
GENERAL

HOW TO USE THIS MANUAL	
GENERAL INFORMATION	01-1
IDENTIFICATION INFORMATION	
VEHICLE IDENTIFICATION AND SERIAL NUMBERS	01-4
REPAIR INSTRUCTION	
CAUTIONS	01-5
VEHICLE LIFT AND SUPPORT LOCATIONS	01-16
HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS	
NEW DIAGNOSIS SYSTEM	01-21
HOW TO PROCEED WITH TROUBLESHOOTING	01-24
CUSTOMER PROBLEM ANALYSIS	01-25
SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE	01-27
SYMPTOM SIMULATION	01-30
DIAGNOSTIC TROUBLE CODE CHART	01-31
PROBLEM SYMPTOMS TABLE	01-31
DTC SYSTEM SPECIFIC INSPECTION PROCEDURE	01-32
ELECTRONIC CIRCUIT INSPECTION PROCEDURE	01-33
TERMS	
DESCRIPTION OF ABBREVIATION	01-39

HOW TO USE THIS MANUAL

GENERAL INFORMATION

1. Range of repair work description

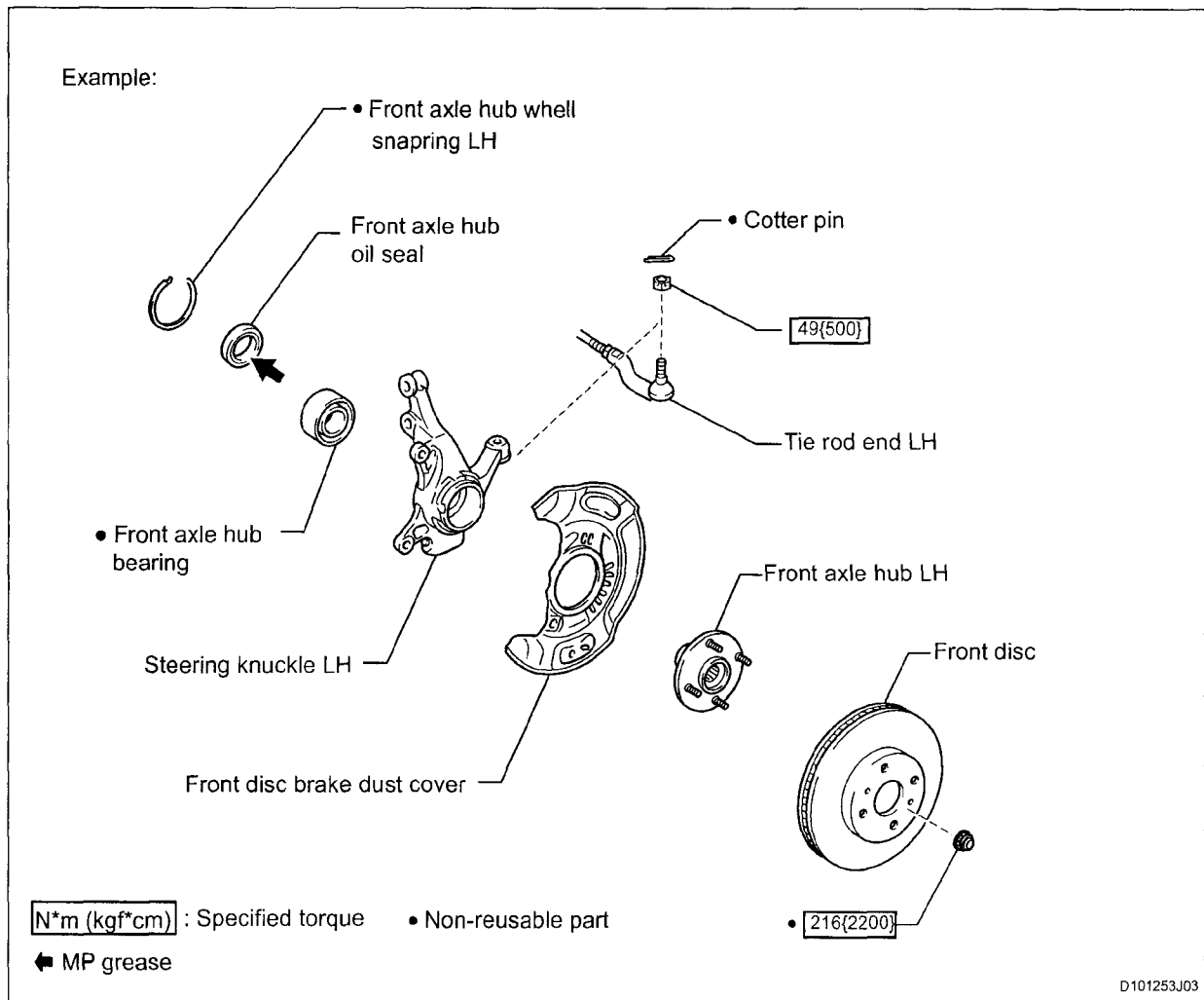
- (1) Repair work is broadly divided to three processes of [Diagnosis], [Removal, replacement, disassembly/ assembly and check/ adjustment] and [Completion inspection].
- (2) This manual describes the first process [Diagnosis] and the second process [Removal, replacement, disassembly/ assembly and check/ adjustment]. The third process [Completion inspection] is not included.
- (3) This manual does not contain the information on the following works but they shall be implemented during actual work.
 - (a)Jacking and lifting
 - (b)Cleaning and washing of the removed part if necessary
 - (c)Visual check

2. Items to be prepared

- (1) SST, service tools, grease/ others need to be prepared before work and they are listed as List of Items to be Prepared. The items that may be always kept at the general maintenance shop such as a tool stand, a jack, a rigid rack, however, are not listed.
- (2) The tools or equipment listed in the List of Items to be Prepared except for SST are listed by way of example and any specific suppliers and item names/ item numbers are not designated.

3. Work procedure

- (1) The block diagram is listed by section or title as needed.
- (2) Nonreusable parts, grease applying points, precoat bolts and torques are indicated in the block diagram.



(3) The torques, grease applying points, and nonreusable parts are indicated as key points of the procedure.

<CAUTION>

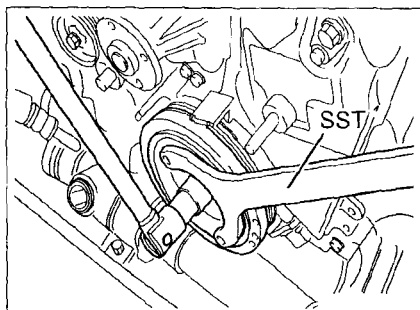
If the items above can be indicated with the illustration only, the block diagram describing the procedure is contained. Information on the torque and grease are also included in the illustration in that case.

(4) Procedural steps are shown for the items with the procedure only. The work part and content are indicated by the illustration and the text contains the detail work steps, the specified values and cautions.

(5) Some illustrations may be shared by similar vehicle types. Therefore, the details may be different from the actual vehicle.

01

Example:



Operation
CRANKSHAFT DAMPER INSTALLATION
 Using the SST, hold the crankshaft damper and tighten the bolt.

Standard

Explanation: A detailed explanation of the operation method

A163401

4. Maintenance specified value

(1) The specified values and the limits are indicated by boldface in the text.

5. Definition of term

Specified value	Indicates the tolerance for check and adjustment.
Limit	Indicates the maximum and minimum values of the check and adjustment.
Reference value	Indicates the specified value for the simple measurement method when there is no risk of occurrence of failure if the measurement method for acquiring the real specified value is extremely difficult.
<WARNING>	The matters are included which may lead to trouble of the worker and others and may lead to trouble or accident if the contents are not observed.
<CAUTION>	The matters to be especially paid attention and the work procedure that must not be implemented because the vehicle and/or components may be damaged if they are not observed.
<HINT>	Supplemental information is separated from the text to facilitate the work.

6. SI unit

(1) The unit used in this manual is the SI unit (International System of Units), and then, the metric unit.

(Example)

Specified value: $T=28\text{N}\cdot\text{m}$ {286kgf $\cdot\text{cm}$ }

Conversion coefficient table for SI unit

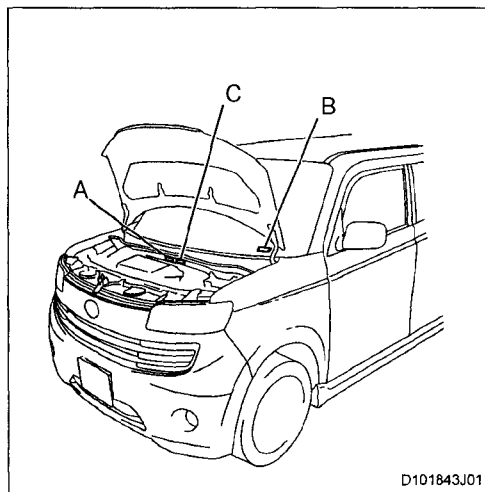
Item	SI unit	Conventional unit	Conversion coefficient for SI unit
Acceleration	m/s^2	G	1 G = 9.80665 m/s^2
Torque, moment	$\text{N}\cdot\text{m}$	kgf $\cdot\text{cm}$	1 kgf $\cdot\text{cm}$ = 0.0980665 $\text{N}\cdot\text{m}$
Force	N	kgf	1 kgf = 9.80665 N
Pressure	MPa	kgf/ cm^2	1 kgf/ cm^2 = 0.0980665 MPa
	kPa	mmHg	1 mmHg = 0.133322 kPa
Power, power efficiency	kW	PS	1 PS = 0.735499 kW
	W	kcal/h	1 kcal/h = 1.16279 W
Volume	cm^3	cc	1 cc = 1 cm^3
Constant of spring	N/mm	kgf/m	1 kgf/mm = 9.80665 N/mm

SI prefix

M (mega-)	10^6	d (deci-)	$10^{-1} = 0.1$
k (kilo-)	10^3	c (centi-)	[fuzzy] $10^{-1} = 0.1$
h (hecto-)	10^2	m (milli-)	$10^{-3} = 0.001$
da (deca-)	10^1	μ (micro-)	$10^{-6} = 0.000001$

IDENTIFICATION INFORMATION

VEHICLE IDENTIFICATION AND SERIAL NUMBERS

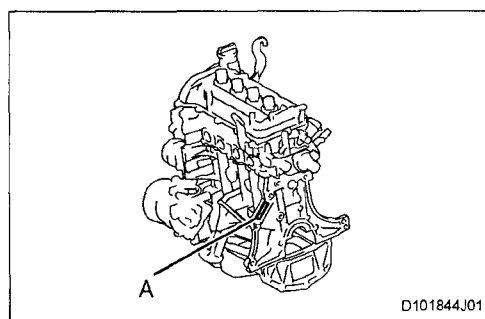


1. Chassis number

- (1) The chassis number (vehicle identification number) is inscribed at the position shown in the diagram and on the nameplate.

A: Chassis number
 B: Chassis number (GCC, UK & SOUTH AFRICA)
 C: Name plate

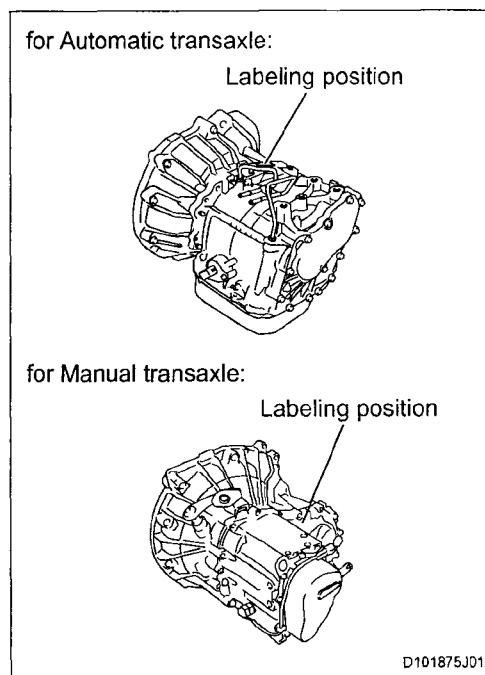
01



2. Engine No. and transaxle No.

- (1) The engine No. is marked on the cylinder block.

A: 3SZ-VE, K3-VE



- (2) Transaxle No. is attached onto the transaxle case.

REPAIR INSTRUCTION

CAUTIONS

1. SRS air bag and seat belt pretensioner

(1) Cautions for handling and work

(a) Handle the air bag and the pretensioner system with the correct procedure/method. If not, they may operate during work leading to the life-threatening accidents. In addition, they may not operate when necessary if repair is not performed correctly. Follow the correct procedure/method described in this manual when maintenance and check are implemented.

(2) Power supply removal

(a) Before starting the work, check the diagnostic trouble code, turn IG off, remove the battery minus terminal, and wait 90 seconds.

<WARNING>

The air bag/ the pretensioner system are equipped with a backup power supply. If the work is started before a lapse of 90 seconds after the battery minus terminal is removed, the air bag may be activated.

(3) General cautions

(a) Use the tester for the electrical check. But never measure the resistance.

<WARNING>

When the resistance is measured, the current of the tester may activate the air bag and the pretensioner, which is very dangerous.

(b) Observe the label instruction stating the cautions for the system periphery.

(c) Never dismantle the air bag and the pretensioner system.

(d) If the air bag and the pretensioner system are dropped or any crazing, dent, chip or other deformation is found, replace a new genuine part.

(e) Never use other vehicle's air bag and pretensioner part. Be sure to attach a new part when the part is replaced.

(f) Do not expose the air bag and the pretensioner system to high heat and fire.

(g) If the air bag and the pretensioner part do not operate at the time of impact, implement check with the diagnosis.

(h) Avoid grease, cleaner, oil and water attachment. If any of those is attached onto the part, immediately wipe it off with a dry cloth or suchlike.

(i) Avoid high temperature (atmospheric temperature 93°C and above [for the pretensioner, 80°C and above], humidity, and electrical noise for storing and handling the air bag and the pretensioner.

(4) Cautions for disposal of the air bag and the pretensioner (before activation)

(a) Never dispose the air bag and the pretensioner that have not operated (Always operate them using SST).

(b) Operate them in the safe and flat place of outdoors. Avoid the residential area.

