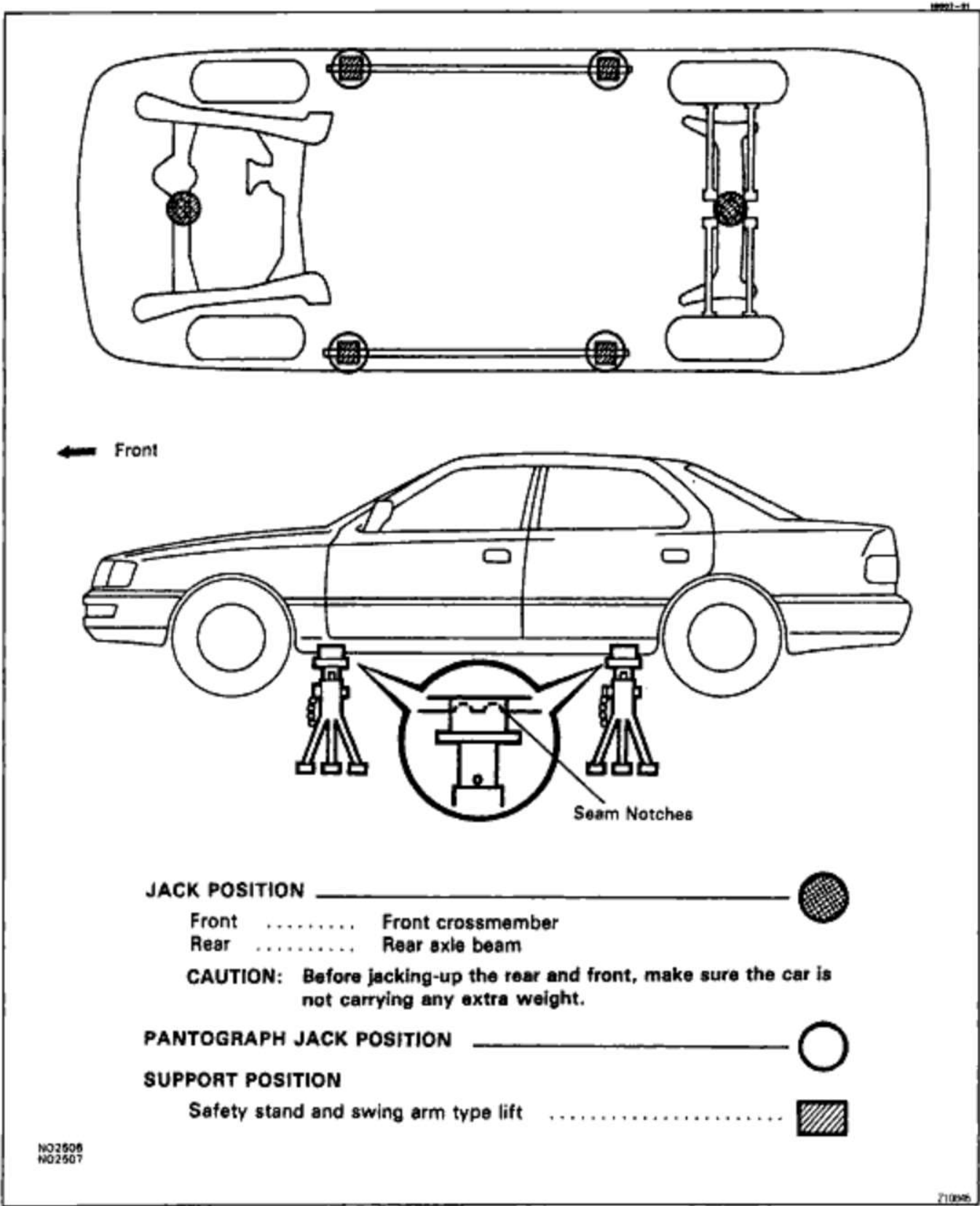
- (1) Measure the resistance between the ECU ground terminal and the body ground.