(c) The operation sound is quite big. Keep everyone around informed in advance.

(d) Move away from the air bag/the pretensioner for 5 m or more using SST when they are activated.

(e) Static electricity may activate the air bag and the pretensioner. Touch the water pipe or steel frame with bare hands in advance to discharge the static.

(f) If the air bag is activated, avoid the deployment surface facing down.

<WARNING>

If the deployment surface faces down when the air bag is activated, the life-threatening accident may be caused.

(5) Cautions for disposal of the air bag and the pretensioner (after activation)

(a) Leave the activated air bag/pretensioner for 30 minutes or more after activation because the temperature of some parts is a few hundred °C and above.

(b) Do not pour water or suchlike on the activated air bag and pretensioner.

(c) To handle the activated air bag and pretensioner, wear the dustproof glasses and gloves.

(d) Put the activated air bag and pretensioner in the solid transparent plastic bag. Seal the bag and dispose it.

(e) When the work is completed, always wash hands with water.

(6) Cautions in storing the air bag

(a) When the air bag is removed temporarily, for instance, during the work, keep the deployment surface up to store it.

<WARNING>

When the air bag is activated by some kind of cause, the deployment surface facing down may lead to the life-threatening accident.

(b) Avoid placing objects or other air bags on the air bag when storing it.

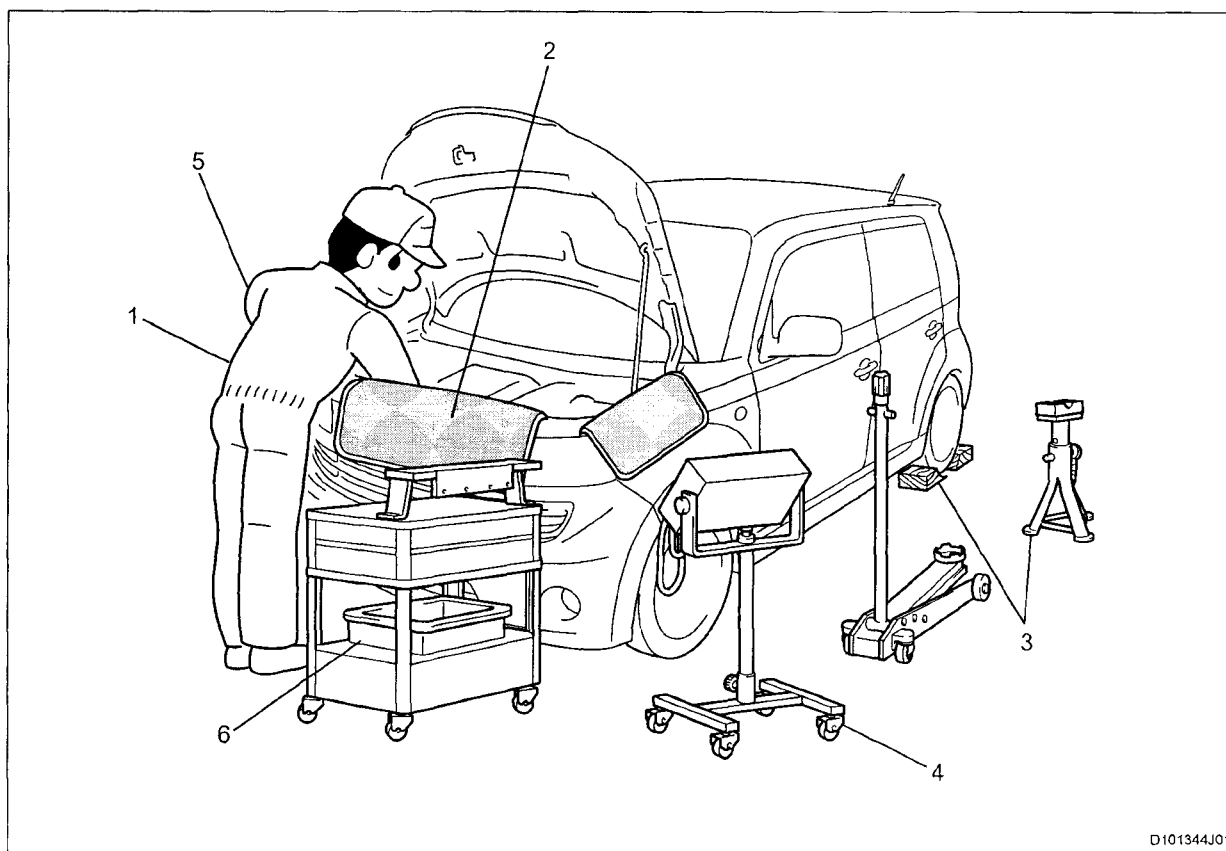
(7) Cautions for wire harness and connector

- (a) Wire harnesses and connectors are all yellow except for those kept in the engine room and special connectors are used. Handle them with care when disconnecting them.
- (8) Measures for vehicles received impact by crash
- (a) When the electrical welding machine is used, remove the air bag and the pretensioner before work.
- (b) Remove the air bag computer assembly, the front air bag sensor, the side air bag sensor assembly, and the side air bag sensor assembly No. 2 before work if impact may be impressed on them.
- (c) Avoid exposing the air bag computer assembly, the front air bag sensor, the side air bag sensor assembly, and the side air bag sensor assembly No. 2 to high temperature.
- (d) Some parts of the air bag and the pretensioner reach a few hundred °C and above during activation. Make sure that the peripheral wire harnesses and connectors have no damage and melting part.

01

2. Basic items

(1) Points on work



D101344J01

1	Appearance	> Always put on a clean engineer wear. > Wear a cap and protective shoes.
2	Vehicle protection	> Place a grille cover, a fender cover, seat covers and a floor mat before work.
3	Safety work	> Use sprags to fix a vehicle. > When the work is performed by two or more persons, check each other's safety. > In case of the work with the engine on, pay attention to ventilation. > Be careful with burn and injury in case of working on the part that may become hot, the rotating part, the sliding part, and the vibrating part. > When the vehicle is jacked up, support it at the specified position with a rigid rack. > When the vehicle is lifted up, use the safety device.
4	Preparation for tools and measuring instruments	> Prepare a tool stand, SST, measuring instruments, grease, waste and the part for replacement before starting to work.
5	Removal/ Disassembly/ Assembly	> Understand the phenomenon of the failure thoroughly and diagnose for efficient work. > Check the attaching condition, deformation and damage before removing the part. > If the construction is complicated, take a note and put the dowel mark to prevent adverse influence on the function. > Clean, wash, and check the removed part as needed before reattaching.

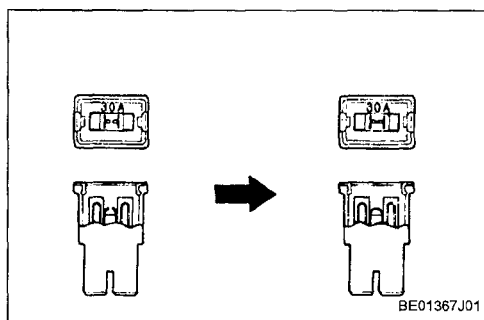
6	Removed part	> Organize the removed parts avoiding mixing them up or making them dirty. > Replace nonreusable parts such as gaskets, O-rings, and self-lock nuts with new parts according to the instruction in the text. > Organize the parts replaced in the box to show the customer.
---	--------------	--

(2) Gasket

- (a) A gasket must not be reused. Always replace it with a new one.
- (b) Use a sealing agent for the gasket, if necessary, to prevent leakage.

(3) Bolts, nuts, and screws

- (a) Check the torque for the bolts, nuts, and screws and always use a torque wrench.



(4) Fuse replacement

- (a) When the fuse is replaced, replace it with the fuse with the same capacity. If there is no choice to use a fuse with the different capacity, use the fuse with the capacity lower than the specified ampere.

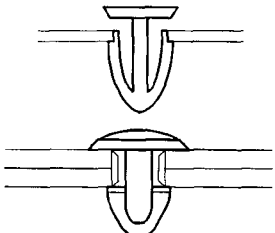
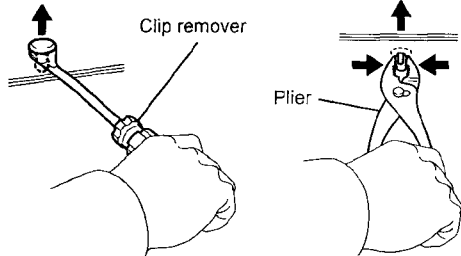
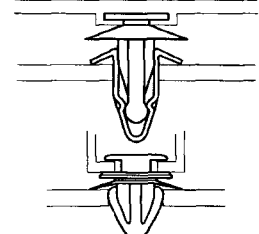
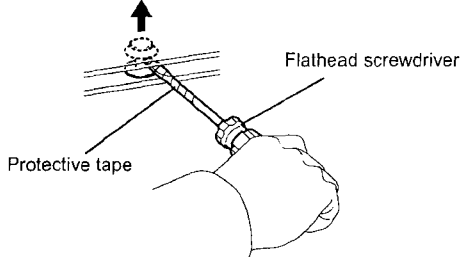
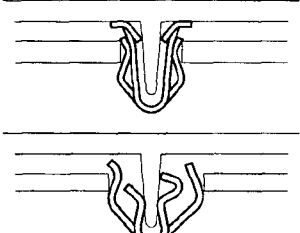
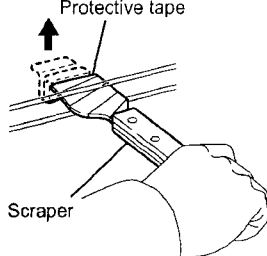
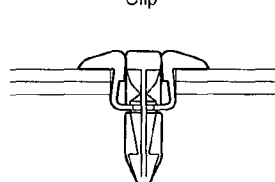
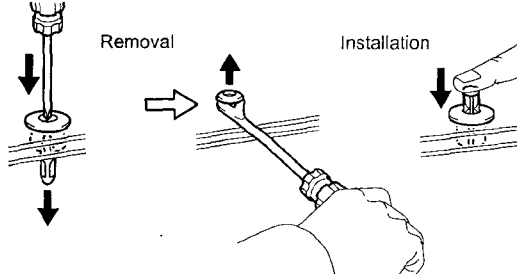
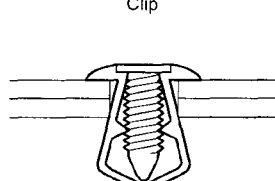
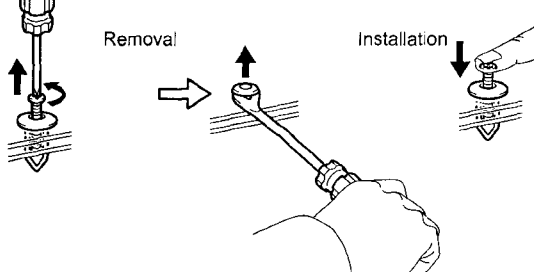
Illustration	Symbol	Part Name	Abbreviation
		Fuse	Fuse
		Medium current fuse	M-fuse
		High current fuse	H-fuse
		Fusible link	FL
		Circuit breaker	CB
		Fusible link assembly	FL

H

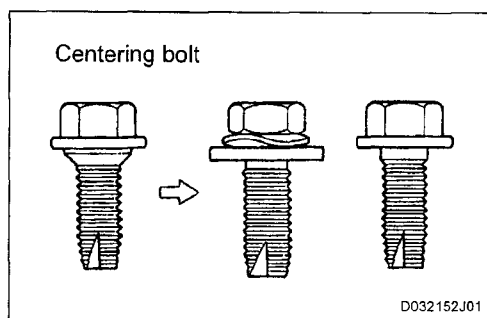
D100:51J02

(5) Clip

- (a) When the fitting is shaken at the clip position and the tab position, be sure to use the protective tape to prevent the vehicle from being damaged.
- (b) General clip removal for the body parts is shown in the diagram.
 - <HINT>
 - > If the clip is damaged during the work, be sure to replace it with a new one.
 - > The dotted triangle in the illustration indicates a clip and the dotted circle indicates a tab.

Shape (Example)	Removal
 Clip 	 Clip remover Plier
 Clip 	 Flathead screwdriver Protective tape
 Tab 	 Protective tape Scraper
 Clip 	 Removal Installation
 Clip 	 Removal Installation

01

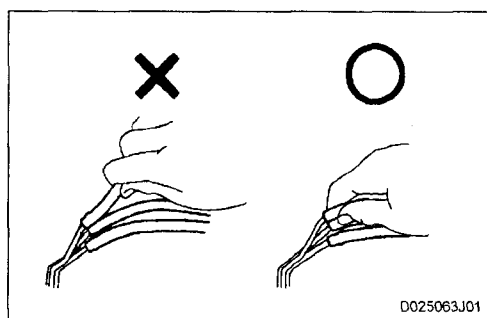


(6) Cautions for fitting adjustment

- (a) If a centering bolt is used at the hinge of the bonnet or door, replace it with the supplied bolt before fitting adjustment.

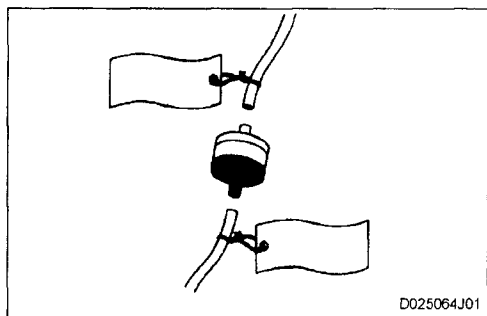
(7) Jack-up, jack-down, and support of the vehicle

- (a) If the vehicle is jacked up or down and supported, be sure to observe the cautions (See page 01-16 for the jack, the rigid rack, and the support position of the lift).



(8) Vacuum hose removal and installation

- (a) To draw the vacuum hose out, hold the hose end.



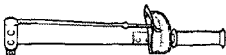
- (b) When the vacuum hose is removed, use a tag to indicate where the hose is connected.

- (c) When the vacuum gage is used, do not connect the hose if the connector is too big. Use the slightly smaller adapter for adjustment. If the hose is stretched, the air may be leaked.

(9) Tightening tool

- (a) Use the torque wrench shown in the table below (or equivalent) for torque management described above. Select the best-suited torque wrench, together with an extension tool (such as an extension bar) in accordance with the work space.