Resistance: 1Ω 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



ABBREVIATIONS USED IN THIS MANUAL

ME10-02

ABS	Anti-Lock Brake System
ALR	Automatic Locking Retractor
A/T	Automatic Transaxle
ATF	Automatic Transmission Fluid
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
Calif.	California
CB	Circuit Breaker
CRS	Child Restraint System
DP	Dash Pot
ECU	Electronic Control Unit
ELR	Emergency Locking Retractor
ESA	Electronic Spark Advance
EX	Exhaust (Manifold, Valve)
Ex.	Except
FIPG	Formed in Place Gasket
FL	Fusible Link
Fr	Front
IG	Ignition
IN	Intake (Manifold, Valve)
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 Transaxle
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

INTRODUCTION – ABBREVIATIONS USED IN THIS MANUAL

TDC	Top Dead Center
TEMP.	Temperature
T/M	Transmission
TMC	Toyota Motor Corporation
TM M	Toyota Motor Manufacturing U.S.A., Inc.
u/s	Undersize
VCV	Vacuum Control Valve
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
w/	With
w/o	Without

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INTRODUCTION – GLOSSARY OF SAE AND TOYOTA TERMS

GLOSSARY OF SAE AND TOYOTA TERMS

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

SAE ABBREVIATIONS	SAE TERMS	TOYOTA TERMS ()-ABBREVIATIONS
A/C	Air Conditioning	Air Conditioner
ACL	Air Cleaner	Air Cleaner
AIR	Secondary Air Injection	Air Injection (AI)
AP	Accelerator Pedal	--
B+	Battery Positive Voltage	+ B, Battery Voltage
BARO	Barometric Pressure	--
CAC	Charge Air Cooler	Intercooler
CARB	Carburetor	Carburetor
CFI	Continuous Fuel Injection	--
CKP	Crankshaft Position	Crank Angle
CL	Closed Loop	Closed Loop
CM P	Camshaft Position	Cam Angle
CPP	Clutch Pedal Position	--
CTOX	Continuous Trap Oxidizer	--
CTP	Closed Throttle Position	Idle ON (IDL ON)
D FI	Direct Fuel Injection (Diesel)	Direct Injection (DI)
DI	Distributor Ignition	--
DLC1 DLC2 DLC3	Data Link Connector 1 Data Link Connector 2 Data Link Connector 3	1: Check Connector 2: Toyota Diagnosis Communication Link (TDCL) 3: OBDII Diagnostic Connector
DTC	Diagnostic Trouble Code	Diagnostic Code
DTM	Diagnostic Test Mode	--
EC L	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)
EG R	Exhaust Gas Recirculation	Exhaust Gas Recirculation (EGR)
EI	Electronic Ignition	Toyota Distributorless Ignition (TDI)
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)
H02S	Heated Oxygen Sensor	Heated Oxygen Sensor (H02S)

INTRODUCTION – GLOSSARY OF SAE AND TOYOTA TERMS

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
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 Light
MST	Manifold Surface Temperature	—
MVZ	Manifold Vacuum Zone	—
NVRAM	Non-Volatile Random Access Memory	—
O2S	Oxygen Sensor	Oxygen Sensor, Ot Sensor (OtS)
OBD	On-Board Diagnostic	On-Board Diagnostic (OBD)
OC	Oxidation Catalytic Converter	Oxidation Catalyst Converter (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	—
SFI	Sequential Multiport Fuel Injection	Electronic Fuel Injection (EFI), Sequential Injection
SPL	Smoke Puff Limiter	—
SRI	Service Reminder Indicator	—
S RT	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 (Electronic Control Unit)
TP	Throttle Position	Throttle Position
TR	Transmission Range	—

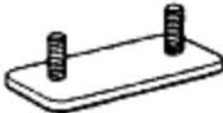
IN-42**INTRODUCTION – GLOSSARY OF SAE AND TOYOTA TERMS**

TVV	Thermal Vacuum Valve	Bimetallic Vacuum Switching Valve (BVSV) Thermostatic Vacuum Switching Valve (TVSV)
TWC	Three-Way Catalytic Converter	Three-Way Catalytic (TWC) CC _{RO}
TWC+OC	Three-Way + Oxidation Catalytic Converter	CCR+ CCo
VAF	Volume Air Flow	Air Flow Meter
VR	Voltage Regulator	Voltage Regulator
VSS	Vehicle Speed Sensor	Vehicle Speed Sensor (Read Switch Type)
WOT	Wide Open Throttle	Full Throttle
WU-OC	Warm Up Oxidation Catalytic Converter	—
WU-TWC	Warm Up Three-Way Catalytic Converter	Manifold Converter
3GR	Third Gear	—
4G R	Fourth Gear	—

STANDARD BOLT TORQUE SPECIFICATIONS

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HOW TO DETERMINE BOLT STRENGTH

	Mark	Class		Mark	Class
Hexagon head bolt	 Bolt head No 4 5 6 7 8 9 10 11	4T 5T 6T 7T 8T 9T 10T 11T	Stud bolt	 No mark	4T
	 No mark	4T		 Grooved	6T
Hexagon flange bolt w/ washer hexagon bolt	 No mark	4T	Welded bolt		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			

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INTRODUCTION – STANDARD BOLT TORQUE SPECIFICATIONS

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

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