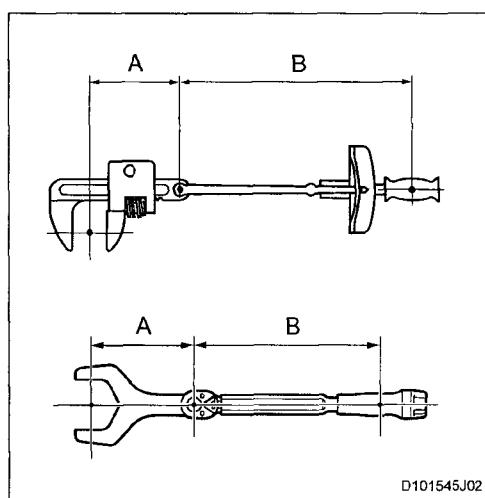
Torque wrench

	Product name	Part No.	Torque range
	Plate-type torque wrench	SF 1.5 N	6.3 sq (0.2-1.5 N*m)
		SF6N	6.3 sq (0.6-6 N*m)
		F23N	9.5 sq (3-23 N*m)
		F46N	9.5 sq (5-46 N*m)
		F92N	12.7 sq (10-92 N*m)
		F130N	12.7 sq (20-130 N*m)
		F190N	12.7 sq (30-190 N*m)
	Ratchet preset type Torque wrench	QL25N-MH	9.5 sq (5-25 N*m)
		QL50N-MH	9.5 sq (10-50 N*m)
		QL100N-MH	12.7 sq (20-100 N*m)
		QL140N-MH	12.7 sq (30-140 N*m)
		QL200N-MH	12.7 sq (40-200 N*m)

Extension bar

	Product name	Part No.	Total length of tool
	Extension bar	BE3-030	9.5 sq (30 mm)
		BE3-050	9.5 sq (50 mm)
		BE3-075	9.5 sq (75 mm)
		BE3-100	9.5 sq (100 mm)
		BE3-150	9.5 sq (150 mm)
		BE3-270	9.5 sq (270 mm)
		BE4-075	12.7 sq (75 mm)
		BE4-150	12.7 sq (150 mm)
		BE4-270	12.7 sq (270 mm)
		BE4-600	12.7 sq (600 mm)

01

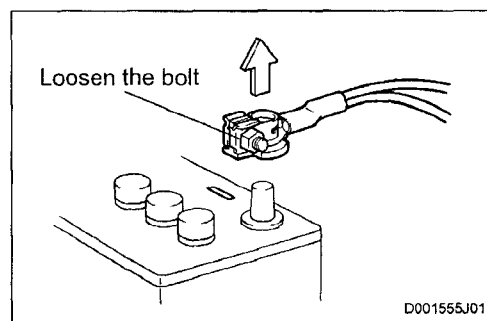


(b) The text contains the specified torque only. If the SST or extension tool is used, determine the torque wrench reading by the calculation formula.

(c) When the SST or tool is combined to the torque wrench to extend the total length and tighten, if the torque wrench reading reaches the specified torque value, the actual torque becomes excessive.

(d) Calculation formula $T' = T \times B / (A + B)$

Symbol	Meaning	Unit
T'	Torque wrench reading	[N*m {kgf*cm}]
T	Specified torque	[N*m {kgf*cm}]
A	SST or tool length	[cm]
B	Torque wrench length	[cm]

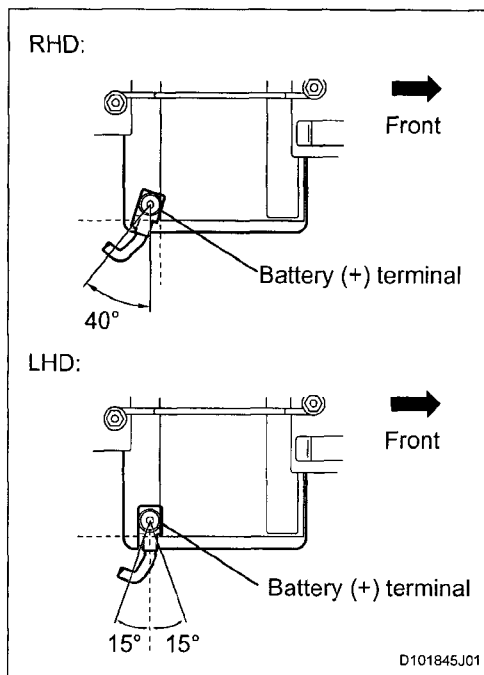


3. Electrical system

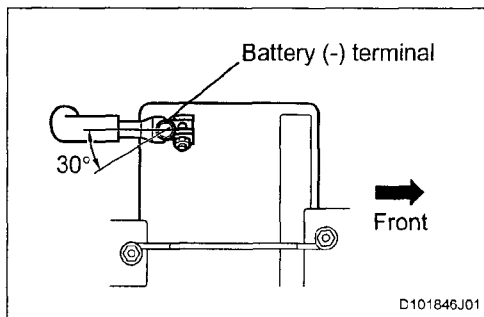
(1) Battery terminal removal

- In case of the work for the electrical system, remove the battery minus terminal in advance to avoid burnout caused by short circuit.
- If the battery terminal is removed, turn off the ignition switch and the lighting switch and loosen the nut of the terminal to avoid shaking it.
- If the battery terminal is disconnected, the memory such as a clock and diagnosis will be erased. Check the content in advance.

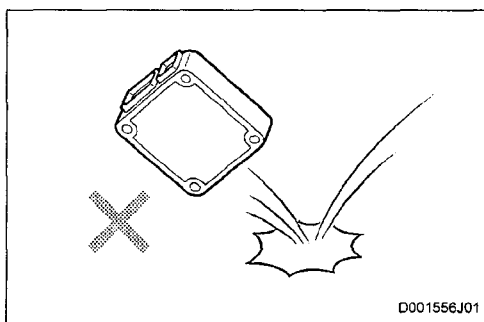
01



- (d) To attach the battery terminal, connect the plus terminal first and then the terminal wire so that it is kept in the range shown in the diagram, and tighten it with the specified torque.
Specified value: $T=6.4\text{N}\cdot\text{m}$ {65kgf*cm}



- (e) To attach the battery minus terminal, connect it so that the terminal wire is kept in the range shown in the diagram, and tighten it with the specified torque.
Specified value: $T=6.4\text{N}\cdot\text{m}$ {65kgf*cm}



(2) Handling of electronic components

- Do not open the ECU cover or the case (Touching the IC terminal may damage the IC due to static electricity).
- Avoid giving impact on the electronic components such as computers, sensors and relays. If such components are dropped, replace them.
- Do not expose the electronic components to high temperature/high humidity.
- If the engine is cleaned with steam, pay attention not to put water directly on the electronic parts, air filter and emission related parts.
- Do not touch the connector terminals since failure due to deformation and static electricity may occur.
- Never remove and attach the temperature switch and the temperature sensor using the impact wrench.

4. Removal of parts in fuel system

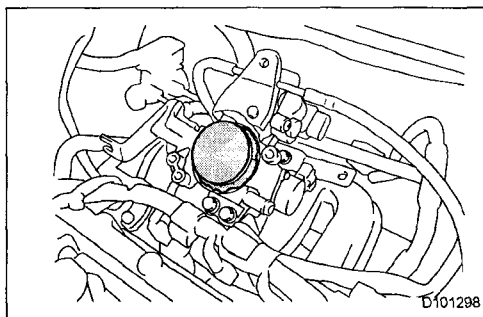
(1) Removal work area for the parts in fuel system

- Work in the well-ventilated place without a welding machine, grinder, drill, electric motor and any fires such as a stove around.
- Avoid working at or near the pit where evaporated fuel may be filled.

(2) Removal of parts in fuel system

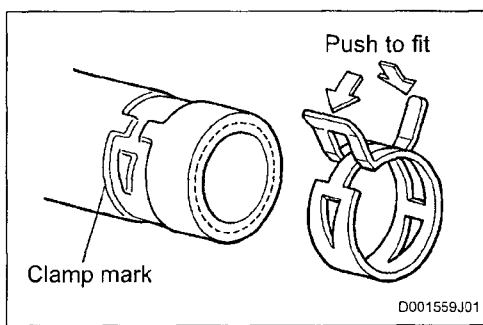
- Prepare an extinguisher before the work is started.

- (b) For static prevention, water under foot as much as the worker does not slip as well as ground the fuel changer, the vehicle, and fuel tank.
- (c) Do not use electrical equipment such as an electric pump and a working lamp since sparks may fly and the equipment may become very hot.
- (d) Do not use an iron hammer since sparks may fly during the work.
- (e) Handle the waste to which the fuel is attached separately.



5. Removal of engine air intake system parts

- (1) If metal pieces get in the air intake path, the engine is adversely affected.
- (2) When the air intake parts in the air intake system are removed, cover the removed parts and the opening on the engine side with a clean waste cloth or a gum tape.
- (3) When the air intake parts are attached, make sure that foreign particles such as metal pieces do not get in.



6. Handling of hose/ hose clamp

- (1) Before removing the hose, check the insertion depth and the clamp position so that it can be reattached properly.
- (2) If the clamp is deformed or degraded, replace it with a new one.
- (3) If the hose is reused, adjust the clamp at the clamp mark left on the hose and attach it.
- (4) For the flat spring clamp, impress the camp in the direction of the arrow to fit it in after attachment.
- (5) When the hose is disconnected, use the SST (a plug set and a hose) to cover the hose and prevent leakage of the grease or the cooling water.

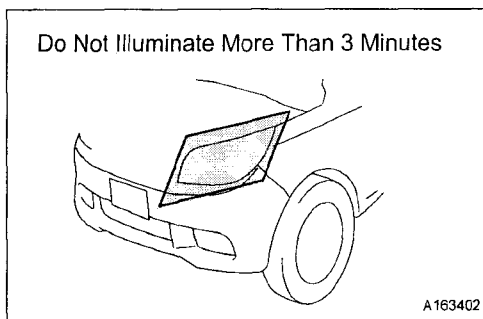
<CAUTION>

Check if foreign particles such as stains, dust, and iron powder are not attached onto the SST before use. If so, be sure to clean them.

SST 09258-00030

7. Radio equipment installation

- (1) Attach the antenna as far away from the vehicle electronic system such as computers and sensors as possible.
- (2) Attach the antenna cord at least 20 cm away from the vehicle electronic system such as computers and sensors.
- (3) Do not bind the antenna cord with other wires. Place the antenna cord as far away from other wires as possible.
- (4) For retrofitted items, attach them according to the individual installation procedures.
- (5) Do not attach high-power mobile communication equipment.



8. Head lamp check and maintenance

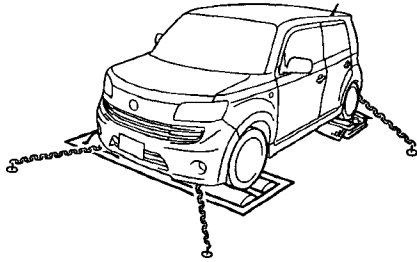
- (1) If the cover is used while the head lamp is lit, do not implement maintenance for 3-minutes or more.

<CAUTION>

The outer lens used for the head lamp is plastic and it may be deformed if the check and maintenance takes a long time.

01

When drum tester is used:



D101647J01

9. Traction control (TRC) and VSC (Vehicle Stability Control) (2WD vehicle)

(1) Cautions when the two-wheel drum tester is used

(a) If the two-wheel drum tester, such as a speed meter tester, a speed meter tester and brake tester combined machine, and a chassis dynamometer, is used, be sure to turn on the traction control switch (TRC OFF switch) to prohibit the TRC control before measure.

<WARNING>

When the drum tester is in use, the vehicle may dash out from the tester due to the TRC operation.

<CAUTION>

- > Check if the TRC operation is disabled with illumination of the slip indicator lamp in the combination meter.
- > Fix the vehicle with a lock chain for safety work.

<HINT>

See Cautions for VEHICLE STABILITY CONTROL SYSTEM - Cautions when the drum tester is used for how to disable the TRC control.

(b) When the check by the drum tester is completed, be sure to cancel the operation prohibition mode.

<WARNING>

Always cancel the operation prohibition mode after the check is finished. Do not drive the vehicle with the operation prohibited condition.

(2) Cautions for VSC related work

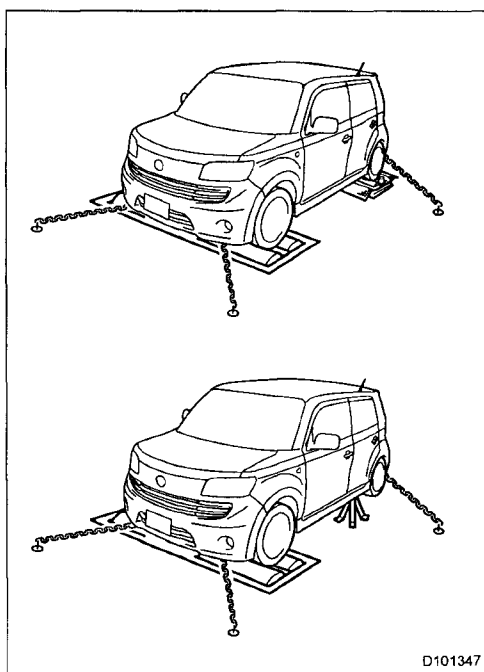
(a) Do not remove the VSC related parts unless otherwise necessary because removal may cause incomplete adjustment.

(b) When the work related the VSC is implemented, be sure to perform preparation before work and check after completion according to the instruction of the manual.

10. Cautions for check and maintenance of the full-time 4WD vehicle

<CAUTION>

The tester with load setting system for two wheels only (model with the power absorption system for two wheels only: a two-wheel chassis dynamometer, two-wheel chassis dynamometer and speed meter tester, a brake tester combined machine) can not be used.



(1) Speed meter tester measurement procedure

<CAUTION>

- > Check the front wheel.
- > Avoid rapid starting and sudden acceleration.
- > The maximum speed shall be 60 km/h or less (50 km/h or less when the free roller is used).
- > The vehicle shall be run within 1 minute.
- > If the procedure below is not observed, function deterioration of the 4WD, failure of the drive system parts, and dash-out of the vehicle are possible. Always follow the procedure described below.

- (a) Place the front wheels on the roller.
- (b) Free the rear wheels with a free roller or a rigid rack.
- (c) Use the lock chain to fix the vehicle.
- (d) Start the engine and gradually increase the vehicle speed with D range to measure the tester.
- (e) After measurement, use the brake to decelerate gradually and stop the vehicle.

01

11. Brake tester measurement procedure

<CAUTION>

- > A tester with load setting system can not be used.
- > A high-speed brake tester can not be used.

- (1) Place the wheels of the vehicle to be measured (front or rear wheels) on the roller.
- (2) Change the shift position to neutral.
- (3) Drive the roller of the tester to measure.

<HINT>

When the drag force exceeds 10% of the axle load, jack both right and left axles up to check the wheel rotation. If no failure is found, it is caused only by the viscous torque of the viscous coupling and it is not abnormal.

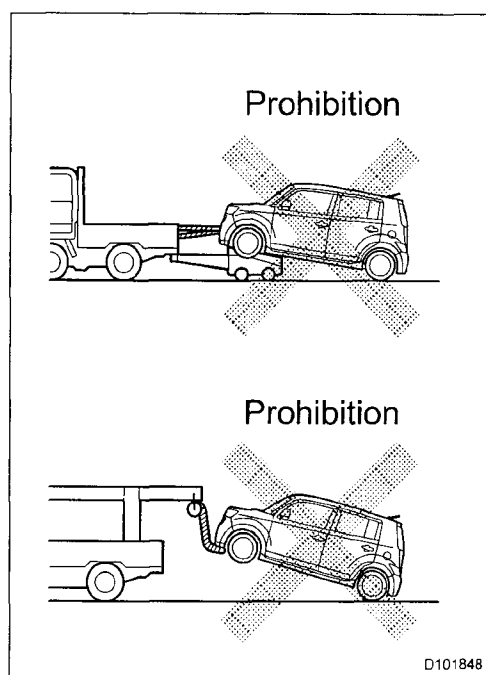
12. Cautions in towing a 2WD vehicle

- (1) Tow the vehicle with front wheels or all four wheels lifted. If the vehicle is towed with four wheels road held, it shall be pulled forward within the distance of 50 km at the pulling speed of 30 km/h or less.

<WARNING>

If the vehicle is towed exceeding these speed and distance or backward, the transaxle is adversely affected and may be damaged.

01



13. Cautions in towing a 4WD vehicle

- (1) Tow the vehicle with four wheels road held or lifted. If the vehicle is towed with four wheels road held, it shall be pulled forward within the distance of 50 km at the pulling speed of 30 km/h or less.

<CAUTION>

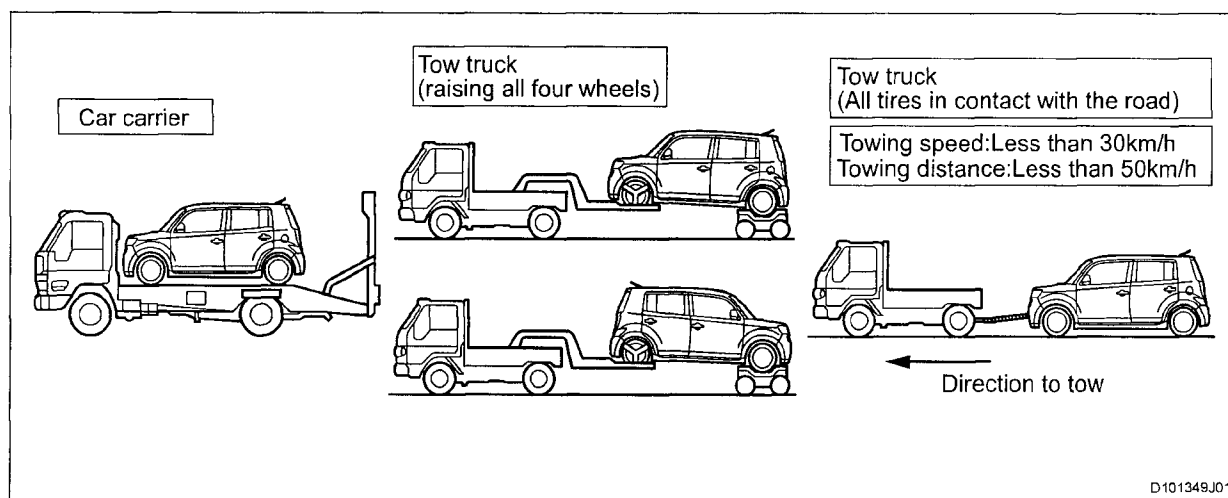
If the vehicle is towed exceeding these speed and distance or backward, the transaxle is adversely affected and may be damaged.

- (2) Tow the vehicle with both the front and rear wheels lifted if it is lifted to tow. If there is failure in the running system and the drive system, carry the vehicle with four wheels lifted.

<CAUTION>

Towing the vehicle with only either the front or rear wheels lifted may burn the transaxle or make the wheels protrude from the tow truck.

- (3) Tow the vehicle following one of the methods shown in the diagram.



<CAUTION>

- > If there is failure in the chassis and the drive train of the vehicle, use a carrier car.
- > Always use the towing method shown in the diagram.

Parking brake and shift lever state during towing

Towing method	Parking brake	Transmission Shift lever position
Carrier car	Brake pulled	Any position is OK.
Break down lorry (four wheels lifted)	Brake pulled	Any position is OK.
Break down lorry (four wheels road-held)	Brake released	Neutral

14. Vehicle with a catalytic converter

- (1) If a large amount of unburned gasoline flows in the converter, the catalyst will be damaged. To prevent this, observe the followings.

(a) Use unleaded gasoline only.

(b) If spark check of the spark plug is necessary, remove the connector of the injector to stop the injection.

(c) To measure the compression pressure of the engine, remove the connector of the injector to stop the injection.

(d) Do not operate the engine with the fuel tank almost empty. If the engine is operated under such condition, misfire occurs and excessive load may be applied to the converter.

VEHICLE LIFT AND SUPPORT LOCATIONS

1. Cautions for the vehicle condition when it is lifted up

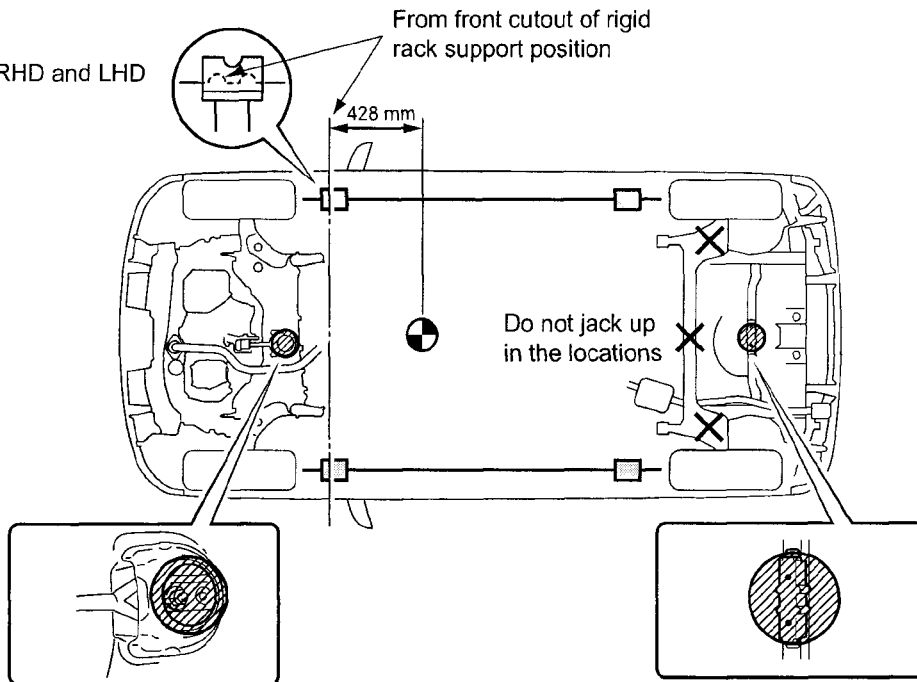
- (1) The vehicle must be almost empty. Do not jack and lift the vehicle up with heavy objects loaded.
- (2) When the heavy objects such as an engine and a mission are removed, the gravity center of the vehicle will be shifted. Therefore, mount them so that the balance weight does not turn over or hold the jack support position with a mission jack or suchlike.
- (3) Be sure to support the specified position with the jack, rigid rack, holding block and attachment.
- (4) Never jack or lift up the vehicle exceeding the jack or lift capacity.

01

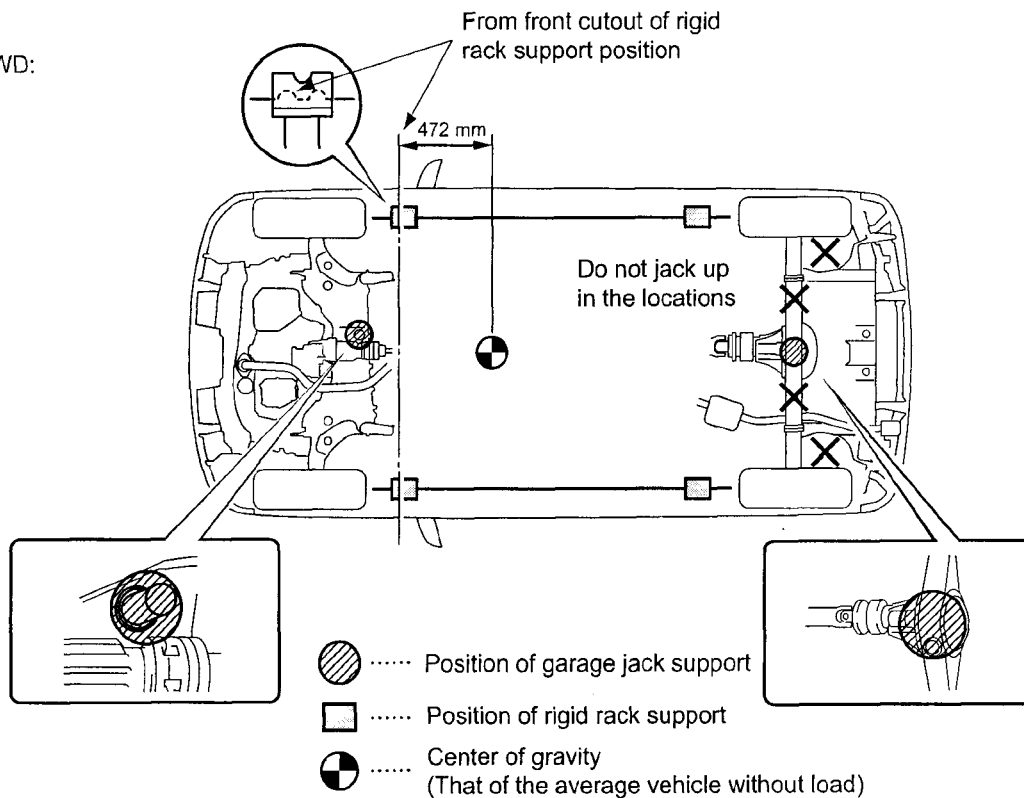
2. Support position when the vehicle is lifted up

01

FF:
for both RHD and LHD



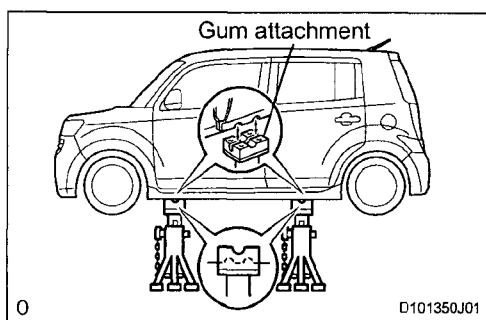
4WD:



D101173J05

3. Cautions when the jack and the rigid rack are used

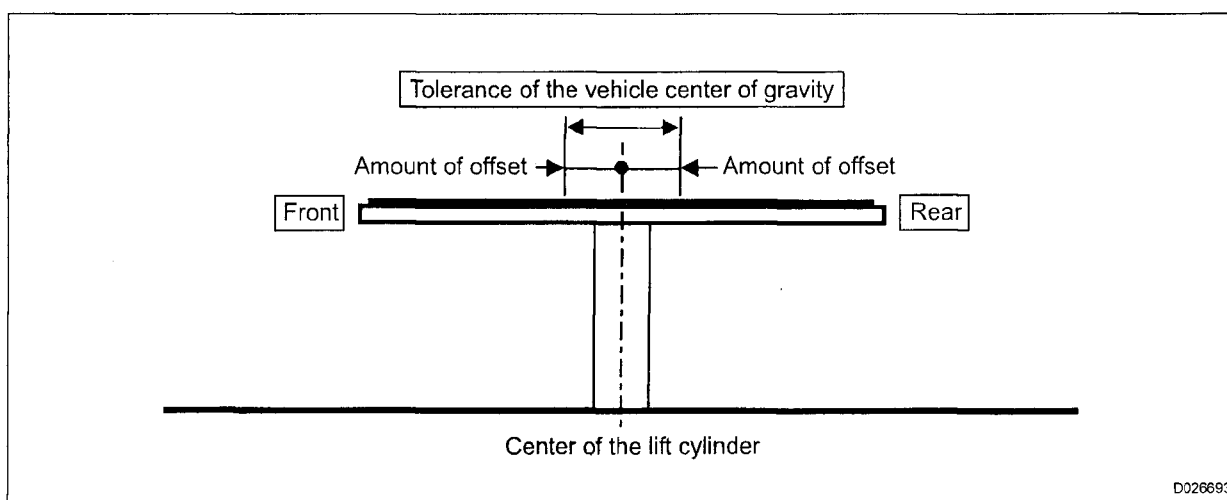
- (1) Be sure to work in the flat area using sprags.



- (2) Use the rigid rack with a rubber attachment as shown in the diagram.

01

- (3) Be sure that the jack supports at the specified position with the center of the jack dish.
- <CAUTION>
Avoid putting the garage jack onto the oil pan.
- (4) Be sure that the rigid rack supports the specified position.
- (5) If the front wheels are jacked up, release the parking brake and place the sprags at the back of the rear wheels. If the rear wheels are jacked up, place the sprags at the front of the front wheels.
- (6) If only either the front or rear wheels are jacked up, place the sprags at both the front and back of the wheels contacting the ground.
- <HINT>
Do not work or leave the vehicle supported with a jack only. Always use the rigid rack.
- (7) When the vehicle which is jacked up with only the front wheels is jacked down, release the parking brake and place the sprags only at the front of the rear wheels. When the vehicle which is jacked up with only the rear wheels is jacked down, place the sprags only at the back of the front wheels.
4. Cautions when the plate lift is used
- (1) Operate the lift safely according to the operation manual of the lift.
- <CAUTION>
If the lift support position is largely away from the vehicle center, the vehicle becomes significantly unstable or the under cover may be damaged.
- (2) Use the plate lift attachment.
- (3) When the vehicle is lifted up using the plate lift, make sure that the vehicle center comes in the vehicle center tolerance of the lift support.



- <CAUTION>
If the vehicle center is out of the tolerance, the vehicle may shake when it is lifted up and down.
- <HINT>
If the tolerance of the vehicle center of gravity is unknown, ask the manufacturer of the lift.

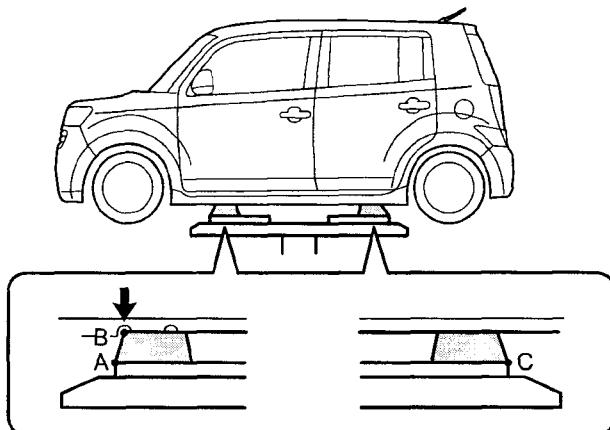
(4) Be sure to drive the vehicle in to the specified position.

Vehicle setting position in the horizontal direction	Drive the vehicle in the center of the lift.
Vehicle setting position in the anteroposterior direction	> Align the end of the plate cushion rubber to the bottom end of the attachment (A and C). > Adjust and align the top end of the attachment to the front notch of the rigid rack support position on the front side, avoiding contacting the rocker molding (B).

(5) Lift the vehicle until the tire is slightly lifted up and check if the vehicle is stable.

01

Plate lift :

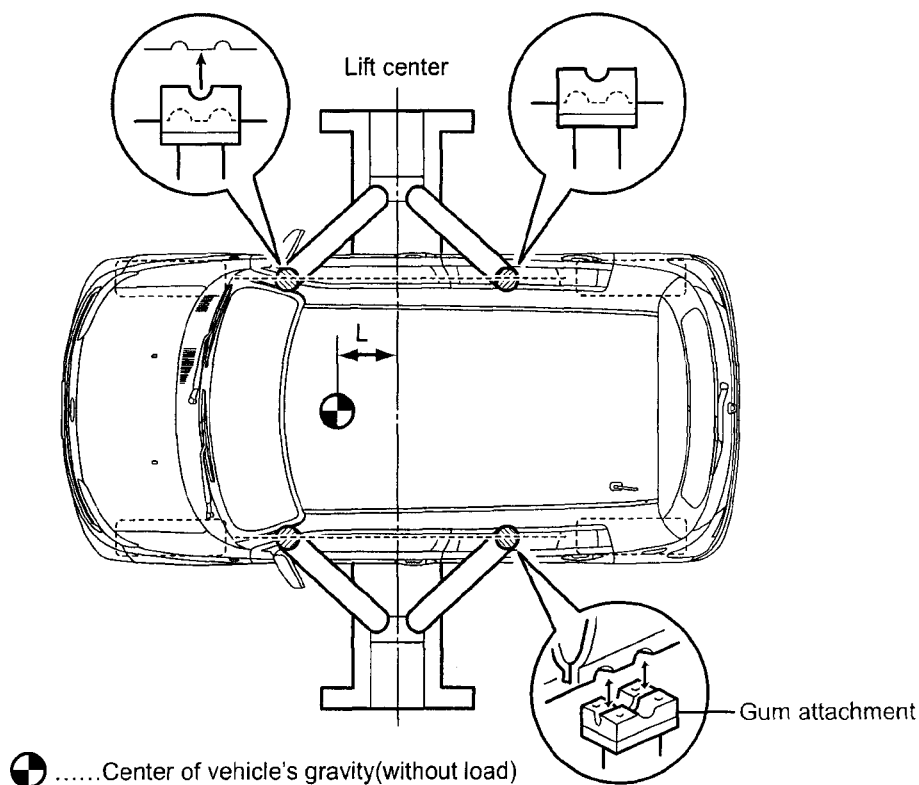


0

D101351J02

5. Cautions when the swing arm lift is used

Swing arm lift:



D101849J01

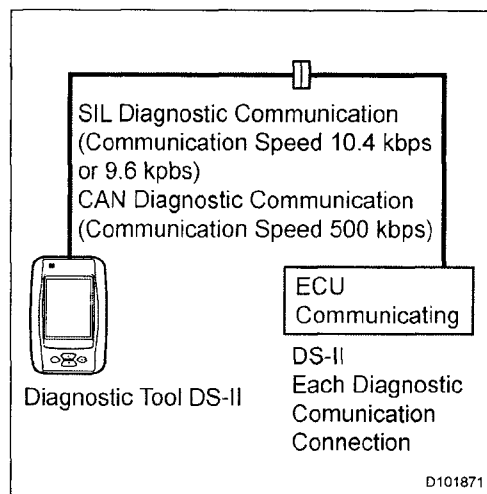
- (1) Operate the lift safely according to the operation manual of the lift.
- (2) Use the support with rubber attachment as shown in the diagram.
- (3) Drive the vehicle in so that the lift center is as close to the vehicle center of gravity as possible (L is as short as possible).

-
- (4) Avoiding contacting the rocker molding, adjust the lift support height so that the vehicle is leveled. Then, fit the rigid rack support position in the groove of the lift support.
 - (5) Be sure to lock the swing arm during the work.
 - (6) Lift the vehicle until the tire is slightly lifted up and check if the vehicle is stable.
6. Cautions when the four-post lift and the drive-on type lift are used
- (1) Work safely according to the operation manual of the lift.
 - (2) Do not damage the tires and wheels with the free wheel beam.
 - (3) Use sprags to fix a vehicle.

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

NEW DIAGNOSIS SYSTEM

01



1. Overview

- (1) The new diagnosis system is a new failure diagnosis system conforming to the onboard electronics system that has become sophisticated, complicated. The function of this system can be used by the diagnostic tool DS-II.

2. Function of the diagnostic tool DS-II

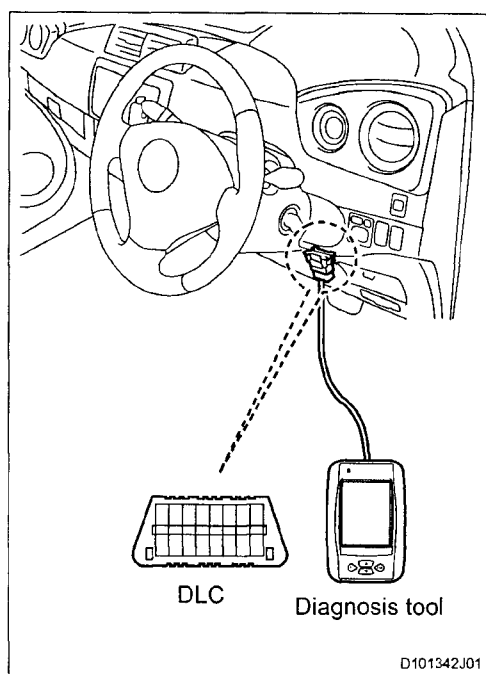
- (1) The diagnosis tool DS-II compliant with this new diagnosis system contains the functions shown in the table below.

Function	Overview	
Bus check	CAN bus diagnosis function	
Diagnostic functions	CARB mode	Individual functions compliant with ISO 15031-5
	DTC check	Function to display the diagnostic trouble code and the freeze data saved in memory at occurrence of failure
	Data list	ECU data monitoring function using values and graphs.
	Active test	Function to drive the actuator forcibly.
	Utilities	Work support function necessary at replacement of the ECU and the actuator
Saved data playback functions	Function to play back the saved data after the failure is diagnosed.	
Measurement functions	Voltage measurement and oscilloscope function	

3. Diagnosis communication enabled computer/ sensor

Computer/ sensor name	Diagnostic trouble code read (Normal mode)	Diagnostic trouble code read (Check mode, test mode)	Freeze frame data read (Computer data at occurrence of failure)	Data monitor read and save/display	Active test	Diagnosis communication line
Engine ECU	O	-	O	O	O	CAN
Automatic ECU	O	-	O	O	O	SIL
Skid control computer	O	O	O*	O	O	SIL
Power steering computer assembly	O	O	O	O	-	SIL
Air bag ECU	O	O	-	-	-	SIL
Transponder key ECU	O	-	-	O	-	SIL

*: Freeze data when the system is operated is readable.

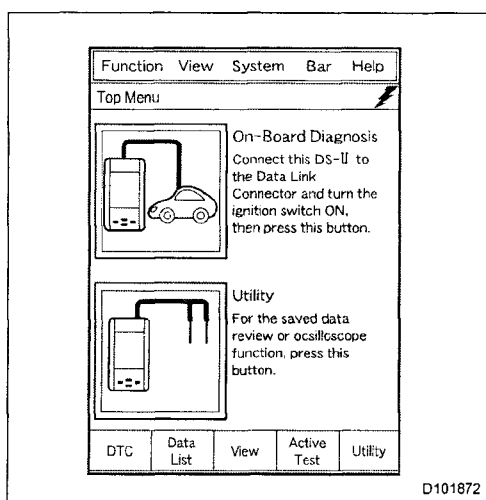


4. How to use the diagnostic tool DS-II

(1) Connection to the vehicle

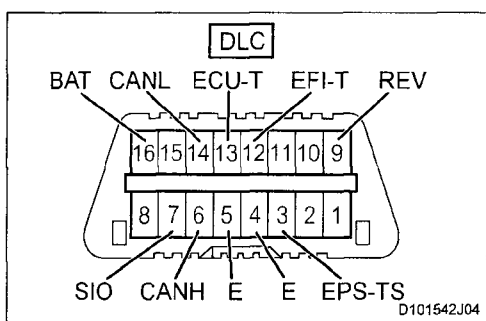
- (a) Connect the DLC (data link connector) installed around the feet of the driver.

01



(2) How to use the diagnostic tool DS-II

- (a) When the power switch of the DS-II is turned on, the menu screen is displayed.
- (b) Select [OBD] and select [Next] after selecting all vehicle information, and the [System Select] screen will be displayed.
- (c) Select any item to be implemented. Then, proceed afterward interacting with the screen.

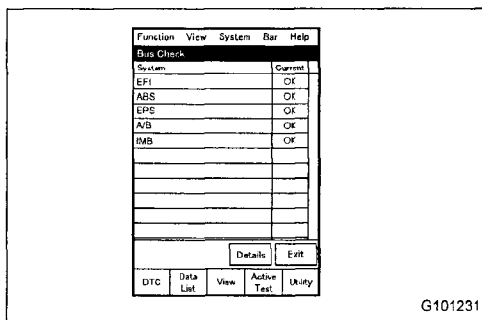
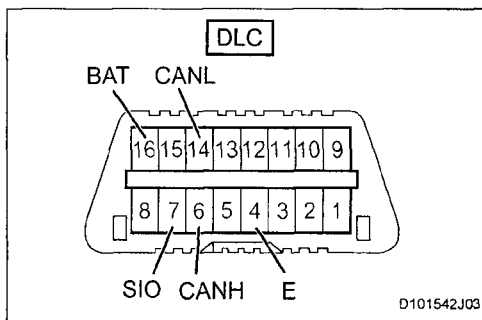
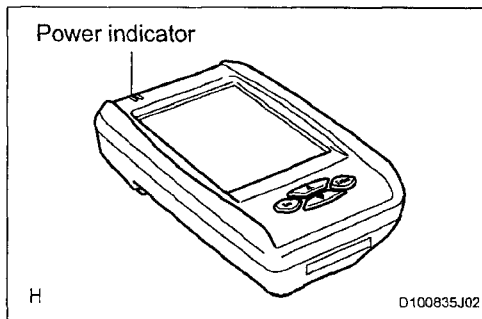


5. Diagnosis connector

- (1) Along with adoption of the new diagnosis system, the function is put together at the DLC (installed at the bottom of instrument panel of the driver seat).

(2) Names and functions of the DLC terminals

Terminal name	Function
BAT	Battery power
CANL	CAN communication LO
ECU-T	ECU-T check terminal
EFI-T	EFI-T check terminal
REV	Engine revolution signal
SIO	Diagnosis communication with each computer
CANH	CAN communication HI
E	Signal earth
E	Body earth
EPS-TS	EPS-TS check terminal



6. Handling at occurrence of errors

<CAUTION>

If the power indicator of DS-II is not lit or if names of all diagnosis communication enabled and diagnosis CAN communication enabled systems are not displayed when the menu is displayed, implement the following checks and repair the failure.

- (1) DS-II power indicator is not lit

- (a) Connect the DS-II to the other vehicle and start the DS-II.

Operational status	Failure point	Check point
When the DS-II power indicator is lit red or green	Vehicle side	1. Voltage check of the DLC BAT terminal 2. Conductivity check between the DLC E terminal and the body earth
When the DS-II power indicator is not lit	DS-II	-

- (2) If the system diagnosis is pressed in the diagnosis menu, the names of all diagnosis communication enabled and diagnosis CAN communication enabled system are not displayed.

- (a) Turn off the IG switch and DS-II power and then start the DS-II again.

- (b) Select [OBD] and check the status when the [System Select] screen is displayed after inputting all vehicle information.

Operational status	Failure point	Check point
All system names are not displayed.	DS-II	-
The names of the diagnosis communication enabled system are not displayed.	Vehicle side	1. Conductivity check between SIO terminal of the DLC communication line and the junction 2. Short circuit of +B and earth between SIO terminal of the DLC communication line and the junction
The names of the diagnosis CAN communication enabled system are not displayed.	Vehicle side	Correct the CAN communication following the steps after Step 4 [DLC check (CANH-CANL)] in CAN communication troubleshooting.
One diagnosis communication enabled system name is not displayed.	Vehicle side	1. Conductivity check between SIO terminal of the DLC communication line of the nondisplay ECU and the junction 2. Short circuit of +B and earth between SIO terminal of the DLC communication line of the nondisplay ECU and the junction 3. Nondisplay ECU+B and earth check 4. Nondisplay ECU replacement
One diagnosis CAN communication enabled system name is not displayed.	Vehicle side	Correct the CAN communication following the steps after Step 3 [Diagnostic Trouble Code Check] in CAN communication troubleshooting.

HOW TO PROCEED WITH TROUBLESHOOTING

<HINT>

Troubleshoot according to the diagnosis procedure described below. Only the basic procedure is described here. For details, the most efficient method by circuit is described for the system in each section. Check the troubleshooting procedure before starting to troubleshoot the appropriate circuit.

01

1 VEHICLE BROUGHT TO WORKSHOP



2 CUSTOMER PROBLEM ANALYSIS

- (1) Ask the customer the state and condition where the failure occurred and prepare the inquiry sheet accordingly.

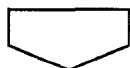


3 FAILURE PHENOMENON CHECK AND DIAGNOSTIC TROUBLE CODE (INCLUDING THE FREEZE FRAME DATA) CHECK

- (1) Check the battery voltage using the tester.
Specified value: 11 - 14 V (at engine stop)
- (2) Check all the parts that can be checked visually: blown fuse, wire harness disconnection, short circuit, badly connected connector, etc.
- (3) Check the phenomenon and status of the failure and check the diagnostic trouble code according to the applicable chart.

With the diagnostic trouble code: To each list of diagnostic trouble code

Without the diagnostic trouble code: To List by Symptom



4 UNDERSTANDING THE VEHICLE CONDITION

- (1) Check and understand each setting status of the vehicle before the repair because some data in the memory may be erased or some settings may be initialized by disconnecting the battery minus terminal.
<HINT>

Setting when the part is replaced/ removed (See page 03-8)



5 CIRCUIT CHECK OR PART CHECK

- (1) Check if the circuit in the system is checked or which part to be checked using the list of diagnostic trouble codes or list by symptom.



6 REPAIR OF THE FAILURE

- (1) Repair the failed system or part according to the instruction of Step 5.



7	CHECK TEST
---	------------

01

- (1) Check if the failure is eliminated after the repair is completed. (If the failure reappears, implement the check test in the same environment with the same status where the failure originally occurred.
- (2) If the diagnostic trouble code is input for the failure, check the diagnosis result.



8	RESTORATION OF THE VEHICLE STATUS
---	-----------------------------------

- (1) Return each setting to the vehicle condition checked at Step 4.
<HINT>
If there are any settings which can not be returned to the original settings, explain that to the customer.



OK	
----	--

CUSTOMER PROBLEM ANALYSIS

1. Eliminate any preconceived notion during troubleshooting to check the failure phenomenon correctly and assess the failure properly. It is very important to ask the customer the condition where the failure occurred to check the failure phenomenon.
2. The following five items are important for analysis. The past failure that seems unrelated and the repair history may be useful. It is essential for troubleshooting to collect such information as much as possible and understand the relationship to the current failure precisely. The inquiry sheet is contained in the diagnosis section of each system.
 - > What - vehicle model, system name
 - > When - date and time, frequency
 - > Where - course condition
 - > Condition - running status, weather
 - > How it happened - failure phenomenon

<HINT>
Shown below is an example of the inquiry sheet.

Engine Problem Diagnosis Check Sheet

Model		Date vehicle brought in		Service history	No/Yes (times)
VIN		Date registered		Registration No.	
		Date problem first occurred		Odometer reading	km
Accessories					

Previous vehicle	Main region/purpose of travel
Customer profile/characteristics	
Description of symptoms	
Warning light illumination Off/On ()	

	System Conditions	Driving Conditions	Road Conditions	Others	Problem Frequency
Check Results	Speed problem first occurred()km/h Shift position () range ☐ Starting off ☐ Immediately after start off ☐ () min after start ☐ After ()min driving ☐ Cold ☐ Warm ☐ Idling ☐ Others ()	☐ Starting off ☐ Cruising ☐ Increasing speed ☐ Decreasing speed ☐ Braking ☐ Turning ☐ Stopped ☐ Not related ☐ Others ()	☐ Level ☐ Uphill ☐ Downhill ☐ Dry paved road ☐ Wet paved road ☐ Unpaved/rough road ☐ Snowy/icy road ☐ Uneven, manholes etc. ☐ Others ()	Accelerator opening ()% Ambient air temperature () Weather ()	☐ Always ☐ One time only ☐ Sometimes ☐ ()times a day ☐ ()times a week ☐ ()times a month
	Additional Items				

Inspection Results	DTC Inspection		
	Malfunction Indicator Lamp (MIL) Off On	☐ Normal Code(s) ☐ Malfunction code(s)(all noted)	Fuel pressure when engine stopped Fuel pressure 1 min. after engine stopped
	Problem details Driving conditions and location when problem first occurred and reoccurred		
Reoccurrence conditions ☐ Always ☐ Occasional ☐ Once problem occurs, it continues ☐ Does not reoccur			

Dealer Name	Office	Person in charge	Technician
-------------	--------	------------------	------------

SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE

<HINT>

The diagnosis system contains various functions. If a failure occurs in the signal circuit to the ECU, it is saved as a code in the ECU memory and the code is output as a diagnostic trouble code during troubleshooting. The diagnosis function is incorporated in the following system to narrow down the range where the failure occurs quickly and troubleshoot efficiently utilizing this diagnosis function.

01

System [ECU]	Diagnostic trouble code Check (Normal mode) DS-II	Diagnostic trouble code Check (Normal mode) DLC (ECU-T ↔ E short- circuit)	Diagnostic trouble code Check (Test mode) (Check mode)
EFI system (3SZ-VE)[engine ECU]	O	O	-
EFI system (K3-VE) [engine ECU]	O	O	-
Automatic transaxle system [AT ECU]	O	O	-
Anti-lock brake system [skid control computer]	O	O	O
Vehicle stability control system [skid control computer]	O	O	O
Power steering system [power steering computer assembly]	O	O	O
SRS air bag system [air bag ECU]	O	O	O*
Engine immobilizer system [Transponder key ECU]	O	O	-
LIN communication system	-	-	-
CAN communication system	O	O	-

*: Check mode

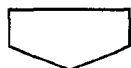
It is very important for the diagnostic trouble code check to determine if the failure indicated by the diagnostic trouble code is ongoing or it occurred in the past but is now returned to normal. In addition, it is necessary to check if the failure indicated by the diagnostic trouble code is directly related to the failure phenomenon through the failure phenomenon check.

For this reason, it is required to check the diagnostic trouble code before and after checking the phenomenon in order to evaluate the current status. Failing to perform this may lead to unnecessary troubleshooting regardless of the normal operation system and makes it difficult to find where the failure is, ending up with unrelated and unnecessary repair. Therefore, it is important to always check the diagnostic trouble code following the correct work procedure.

<HINT>

- > The flow chart below shows the troubleshooting procedure using the diagnostic trouble code.
- > This flow chart shows how to use the diagnostic trouble code efficiently. It also shows how to proceed to troubleshooting using the diagnostic trouble code or the list of failure phenomena by checking the result thoroughly.

1	FAILURE INDICATION (INQUIRY)
---	------------------------------



2	DIAGNOSTIC TROUBLE CODE CHECK
---	-------------------------------

<CAUTION>

Be sure to check all diagnostic trouble codes.

A	Can not read from all the connection ECU
B	Without the diagnostic trouble code
C	With the diagnostic trouble code

A	TO STEP 7
B	TO STEP 8

C

3

SAVING THE DIAGNOSTIC TROUBLE CODE AND THE FREEZE FRAME DATA

- (1) Save the output diagnostic trouble code and freeze frame data.

<CAUTION>

Do not erase the code and the data before saving them. If they are erased before saved, all of the diagnostic trouble code, freeze frame data, and history data will be erased.

<HINT>

- > If several codes are output, find out the main cause from all diagnostic trouble codes.
- > Use the input timing estimated data (data monitor) for EFI, AT, and ABS.
- > Some diagnostic trouble codes are output even if it is not failure (sunlight sensor for air conditioner, non-learning after battery clear).

01

A	Except for the diagnostic trouble code for communication
B	The diagnostic trouble code for communication only
C	The diagnostic trouble code for communication and other diagnostic trouble codes

A

TO STEP 5

B

BUS (COMMUNICATION WIRE) FAILURE (SEE THE CAN COMMUNICATION SYSTEM AND THE LIN COMMUNICATION SYSTEM.)

C

4

DETERMINING FAILURE CAUSE

- (1) Determine if the main cause is the part or the bus (communication wire) according to all diagnostic trouble codes.

<HINT>

The diagnostic trouble code for communication may be output simultaneously by part failure.

A	Bus (communication wire) failure
B	Part failure

A

TROUBLESHOOTING OF THE BUS (COMMUNICATION WIRE) FAILURE (SEE THE CAN COMMUNICATION SYSTEM AND THE LIN COMMUNICATION SYSTEM.)

B

5 DIAGNOSTIC TROUBLE CODE AND FREEZE FRAME DATA ERASE

01

6 RUNNING TEST AND DIAGNOSTIC TROUBLE CODE CHECK

A

With the diagnostic trouble code

B

Without the diagnostic trouble code

A

TROUBLESHOOTING ACCORDING TO THE FLOW BY DIAGNOSTIC TROUBLE CODE

B

SIMULATION TEST USING THE SIMULATION METHOD OF THE FAILURE PHENOMENON

7 CONNECT THE DS-II TO OTHER VEHICLE AND CHECK THE DIAGNOSTIC TROUBLE CODE

A

Can not read when the DS-II is connected to other vehicle as well.

B

Normal in case of other vehicle

A

DS-II FAILURE (See page 01-21 FOR HANDLING WHEN DS-II FAILURE OCCURRED.)

B

BUS (COMMUNICATION WIRE) FAILURE (SEE THE CAN COMMUNICATION SYSTEM AND THE LIN COMMUNICATION SYSTEM.)

8 FAILURE PHENOMENON CHECK

(1) Use the inquiry result and the ECU data monitor to determine if the customer indication is actual failure.

NG

TROUBLESHOOTING ACCORDING TO THE FLOW BY SYMPTOM

OK

THE SYSTEM IS NORMAL

SYMPTOM SIMULATION

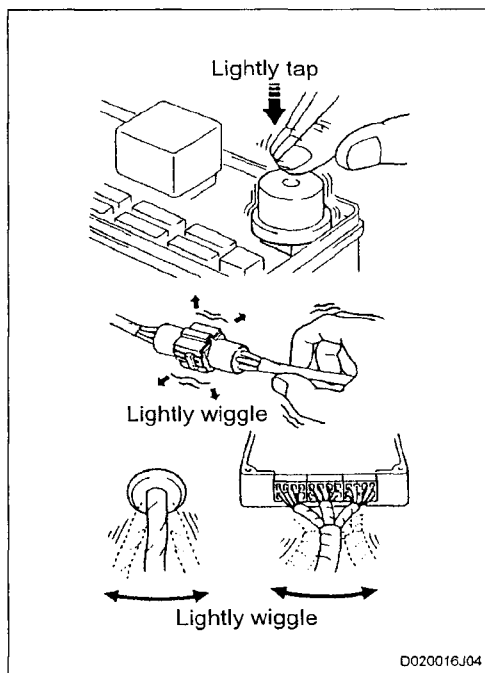
<HINT>

- > The most difficult part of the troubleshooting is that the failure phenomenon may not appear. In such a case, thorough analysis of the failure is required. To do so, it is necessary to recreate the condition/environment where the failure occurred in the customer vehicle. Troubleshooting without checking the failure phenomenon may lead to overlooking the important point in the repair or misunderstanding, resulting in a stalemate.
- > For instance, checking the engine warmed up if the failure occurred when the engine is cool or checking the vehicle stopped if the failure was caused by the road condition during running can not specify the failure point.
- > Vibration, heat, and intrusion of water (humidity) are the causes of the failure without repeatability. However, the failure phenomenon reproduction method introduced here is effective since the external factors are provided to the vehicle stopped.

01

Important points for the failure simulation test

In the failure phenomenon reproduction method, the range/part of the failure as well as the phenomenon needs to be found. To do so, first narrow down the circuit containing the failure based on the phenomenon before implementing the test and connect the tester. Then, implement the failure reproduction method to determine if the circuit is good during the test. Also, check the failure phenomenon at the same time. To narrow down the cause of the failure phenomenon, refer to the list of failure phenomena for each system.



1. Vibration method: when vibration assumes to be a cause of failure

(1) Part and sensor

- (a) Lightly hit the part presumably causing the failure by hand to vibrate it and check if the failure occurs.

<HINT>

Relays may open the points when strong impact is applied to.

(2) Connector

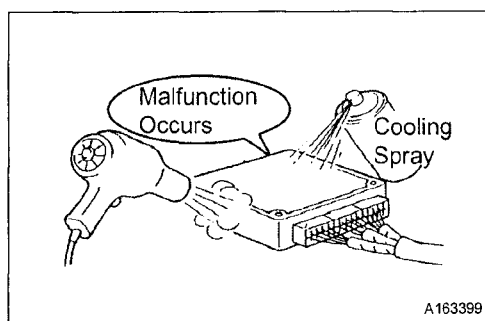
- (a) Shake the connector lightly from right to left and up and down.

(3) Wire harness

- (a) Shake the wire harness lightly from right to left and up and down to check if the failure occurs.

<HINT>

Focus on especially the foot of the connector, the supporting point of vibration, and the penetration part of the body.



2. Thermal shock method: when the failure assumes to occur in cold or warm

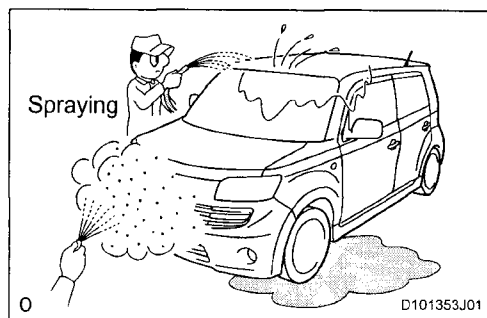
- (1) Use a hair drier and a coolant to heat up or cool down the part presumably causing the failure and check if the failure occurs.

<CAUTION>

- > Do not heat the part more than +60°C (can be touched by hand).
- > Do not open the cover of ECU to heat up or cool down the electronic component directly.

<HINT>

The coolant can be available at the electronic component retailer.



3. Watering method: when the failure assumes to occur in rainy weather or at high heat

(1) Water the vehicle to check if the failure occurs.

<CAUTION>

- > Avoid watering the engine room directly. Mist the radiator front with water to change the temperature and the humidity indirectly.
- > Do not directly water the electronic component.

4. Other: when the failure assumes to occur in case of excessive electrical load

(1) Operate the electrical components such as a heater blower, head lamps, and a rear defogger to increase the electrical load and check if the failure occurs.

DIAGNOSTIC TROUBLE CODE CHART

This list of diagnostic trouble codes enables to troubleshoot accurately and effectively using the diagnostic trouble code displayed in the diagnostic trouble code check. Troubleshoot according to the check procedure in the diagnosis chart applicable to the displayed diagnostic trouble code. The following is an example of the list of diagnostic trouble code for the EFI system.

The left side is the SAE Output Code No./ The right side indicates the Output Code when the Check Engine Warning Light is used.

Indicates the contents of the system that is malfunctioning

Engine Control - EFI System

DTC Table

DTC No	Diagnosis Item	Light Illuminated	Code Memory	Reference Page
	Intake Air Temperature Sensor Signal	○	○	
	Water Temperature Sensor Signal	○	○	
	Throttle Sensor Signal	○	○	

Indicates repair manual instructions and the page on which each circuit detection procedure can be found.

A163400

PROBLEM SYMPTOMS TABLE

Problem symptoms table

The list below shows the presumed circuit and part with problems for each failure phenomenon. The normal code is displayed on the diagnostic trouble code check but if the failure remains, troubleshoot using this list. The presumed failure point indicates the circuit or part to be checked.

<HINT>

If the failure can not be detected by the diagnosis system even though there is failure phenomenon, the failure may have occurred outside of the detection range of the diagnosis system or in the system other than the diagnosis system.

Indicates a symptom for which a DTC No. is not displayed.

Indicates part name and the circuit for each system to be inspected.

Indicates on which page the detection requirements and flow chart for each circuit are found.

Problem Symptoms Table

Symptoms	Inspection Item	Reference Page
Does not crank	Starter or Starter Relay	
	Neutral Starter Switch	
Fails to start (No initial combustion)	ECU Power	06 - 82
	Igniter	06 - 64
	Fuel Pump	06 - 78
	Fuel Injector	
	Crankshaft Angle Sensor	06 - 52
Fails to start (Combustion not complete)	Fuel Pump	06 - 78
	Igniter	06 - 64
	Fuel Injector	
	Crankshaft Angle Sensor	06 - 52
Fails to start (Cranking is normal)	Starter	06 - 76
	ISCV	06 - 61
	Fuel Pump	06 - 78
	Igniter	06 - 64
	Spark Plug	

D101873

DTC SYSTEM SPECIFIC INSPECTION PROCEDURE

Check flow by DTC system

Described below is how to read and use each page.

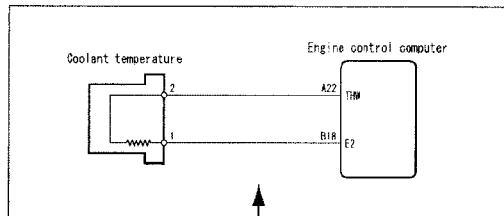
- > Troubleshooting shows the procedure by DTC, system, and symptom for easy diagnosis of the failure status and cause investigation.
- > The troubleshooting procedure is organized as [DTC], [Circuit Description], [Detection Condition], [Circuit Diagram], and [Check Procedure].

01

DTC		DTC Name
DTC	P0115/22	COOLANT TEMPERATURE SENSOR SIGNAL SYSTEM
DESCRIPTION The resistance of the thermistor built into the coolant temperature sensor varies according to the coolant temperature.		
DTC No.	DTC Detection Condition	Suspected Area
P0115/22	1. IG ON 2. Open or short in coolant temperature circuit 3. 0.5 seconds or more 4. 1 trip	• Wire harness or connector • Coolant temperature • Engine control computer

Detection Conditions

CIRCUIT DIAGRAM



Circuit Diagram

This HINT is used to judge whether the circuit is normal or malfunctioning. This reference is used to determine if the malfunction is in the sensor, acuator, wire harness, or ECU.

HINT:

- Read the freeze frame data using the DS-II. Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

1 READ DS-II DATA (COOLANT TEMPERATURE)

- Connect the DS-II to the DLC.
- Read the engine coolant temperature displayed on the DS-II while the ignition switch is turned to the ON position and the engine is stopped.

Tester Display	Preced to
40° C	A
140° C	B
Equivalent to actual coolant temperature	C

- GO TO STEP 4
- CHECK FOR INTERMITTENT PROBLEMS

2 READ DS-II DATA (CHECK FOR OPEN IN ENGINE CONTROL COMPUTER)

SST 09843-18020

- Disconnect the connector of the coolant temperature sensor.
- Short the circuit between terminals 2 (+) and 1 (-) of the water temperature vehicle side connector using the SST (diagnosis check wire No. 2).
- Connect the DS-II to the DLC.
- Turn the ignition switch to the ON position.
- Read the engine coolant temperature displayed on the DS-II.

Standard:
140° C

OK → REPLACE COOLANT TEMPERATURE SENSOR

NG

3 READ DS-II DATA (CHECK FOR OPEN IN ENGINE CONTROL COMPUTER)

SST 09843-18020

- Short the circuit between terminals 54 (THW) and 19 (E2) of the engine control computer using the SST (diagnosis check wire No. 2). (For terminal layout see page ES-16.)
- Read the engine coolant temperature displayed on the DS-II.

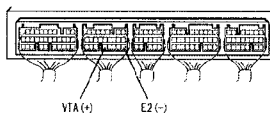
Standard:
140° C

NG → CHECK AND REPLACE ENGIN CONTROL COMPUTER

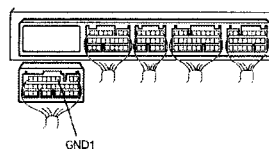
OK

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

Indicates the condition of the ECU connector during inspection.



The (+) and (-) after the terminal name indicate the tester connection.



The ground side is not noted when inspecting body ground. Connectors are disconnected during inspection.

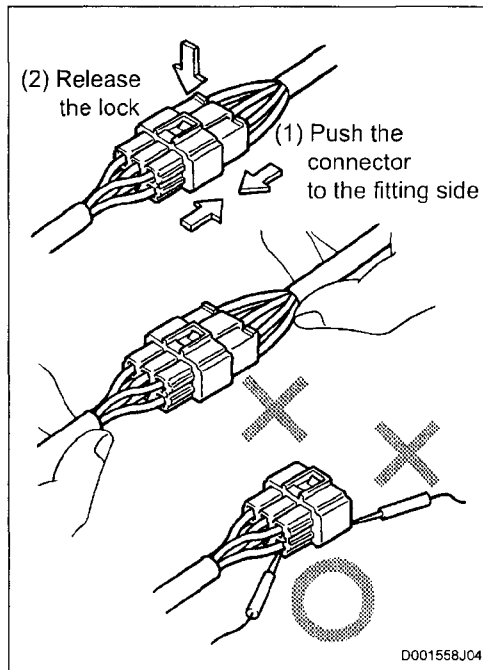
D101874

ELECTRONIC CIRCUIT INSPECTION PROCEDURE

1. Basic inspection

(1) Resistance measuring condition for electronic component

- (a) Measure the resistance at the ambient temperature of 20°C unless otherwise specified. If the measurement was taken at the high temperature immediately after the vehicle is driven, the resistance will be out of the specified value. Wait until the engine cools down to measure.



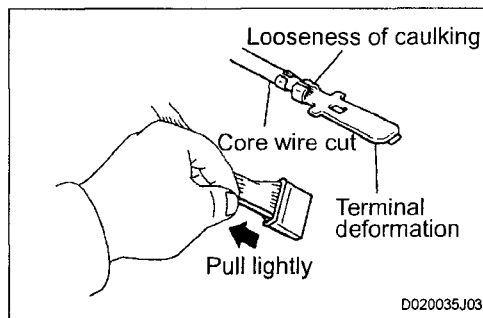
(2) Connector handling

- (a) To disconnect the connector with a lock, push the connector to the fitting side to make the tab easier to move before unlocking.
 (b) Hold the connector, not the harness, to disconnect it.
 (c) Check deformation, damage and missing of the terminal before connecting the connector.
 (d) When connecting the connector with a lock, firmly insert it until a locking sound comes out.
 (e) When the connector is checked with the tester, use the mini-test lead and check it starting from the backside of the connector (harness side).
<CAUTION>
 > The waterproof connector can not be checked from the backside of the connector. Connect a sub harness to check it.
 > Do not move the inserted tester rod excessively to damage the terminal.

01

(3) Connector check procedure

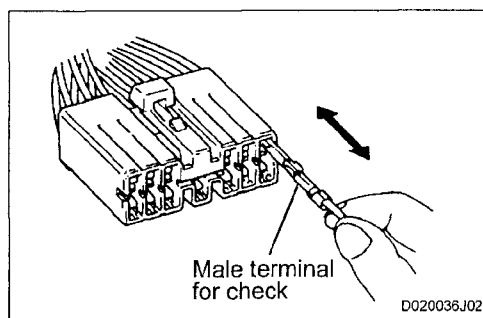
- (a) Hold the connector housing with the connector connected and check how firmly it is locked. (fitting status)



- (b) Lightly pull the wire harness to check with the connector disconnected (Missing terminal, caulking status, core wire cut). Visually check if there are any rust development, metal pieces, and water as well as bend of the terminal. (corrosion, mixture of foreign particles, terminal deformation)

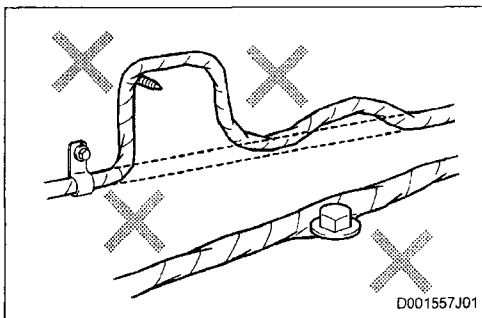
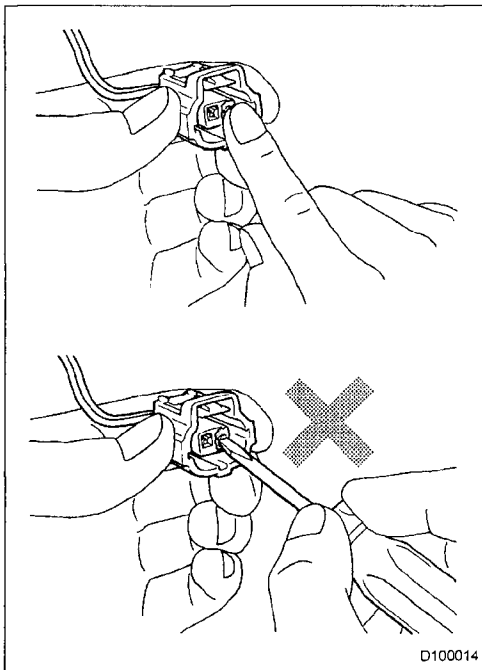
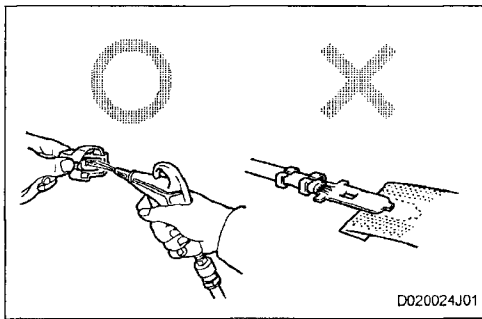
<CAUTION>

To test the female terminal of the gold plating, always use the male terminal of the gold plating.



- (c) Prepare the terminal with the same terminal contact pressure with the male terminal and insert it to the female terminal to check the fitting status and the sliding weight.

01



(4) How to repair the connector terminal

- (a) If the contact point is dirty, use the air gun and the waste cloth to clean it. Never polish the contact point with a sand paper because the surface coating will come off.
- (b) If the contact pressure is not normal, replace the female terminal. Remember using the gold-plated female terminal if the male terminal on the part side is gold-plated and using the tin-plated female terminal if the male terminal on the part side is tin-plated.
- (c) If there is no trouble with the contact point, clean it with the air gun and apply the connector grease (This prevents oxidation and abrasion of the contact).

(5) Connector grease

- (a) For the connectors for the alternator and the head lamps that tend to get wet, the grease (white) to prevent the terminal from corrosion is applied.
- (b) If the connector grease is not sufficient or the terminal is repaired, apply the connector grease to the female terminal by hand.
 - <CAUTION>
 - > Avoid dust attachment.
 - > Do not apply the grease using the tool such as a screwdriver.
- (c) It is no problem if the grease attaches onto the O-ring and the rubber plug of the waterproof connector but attachment to other rubber parts (weather strip and wire harness grommet, etc.) may cause deterioration and discoloration. If the grease attaches any of those parts, wipe it off immediately.

(6) Wire harness handling

- (a) When the harness is removed, check the disposition and the clamp condition before the work to restore the original state.
- (b) Do not twist, pull, and loosen the harness more than necessary.
- (c) Avoid the harness contacting any point which may reach high temperature, the rotating part, the sliding part, the vibrating part, and the sharp edge (the panel corner, the screw end).
- (d) Do not pinch the harness when the part is attached.
- (e) Do not tear the harness sheath off. If it is damaged, replace it with a new one or repair with a vinyl tape or suchlike.

Figure 1

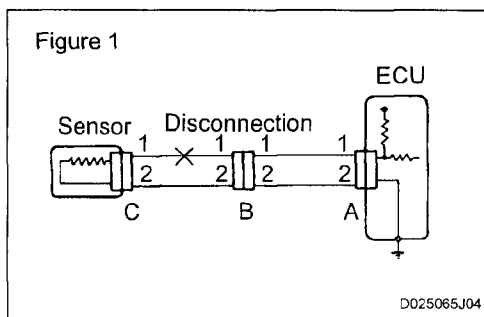


Figure 2

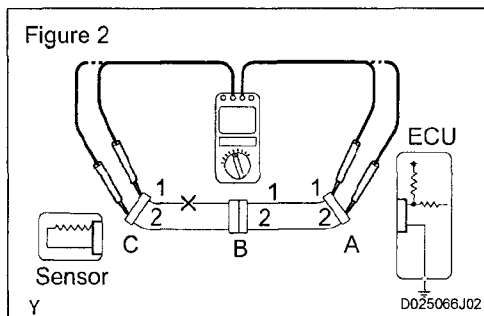


Figure 3

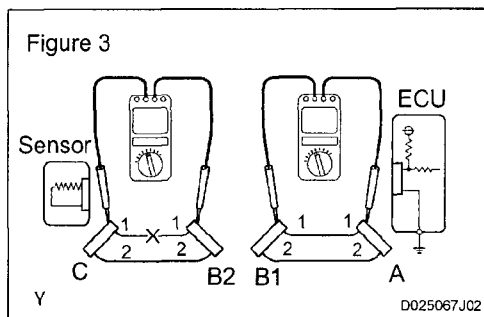
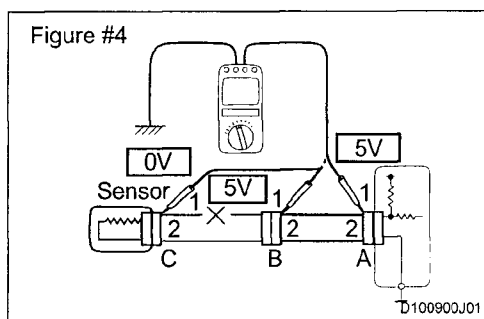


Figure #4



2. Disconnected circuit check

- (1) Implement the conductivity or voltage check to find which part is disconnected for the disconnected circuit of the wire harness shown in the diagram 1.

01

(2) Check the continuity.

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

Specified value: $1\ \Omega$ or less

<HINT>

Measure the resistance shaking the wire harness lightly from right to left and up and down.

- (b) In the diagram 2, there is no continuity (disconnection) between terminal 1 of the connector A and terminal 1 of the connector C and there is continuity between terminal 2 of the connector A and terminal 2 of the connector C. As the result, the circuit between terminal 1 of the connector A and terminal 1 of the connector C is broken.

- (c) Remove the connector B to measure the resistance between the connectors.

- (d) In the diagram 3, there is continuity between terminal 1 of the connector A and terminal 1 of the connector B1 and there is no continuity (disconnection) between terminal 1 of the connector B2 and terminal 1 of the connector C. As the result, the circuit between terminal 1 of the connector B2 and terminal 1 of the connector C is broken.

(3) Check the voltage.

- (a) For the circuit where the voltage is applied to the ECU connector terminal, check the disconnected circuit through the voltage check.

- (b) As shown in the diagram 4, with each connector connected, measure the voltage between the body earth and terminal 1 of the connector A, terminal 1 of the connector B, and terminal 1 of the connector C in that order using the ECU 5V output terminal.

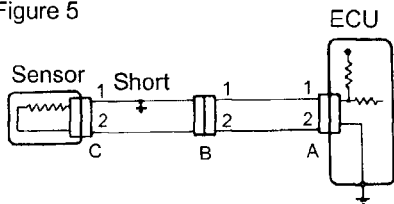
- (c) In case of the following result, the circuit of the wire harness between terminal 1 of the connector B and terminal 1 of the connector C is broken.

Reference. The voltage between terminal 1 of the connector A and the body earth is 5V.

The voltage between terminal 1 of the connector B and the body earth is 5V.

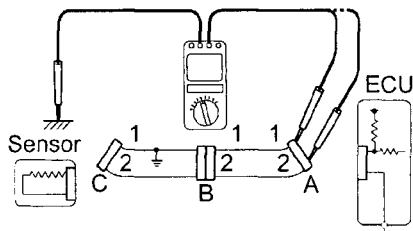
The voltage between terminal 1 of the connector C and the body earth is 0V.

Figure 5



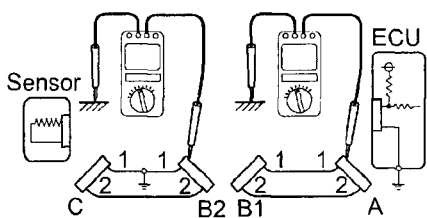
D025069J03

Figure #6 :

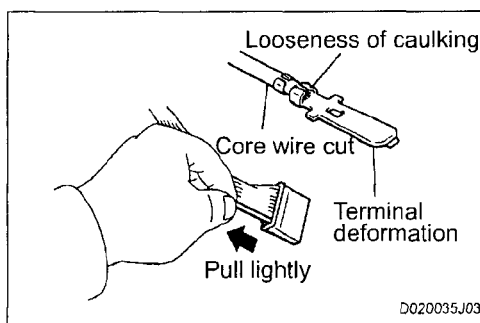


D025070J02

Figure #7 :



D025071J02



D020035J03

3. Short circuit check

- (1) As shown in the diagram 5, if the earth of the wire harness is short-circuited, implement [conductivity check with earth] to check which part causes the failure.

(2) Conductivity check with earth

- (a) Remove the connectors A and C and measure the resistance between terminals 1 and 2 of the connector A and the body earth.

Specified value: 1 Ω or less

<HINT>

Measure the resistance shaking the wire harness lightly from right to left and up and down.

- (b) In the diagram 6, there is continuity (short circuit) between terminal 1 of the connector A and the body earth and there is no continuity between terminal 2 of the connector A and the body earth. As the result, the circuit between terminal 1 of the connector A and terminal 1 of the connector C is short-circuited.

- (c) Remove the connector B and measure the resistance between terminal 1 of the connector A and the body earth and between terminal 1 of the connector B2 and the body earth. There is no continuity between the terminal 1 of the connector A and the body earth but there is continuity (short circuit) between the terminal 1 of the connector B2 and the body earth. As the result, the circuit between the terminal 1 of the connector B2 and the terminal 1 of the connector C is short-circuited.

4. Visual check and contact pressure check

- (1) Remove the connectors on both ends.
- (2) Check if the connector terminal forms rust or there are any foreign particles.

- (3) Check that there is no looseness and damage in the round part and the terminal is firmly fixed at the locking position.

<HINT>

The terminal shall not be disconnected if it is pulled lightly from the back.

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

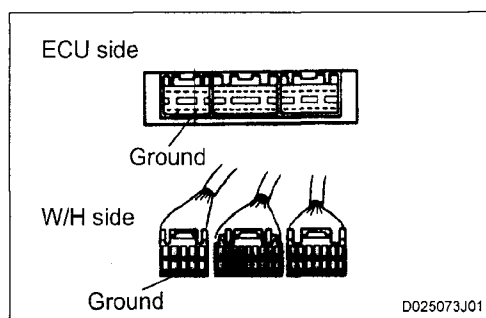
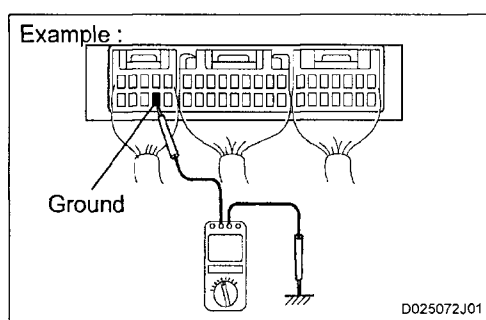
<HINT>

If the test terminal easily comes off compared with other terminals, the contact of that part is not good.

5. ECU check and replacement

<CAUTION>

- > Check the wire harness connector from the back with the connector connected to the ECU.
- > If there is no display on the measuring condition, check the ECU with the engine stopped and IG ON.



- (1) First, check the earth circuit of the ECU. If it is failed, repair it. If the circuit is normal, the ECU has trouble, then replace it with a normal ECU and check if any other failure appears.

- (a) Measure the resistance between the earth terminal of the ECU and the body earth.

Specified value: 1 Ω or less

01

- (b) Remove the ECU connector and make sure that the earth terminal is not bent on the ECU side and the wire harness side. Then, check the contact pressure.

TERMS

DESCRIPTION OF ABBREVIATION

Abbreviation	Original word	Description
FF	Front-Engine Front-Wheel-Drive	Front-Engine Front-Wheel-Drive
2WD	Two Wheel Drive	Two wheel drive
4WD	Four Wheel Drive	Four wheel drive
ABS	Antilock Brake System	Antilock brake system
ABV	Air Bypass Valve	Air bypass valve
A/C	Air Conditioner	Air conditioner
ACC	Accessory	Accessories
ACV	Air Control Valve	Air control valve
A/F	Air-Fuel Ratio	Air-fuel ratio
AI	Artificial Intelligence	Artificial intelligence
ALT	Alternator	Alternator
AMP	Amplifier	Amplifier
ANT	Antenna	Antenna
API	American Petroleum Institute	American Petroleum Institute
ASSY	Assembly	Assembly
A/T	Automatic Transmission (Transaxle)	Automatic transmission, automatic transaxle
ATDC	After Top Dead Center	After top dead center
ATF	Automatic Transmission Fluid	Automatic transmission fluid
AV	Audio & Visual	Audio & Visual
+B	Battery Plus	Battery plus
BA	Brake Assist	Brake assist
BDC	Bottom Dead Center	Bottom dead center
BTDC	Before Top Dead Center	Before top dead center
BVSV	Bimetallic Vacuum Switching Valve	Bimetallic vacuum switching valve
CAN	Controller Area Network	Controller area network
CCD	Charge Coupled Device	Charge coupled device
CD	Compact Disc	Compact disc
CNG	Compressed Natural Gas	Compressed natural gas
CO	Carbon Monoxide	Carbon monoxide
CRT	Cathode-Ray Tube	Cathode-ray tube
CTR	Center	Center
CVT	Continuously Variable Transmission	Continuously variable transmission
DLC	Data Link Connector	Data link connector
DLI	Distributorless Ignition	Distributorless ignition
DSP	Digital Sound Processor	Digital sound processor
DTC	Diagnostic Trouble Code	Diagnostic trouble code
DVD	Digital Versatile Disc	Digital versatile disc
EBD	Electronic Brake force Distribution	Electronic brake force distribution
ECU	Electronic Control Unit	Electronic control unit
EGR	Exhaust Gas Recirculation	Exhaust gas recirculation system
ELR	Emergency Locking Retractor	Emergency locking retractor
EPS	Electronic Power Steering	Electronic power steering
ESA	Electronic Spark Advance	Electronic spark advance
EX	Exhaust	Exhaust
FL	Fusible Link	Fusible link
FP	Fuel Pump	Fuel pump
FR	Front	Front side (front)
GND	Ground	Ground
HC	Hydro Carbon	Hydro carbon
IC	Integrated Circuit	Integrated circuit

Abbreviation	Original word	Description
IG	Ignition	Ignition
IN	Intak	Intake
I/P	Instrument Panel	Instrument panel
ISC	Idle Speed Control	Idle speed control equipment
ISO	International Organization for Standardization	International Organization for Standardization
J/B	Junction Block	Junction block
LAN	Local Area Network	Local area network
LCD	Liquid Crystal Display	Liquid crystal display
LED	Light-Emitting Diode	Light-emitting diode
LH	Left Hand	Left side (left hand)
LIN	Local Interconnect Network	A type of body control multiplex communication network
LLC	Long-Life Coolant	Long-life coolant
LPG	Liquefied Petroleum Gas	Liquefied petroleum gas
LSD	Limited Slip Differential	Limited slip differential
LSPV	Load Sensing Proportioning Valve	Load sensing proportioning valve
LWR	Lower	Lower
MP	Multipurpose	Multipurpose
M/T	Manual Transmission (Transaxle)	Manual transmission (transaxle)
N/A	Natural Aspiration	Natural aspiration
NO _x	Nitrogen Oxides	Nitrogen oxides
O/D	Overdrive	Overdrive
OPT	Option	Option
O/S	Oversize	Oversize
PCV	Positive Crankcase Ventilation	Positive crankcase ventilation
PKB	Parking Brake	Parking brake
PR	Ply Rating	Ply rating
P/S	Power Steering	Power steering
P/W	Power Window	Power window
R & P	Rack and Pinion	Rack and pinion
R/B	Relay Block	Relay block
RH	Right Hand	Right side (right hand)
ROM	Read-Only Memory	Read-only memory
RR	Rear	Rear side (rear)
SAE	Society of Automotive Engineers	Society of Automotive Engineers
SRS	Supplemental Restraint System	Supplemental restraint system
SST	Special Service Tool	Special service tool
STD	Standard	Standard
SW	Switch	Switch
T=	Torque	Torque
T/C	Turbocharger	Turbocharger
TDC	Top Dead Senter	Top dead center
TVSV	Thermostatic Vacuum Switching Valve	Temperature sensing valve
UPR	Upper	Upper
U/S	Undersize	Undersize
VCV	Vacuum Control Valve	Vacuum control valve
VICS	Vehicle Information and Communication System	Vehicle information and communication system
VSV	Vacuum Switching Valve	Vacuum switching valve
VTV	Vacuum Transmitting Valve	Vacuum transmitting valve
W/	With	With (A W/B: A including B)
W/H	Wire Harness	Wire harness

<HINT>

The followings are registered trademarks of Toyota Motor Corporation (already licensed).

> EFI (electronic fuel injection)

- > TRC (traction control)
- > VSC (vehicle stability control system)